SATEL Compact-4BT

Mobile transceiver radio modem

USER GUIDE

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1 IMPORTANT NOTICE

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Salo, FINLAND 2020

2 RESTRICTIONS ON USE

SATEL Compact-4BT radio modem has been designed to operate on frequency ranges, the exact use of which differs from one region and/or country to another. The user of a radio modem must take care that the said device is not operated without the permission of the local authorities on frequencies other than those specifically reserved and intended for use without a specific permit.

SATEL Compact-4BT (403-473 MHz) is allowed to be used in the following countries, either on licence free channels or on channels where the operation requires a licence. More detailed information is available at the local frequency management authority.

Countries*:   AT, BE, BG, CY, DK, FI, FR, DE, GR, IE, IT, LU, MT, NL, NO, ES, SE, CH, GB,
CA, CZ, EE, HR, HU, LV, LT, PL, PT, RO, SI, SK, US

* codes of the countries follow the ISO 3166-1-Alpha-2 standard

WARNING! Users of SATEL Compact-4BT radio modems in North America should be aware, that due to the allocation of the frequency band 406.0 – 406.1 MHz for government use only, the use of radio modem on this frequency band without a proper permit is strictly forbidden.

WARNING! Users of SATEL Compact-4BT radio modems in Canada should be aware, that operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device. (RSS Gen section 7.1.5)

Warning – RF Exposure

The minimum safe distance however must be always at least 20 cm.
In addition, this device must not be co-located or operating in conjunction with any other amplifier etc.

Modification warning statement
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Class B digital device statement

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3 PRODUCT CONFORMITY

Hereby, SATEL Oy declares that SATEL Compact-4BT radio modem is in compliance with the essential requirements (radio performance, electromagnetic compatibility and electrical safety) and other relevant provisions of Directive 2014/53/EU. Therefore the equipment is labelled with the CE-marking.

$$C\epsilon$$

4 WARRANTY AND SAFETY INSTRUCTIONS

Read these safety instructions carefully before using the product:

- Warranty will be void, if the product is used in any way that is in contradiction with the instructions given in this manual, or if the radio modem housing has been opened or tampered with.

- The radio modem is only to be operated at frequencies allocated by local authorities, and without exceeding the given maximum allowed output power ratings. SATEL and its distributors are not responsible, if any products manufactured by it are used in unlawful ways.

- The devices mentioned in this manual are to be used only according to the instructions described in this manual. Faultless and safe operation of the devices can be guaranteed only if the transport, storage, operation and handling of the devices is appropriate. This also applies to the maintenance of the products.

4.1 Handling the battery operated device and safety issues

To maximize the device battery life a certain precautions should be noticed. If the device is left unused for a long period of time a charging could take place to prevent battery going totally empty. The best way to realize the battery capacity is that if the battery indicator LED is Red or the device won't start normally from the power button. These both conditions indicate that the battery has ran or is running empty.

The best temperature for storing the device is the normal room temperature, around +20℃.

If the batteries cannot maintain a charge for long periods of time or they charge not normal way, this may indicate that the battery is defect.

The performance and life expectancy of the battery depends heavily on how the batteries are used. Misusing the battery operated device may cause the battery to get hot, break or ignite and cause serious injury. Be sure to follow the safety rules listed below:

- Do not place the device in fire or heat the device with any external source.
- Do not open or modify the device by any means.
- Do not mechanically abuse the device over its limits or otherwise subject it to strong impacts or shocks.
- Do not use the device to any other purpose that it is intended to.
- Do not use the device if, while using, charging, or storing the device, the device emits an unusual smell, leaks or appears abnormal in any other way.

- Do not place the device in ovens, high-pressure containers, microwave or expose it to high water streams or underwater conditions for long periods.
- In the event that the device leaks battery fluids and the fluid gets into one's eye, do not rub the eye. Rinse well with water and immediately seek medical care. Do not leave it untreated as the fluid could cause damage to the eye.

Be sure to follow the rules listed below while charging the device or operate with the external power supply.

