UTILITY DISTRIBUTION, SCADA

• ETHERNET • INTEGRATED MODULAR SOLUTION • DSP RADIO WITH 45 MHz TUNING RANGE • LINUX OS

SATELLAR Digital System

For Long Range Wireless Data

SATEL®

WIRELESS WORLD – LOCAL SOLUTION

DIGITAL RADIO MODEM SYSTEM

• ETHERNET • INTEGRATED MODULAR SOLUTION • DSP RADIO WITH 45 MHz TUNING RANGE • LINUX OS

SATELLAR is a new generation digital radio modem system that consists of several different units:

- Central unit (CU)
- Radio unit (RU)
- Expansion units (XU)

SATELLAR enables the building of an independent, reliable, real-time radio data communication system that meets the specific needs of the customer.

Typically, a central unit together with a radio unit is used in a network as a master station or in locations where an Ethernet connectivity is needed. For radio router stations, the central unit is not necessarily required. In these cases, the radio unit can be used alone. This is possible because of the modular structure of the product.

SATELLAR units are available as separate entities or as combined product packages:

- the SATELLAR-2DS includes a radio unit and a central unit, which enables IP connectivity.
- the SATELLAR-2DSd provides the same functionality as the SATELLAR-2DS, but it is equipped with a color display and a keypad.
- the SATELLAR-1DS is a radio unit that can be used in stations where a standard RS-connection is sufficient.

Radio unit

Expansion unit

Central unit

Data communication

SATELLAR can operate either as a transparent radio link, essentially replacing a wire, for classic RS-232, RS-485 or RS-422 based protocols, or can operate as a wireless router in an IP-based network.

Using SATELLAR many network topologies are possible, from point-to-point link to a nationwide chain with multiple branches.

Range

With a SATELLAR radio the communication range of a point-to-point link is typically over 10 km in urban conditions (some obstacles to line of sight) and over 40 km for line of sight conditions.

The range can be further extended using high gain antennas, booster modules and radio repeaters. Any SATELLAR can provide both connectivity to a local node and operate as a wireless router.

Security

Data security is typically a concern when using radio communication. In SATELLAR, information security was a design priority; 128 bit encryption on the air interface and the use of built in firewall in the central unit ensures privacy both in the radio network and in the wired IP network.

USER INTERFACES (UI)

Ease of use has been built into SATELLAR by various means, all designed to keep the user up to date with the status of the device and to provide easy access to detailed status and configuration data.

Local use

The status of the device can be seen at a glance from the LEDs of each unit. A more detailed view is available using the display and the seven keys of the central unit.

Remote use

Once deployed, status monitoring and configuration can be performed by using the IP connection (Ethernet interface of central unit). Each central unit hosts a web page showing its status and allowing remote configuration.

Over the air

Any station in a network can be accessed over the air by the remote user interface method described above.

USB 2.0	1W RF-power	DSP Signalling
Serial 57.6 kbps	Ethernet 10/100 Mbps	Linux OS
Air data rate 19.2 / 28.8 / 38.4 kbps	MODULAR	SATELNET Packet Routing
	AES-128 encryption	280...520 MHz

FLEXIBLE AND EXPANDABLE

The SATELLAR family is designed to be flexible and expandable both in terms of hardware and software functions.

Software

In the radio unit the channel spacing and forward error correction can be selected by changing the modem settings. Also the RF output power can be set.

Hardware

The USB host and device connectors of the central unit offer the possibility of connecting commercially available USB devices like Bluetooth and WLAN modules to the modem or to e.g. show the modem as an external memory device to a PC.

The radio unit allows a 45 MHz tuning range and the selection of channel spacing.

Mounting

The device can be mounted directly on a flat surface with two mounting clips that are included in to the sales package or on a DIN rail with separately ordered installation parts. DIN-rail mounting is possible either from the backside of the device (for local UI use) or from the side of each unit (LED indicators remain visible for the user).

Ruggedised

SATELLAR units are constructed of die-cast aluminum to withstand the wear and tear typical of harsh industrial environments. SATELLAR is designed to operate over a wide temperature range and even under the severe vibration common to vehicular or process industry applications.