When charging the device either use a specified cable and power source or otherwise ensure that the charging conditions meet the specifications given in this manual.
Do not attach the device directly to a mains powered AC supply line. This will cause permanent damage to the device and could lead to an electric shock.

When the device becomes hot, the built- in safety feature is activated preventing the battery from charging further. If this happens reduce the heat to build up like shutting down the device during charging or placing the device to a cooler place.
When charging in cold conditions, do not heat up the device to extend its operational temperature range. Bring the device indoors to charge it.

Do not continue charging the device if it does not recharge within the specified charging time or the charging gives constant error indications. This might indicate that the battery is defect or the charging conditions are out of range.

It is recommended to use the power supply YP1240 that can be purchased from SATEL Oy or from the local SATEL distributor. If other power supplies are used the safety and performance are not guaranteed.

4.2 Battery disposal and end of life handling

SATEL Compact-4BT battery can withstand hundreds of charge cycles. However, battery has its range of cycles and then it should be replaced. Do not try to replace the battery by yourself, but send it to manufacturer for proper handling and battery replacement.

If you decide to dispose the unit, Lithium-Ion batteries are classified as non-hazardous waste but should be recycled or disposed properly. See your local area laws and recommendations how to dispose Li-Ion batteries or electronic waste. Many places have a local recycling points where you can drop off your batteries or electronic devices. Empty the battery completely before leaving it to a recycling point.

5 DESCRIPTION OF THE PRODUCT

SATEL Compact-4BT is a UHF radio transceiver modem. It provides a transparent data link with other SATEL Compact-4BT or SATELLINE-EASy family modems (such like SATELLINE-EASy, -TR1, -TR3, -TR4, -R3, -EASy Pro, -4Pro, SATEL Compact-Proof and EASy-Proof). SATEL Compact-4BT can be interconnected to a data terminal or similar devices by three different transmission standards; USB, RS-232 or Bluetooth. Data is further transmitted via UHF data modem.

SATEL Compact-4BT contains a circular M12 connector for USB/RS-232 and TNC for UHF radio modem, Bluetooth antenna is integrated.

SATEL Compact-4BT contains an integrated rechargeable Li-Ion battery pack which maintains the operation without external supply. Internal battery is not removable or serviceable by the user.

SATEL Compact-4BT is intended to use inside or outside environment and fulfills IP67 ratings (1meter / 30minutes). See more detailed description on chapter "Technical Specifications".
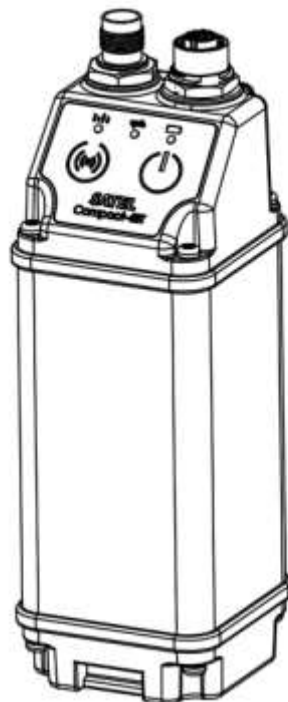
Figure 1.0 SATEL Compact-4BT radio data modem

6 USER INTERFACE

6.1 Data/DC-supply interface
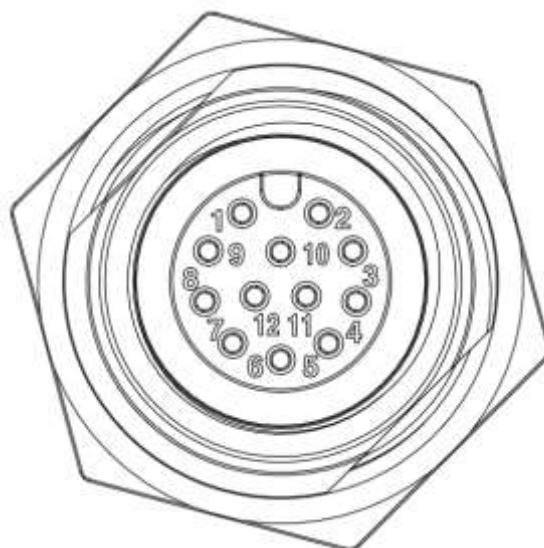
Figure 1.1 M12 circular connector and its pin configuration

PIN	SIGNAL NAME	DIRECTION	DESCRIPTION
1	USB D+	IN/OUT	USB data positive
2, 5, 6	GND		DC supply- and Signal ground
3	TXD	IN	Transmit data (V.24 level)
4	RXD	OUT	Receive data (V.24 level)
7, 8	+V	IN	**Supply voltage, 12-30 V (+/- 10%)
9	USB D-	IN/OUT	USB data negative
10	RTS	IN	Handshake (V.24 level)
11	CTS	OUT	Handshake (V.24 level)
12	+VUSB	IN	USB Supply voltage 5V

** DC input should be used with 3A fuse for protection.

6.2 LED indicators and buttons

SYMBOL	NAME	COLOR	DESCRIPTION
0o0o	Bluetooth status	Blue	All devices can pair and connect
		Red	Only (10 most recent) paired devices can connect
⇌	Data / Mode	Green	CP-4BT is on
		Red	Receives or transmits data over the serial interface
▭	Battery status (Power supply connected)	Green blink	Charging ongoing
		Green static	Charging complete
		Red blink	Charging error
	Battery status (During battery operation)	Green	Battery level is full
		Orange	Battery level is fair
		Red	Battery level is low
((•))	Bluetooth button		Enable / disable Bluetooth
(I)	Power button		Power on / off
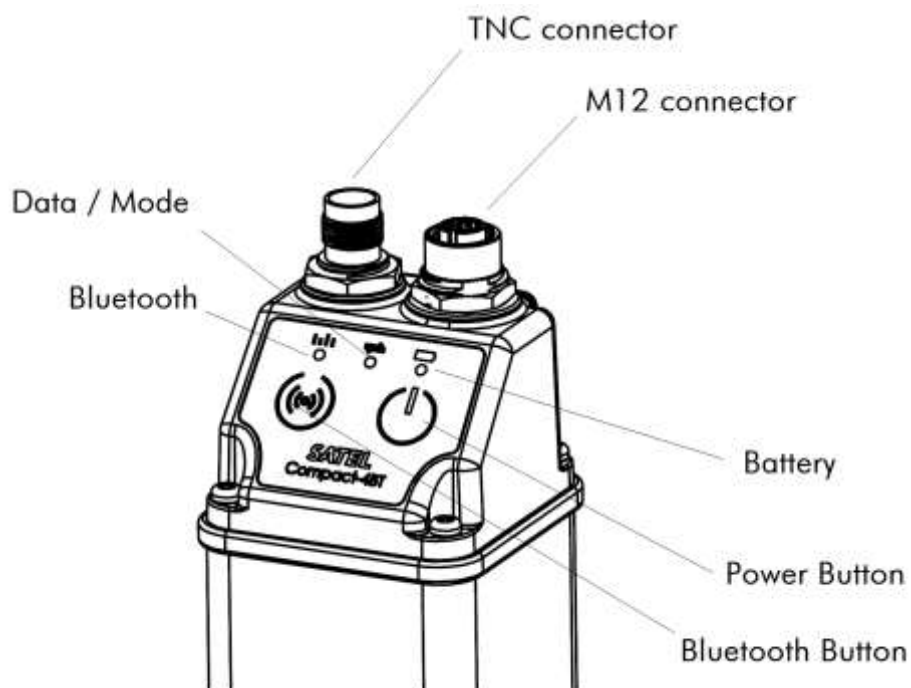
Figure 1.2 User interface

6.3 RF interface

The SATEL Compact-4BT has a single TNC female connector with impedance of 50 Ohm.

The output power of the transmitter is adjustable between 100, 200, 500 and 1000 mW. The greatest allowable power depends on limits set by local authorities, which should not be exceeded under any circumstances. The output power of the transmitter should be set to the smallest possible level, which still ensures error free connections under variable conditions. Large output power levels using short connection distances can, in the worst case, cause disturbances to the overall operation of the system.