SATELLAR-2DSd
Radio unit + central unit with display

SATELLAR-1DS
Radio unit only

TECHNICAL SPECIFICATIONS, RADIO UNIT

RADIO PARAMETERS

Frequency range	280 - 520 MHz *1)
Tuning range	45 MHz
Channel spacing	12.5 and 25 kHz, selectable
Carrier frequency configuration	Frequency programmability in 6.25 kHz steps
Carrier frequency accuracy	+/- 2.5 ppm, at temp. -25 ... +55 °C
Carrier frequency long term stability	+/-2.0 ppm / 3 years
Data latency (transparent mode)	<18 ms @ 25 kHz channel
Forward error correction (FEC)	configurable: off, rate 0.5 or rate 0.667

TRANSMITTER PARAMETERS

Output power	100 mW...1 W, SW adjustable with 100 mW steps
Adjacent channel power	typically < -63 dBc (meas. method EN 300113)
Maximum air interface data rates	38400 bps @ 25 kHz channel, 19200 bps @ 12.5 kHz channel

RECEIVER PARAMETERS

Sensitivity (dBm, FEC OFF) Channel spacing / air speed	BER	
	10E-3	10E-6
25kHz /19200 bps (4-FSK)	-116	-112
12.5kHz /9600 bps (4-FSK)	-119	-115
25kHz /38400 bps (16-FSK)	-102	-98
12.5kHz /19200 bps (16-FSK)	-105	-98

COMMON PARAMETERS

Power consumption	8.5 W at 1 W transmission 6 W at 100 mW transmission 3 W reception
Interfaces - power	Detachable / lockable Screw terminal
Interfaces - DTE (D9 female)	Options: a) RS-232 with handshaking b) RS-422/485/232 without handshaking
Interfaces - RF	TNC female
Mechanical dimensions	130 x 24.3 x 76.5 mm
Weight	300 g

TECHNICAL SPECIFICATIONS, CENTRAL UNIT

Mechanical dimensions	130 x 21.7 x 76.5 mm
Weight	260 g
CPU	ARM 9 @ ~ 200 MHz
RAM	64 MB RAM
ROM	128 MB flash
Display	2.4 ", 320 x 240 pixel resolution, 65 k colours
Keypad	up, down, left, right, OK (select) and two SW defined keys
Power consumption (no USB device connected)	2.0 W With UI 1.4 W Without UI
USB interfaces	USB-host & USB-device USB2.0 full speed
Ethernet interface	10/100 Mbit Ethernet RJ-45 with AUTOMDX

TECHNICAL SPECIFICATIONS, COMMON PARAMETERS

Standard compliance *2)	
Radio requirements	EN 300 113 MS, FCC Part 90
Emissions, immunity, radio unit	EN 301 489-1, 301 489-5, FCC Part 15
ESD, radio unit	EN 61000-4-2 level 4
Emissions, immunity, ESD central unit	EN 61000-6-2, 61000-6-4
RoHS	2002/95/EC

Temperature ranges	-25 ...+55 °C complies with the radio standards, -30 ...+75 °C functional, -40 ... +85 °C storage
Humidity	< 95 % @ 25 °C, non-condensing
Mounting	DIN rail (side or back), Direct on flat surface (with two mounting clips)
Vibration	at least 10 - 500 Hz/5 g without degradation in data transfer capability
Shock resistance	dropping height 1 m / all directions
IP rating	IP52
DC input range	+9 Vdc...+30 Vdc

Values are subject to change without notice.
*1) Check the available versions from local SATEL distributor.
*2) Check the local standard compliances from local SATEL distributor.

TWO MODES OF DATA TRANSFER

A SATELLAR Digital System can be used in either transparent or packet-based transfer mode. Selecting the right mode for the intended application ensures optimum performance and the best use of the radio channel for each application.

Transparent mode

The transparent transfer mode is intended for RS-232-, RS-485- or RS-422-based protocols (MODBUS, PROFIBUS, etc.). In this mode, any data sent to the modem DTE port will be transferred over radio to all recipients directly.

This mode of data transfer is optimised for low latency and relies on the used protocol to handle the communication discipline on the air interface. A point-to-point data latency in the order of 20 ms can be achieved with this mode of data transfer.