NOTE!

Setting the radio data modem output power level to that which exceeds the regulations set forth by local authorities is strictly forbidden. The setting and/or using of non-approved power levels may lead to prosecution. SATEL and its distributors are not responsible for any illegal use of its radio equipment, and are not responsible in any way of any claims or penalties arising from the operation of its radio equipment in ways contradictory to local regulations and/or requirements and/or laws.

6.4 Modem start up

SATEL Compact-4BT is operated by two push buttons. Operational states are shown with three LEDs and different LED colours. To turn on CP-4BT push Power button continuously for three seconds. Battery LED and DATA/Mode LED will illuminate. To turn off SATEL Compact-4BT push power button continuously for three seconds.

Pushing power button continuously for 10 seconds SATEL Compact-4BT will internally reset (electrical reboot of complete device, settings remain).

6.5 Bluetooth

To turn on Bluetooth push Bluetooth button for three seconds. Bluetooth LED starts to blink Blue.

To turn off Bluetooth push Bluetooth button for three seconds. Bluetooth LED will go off.

If Bluetooth was enabled when device was operational Bluetooth will start next time automatically when device is switched on. If Bluetooth was disabled when device was operational Bluetooth will remain off during next time device is switched on.

After enabling Bluetooth LED will blink Blue. During this period all devices can find, pair and connect. After two minutes LED will switch to Red and further on no new devices can pair but (10 most recent) paired devices can connect.

SATEL Compact-4BT is possible to set to a Bluetooth remote mode. Remote mode allow users to switch on the device remotely only by creating a connection to Bluetooth. To set the device to a remote mode Bluetooth should be enabled when the device is off by pushing the Bluetooth button for three seconds.

Notice that Bluetooth uses an internal antenna, so no external antenna is required. Bluetooth antenna is positioned on a bottom of the device so for the best performance the internal antenna should not be blocked or screened by metal objects set close to the housing.

6.6 Data transfer via SATEL Compact-4BT

Data can be sent via Bluetooth, USB or RS-232 which are ON simultaneously so no extra setting is needed to choose which port shall be opened, choosing the data port is done by selecting the dedicated cable.
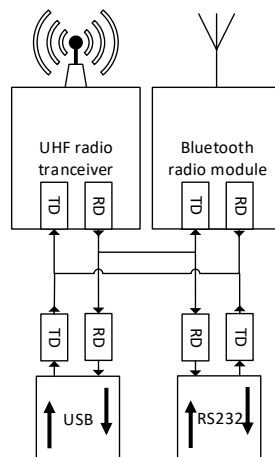
If Bluetooth port is used for data transmission USB and RS-232 ports are also operational. User should not send data to two different ports simultaneously as this might corrupt the data.
All serial ports including Bluetooth do not output or pass through data to other serial ports, all data input is directed to internal UHF modem.

If Bluetooth data transmission is required Bluetooth must first pair and connect with SATEL Compact-4BT.

6.7 Charging the battery

SATEL Compact-4BT contains a Li-Ion battery which can be charged from external DC supply. The device can be operated either battery powered or external DC supply powered. During the external DC supply internal battery is charged. This influence the power consumption from the external source up till 2 Amps @ 12V. When external DC supply is connected all power is drained from that source. After battery is fully charged the external DC supply will continue to feed the device hence not draining the battery. DC supply can be disconnected at any time or it can be left connected all times.

When external DC supply is connected Battery LED will illuminate Green or blinking Green when charging is ongoing.

If during the charging Red LED starts blinking there is an internal error in charging process. Error can occur in a following circumstances; charging temperature is too low or high, maximum charging time has exceeded, battery absent or defect. In a case of error occurrence assure that the device is in a proper temperature range. Notice that inner temperature may be different than outside, or the device may take a while to cool down or heat up. If charging takes too long or behaves not normal, battery may be defect. In this case contact manufacturer for further instructions.