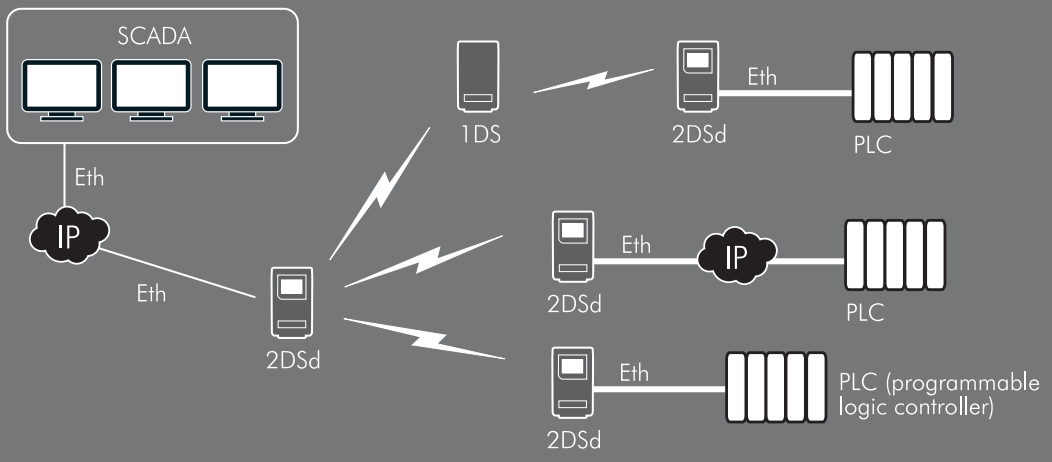
For transparent modem operation the central unit is not required. The radio unit handles the bulk of the workload, the central unit is used merely for USB / Ethernet connectivity and provides a local UI for the modem.

Packet mode data transfer

The packet mode data transfer is optimised for ease of use rather than latency. The modem takes care of collision avoidance on the air interface and packet routing in the radio modem network. This mode enables IP transfer (TCP/UDP) over a radio modem, thus easily achieving licensed reliable IP communication links of a wide range (>10 km), not easily achievable using other technologies.

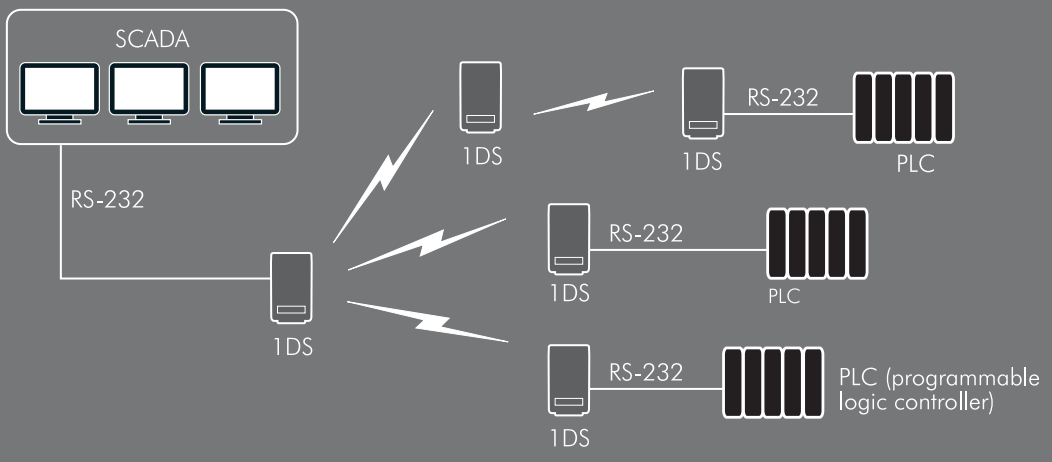
Packet mode transfer can be set up with the radio unit alone. However, to achieve maximum performance and to utilise all potential of the SATELLAR (for example local IP connectivity) the stations should be equipped with central units.

SCADA EXAMPLE 1: ALL IP



An example of a system using IP in all nodes of the network. Each station can serve as a radio router to extend the radio coverage. Each station can serve either only one client or provide a wireless uplink to an entire IP network on a substation consisting of many units.

SCADA EXAMPLE 2: RS-232



An example of a system using transparent transfer mode.

SATELLAR DIGITAL SYSTEM IN UTILITY DISTRIBUTION

SCADA systems are an essential part of any up-to-date utility distribution infrastructure. In many cases SCADA stands for concentrated and efficient handling of critical operations such as automated control, management and maintenance of, for example, distribution networks.

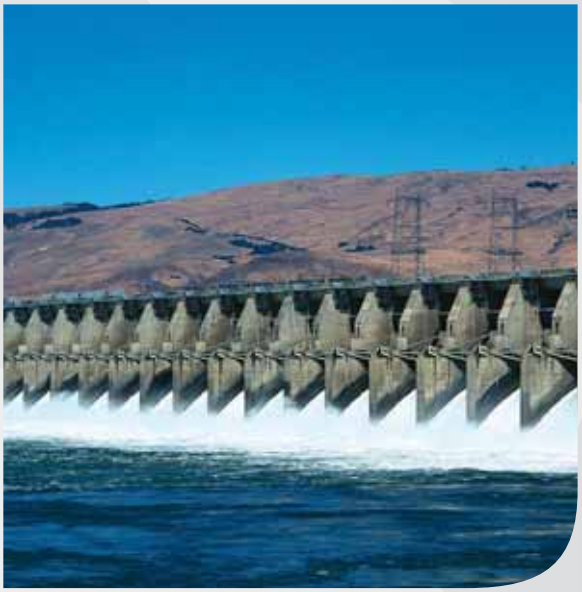
The SATELLAR digital system as a data transfer method in SCADA systems offers real-time, operator-free and secure connection.

Because of the integrated modular solution and versatile features of the SATELLAR digital system, it enables many different kinds of network solutions i.e. IEC 60870-5-101, DNP 3.0, Modbus, Profibus etc. or, alternatively, protocols based on the IP-protocol stack (TCP/UDP). The following describes the possible use of the SATELLAR digital system through a set of application-specific examples.

ELECTRICITY

In power distribution networks, which are sensitive to problematic situations, possible breaks in distribution must be kept as short as possible. This requires a reliable monitoring and control network. With radio modems it is easy to set up a network that monitors the condition of the power grid and link stations. If problems arise, malfunctioning stations can be pinpointed quickly and in some instances restored remotely.

- Remote control and monitoring of the power divider stations
- I/O data transfer from the stations
- Monitoring of the electricity distribution networks' voltage variation



WATER

Radio modems are used widely for the remote control and monitoring of waterworks and sewage processing plants. Since these installations are often in remote locations or cover a large area, the data network needs to be flexible, easy to extend and above all reliable. In water distribution plants, interruptions must be kept to a minimum, and problems addressed instantly. This puts additional pressure on the reliability and integrity on the monitoring and control network. With SATEL radio modems, real-time monitoring networks can be configured and expanded according to demand. The network may cover, for example, pumping stations, water reservoirs and distribution substations. SATEL modems are also used to monitor water usage, flow or other parameters:

- Monitoring of the flow and pressure of the water system
- Temperature depended irrigation for farming (agriculture)
- Overflow gate control
- Monitoring of leaks in water distribution systems
- Remote control of pumping stations
- Remote measurement of water level

GAS/OIL

SATEL radio modems are primarily used for monitoring gas compression and pressure reduction stations. To easily generate radio coverage over a vast geographical area, each radio modem can serve as a datalink for local RTUs and at the same time route/relay messages to other radio modems. SATEL radio modems can easily be used to control devices such as boiler controllers (gas temperature setting after pressure reduction) or injection gas odorisers (THT concentration proportioning and odoriser controller reset).

- Monitoring of pipeline pressure changes
- Collecting production volumes from pumping stations
- Remote control of pumping stations

WIND

Wind turbines are usually erected in remote locations so as to minimise noise pollution. Laying in data cables can prove expensive, thus making radio modems a natural choice for monitoring and controlling these innovative energy sources. Since wind turbines require constant monitoring to ensure the best possible energy output, the communications used must be reliable and fast. With SATEL radio modems, setting up a flexible data transfer network is easy and more importantly, reliable.

- Monitoring of wind power plants:
  - Amount of produced energy
  - Wind speed, humidity, temperature
- Wind mill maintenance

SATELLAR Digital System

For Long Range Wireless Data

More than just a radio modem – a complete solution

SATELLAR's integrated modular solution and Linux platform allow you to build the perfect solution for your specific need. SATELLAR allows us at SATEL to serve you even better and further than before.

SATELLAR-2DSd
Radio unit + central unit with display

SATELLAR-2DS
Radio unit + central unit without display

SATELLAR-1DS
Radio unit only

SATELLAR-2DSd
with expansion unit

SATEL reserves the right to change the technical specifications or functions of its products.

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