6.8 Battery capacity

A good practise is to minimise battery consumption during the operation as this can dramatically extend the operational time. The best way to minimize battery drainage is to use as little Transmit power as possible. If Transmission distances are short, output power of 100mW could be adequate. As well the device should be switched off if not in use.

Below are the typical operational times in various conditions.

Condition, +20°C	Operation	Notes
Transmit, 50 % duty cycle	6 hours*	1 W output
Transmit, 50 % duty cycle	8 hours*	500 mW output
Receive	20 hours*	
Bluetooth only	>20 days*	discoverable mode
Power off	>1 year*	
Charging	4 hours	empty → full
Cycle life	>500**	full charge - discharge cycles

*   In -20 °Celsius operational times can decrease 40 %.
**   Due to the Li-Ion battery technology capacity will slightly decrease after each cycle effecting directly to the operation times.

6.9 <u>**Battery maintenance**</u>

Li-Ion battery technology requires some maintenance procedures to optimise its longevity during use and storage. SATEL Compact-4BT uses its internal battery to some minor functionalities even if the unit is set to OFF. This means that the battery is constantly drained and will eventually deep discharge the battery which radically effects its durability. Therefore it is essential to maintain the battery charge state even if the unit is stored and not used for longer periods. The simple way to maintain the battery condition is to keep the unit in a room temperature and periodically charge it fully every 6 months.

7 TECHNICAL SPECIFICATIONS

SATEL Compact-4BT complies with the following international standards:
EN 300 113
EN 300 489 (EMC)
IEC 60950 (safety)
CFR47 part90

	RECEIVER	TRANSMITTER	Note!
Frequency Range	403 … 473 MHz		
Tuning range	70 MHz		
Minimum RF Frequency Step	6.25 kHz (10 kHz @ 20 kHz channel spacing)		
Channel Bandwidth	12.5 kHz / 25 kHz		Programmable
Channel Spacing	12.5, 20 (uses 12.5kHz channel width), 25 kHz		
Frequency Stability	<1 kHz		
Maximum Receiver Input Power without Damage	+14 dBm		
Maximum Receiver Input Power without Transmission Errors	-10 dBm		FEC ON
Sensitivity	-112 dBm @ 25 kHz -116 dBm @12.5 kHz		FEC ON
Blocking	> 86 dB @ 25 kHz > 88 dB @ 12.5 kHz		FEC ON
Intermodulation Attenuation	> 61 dB @ 25 kHz > 61 @ 12.5 kHz		FEC ON
CO-Channel Rejection	> -11 dB @ 25 kHz > -10 dB @ 12.5 kHz		FEC ON
Adjacent Channel Selectivity	> 56 dB @ 25 kHz > 51 dB @ 12.5 kHz		FEC ON
Spurious Rejection	> 67 dB		FEC ON
Typical Power Consumption Note 1.	Charging	12 V: 7.4 W	RX-OFF
	Charging + RX	12 V: 8.4 W	RX-mode
	Charging + TX	12 V: 13.2 W @ 1 W RF	TX-mode, Continuous, 50Ω
	Device OFF	12 V: 0.46 W	Not Charging
	RX	12 V: 1.32 W	Not Charging
	TX	12 V: 5.8 W @ 1 W RF	
Transmitter Power (programmable)		0.1, 0.2, 0.5, 1 W	TX-mode, 50Ω load
Communication Mode	Half-Duplex		
Adjacent Channel Power		acc. to EN 300 113	TX-mode
Transient Adjacent Channel Power		acc. to EN 300 113	TX-mode
Carrier power stability		< ±1.5 dB	

	DATA MODEM	Note
Electrical Interface	RS-232 / USB	
Bluetooth	Bluetooth 2.1 / BLE	
Interface Connector	M12 Circular	
Data speed of I/O-interface	9600 – 115200 bps	
Data speed of Radio Interface	4FSK FEC OFF: 19200 bps (25 kHz) 9600 bps (12.5 kHz) 4FSK FEC ON: 14400 bps (25 kHz) 7200 bps (12.5 kHz) 8FSK FEC OFF: 28800 bps (25 kHz) 14400 bps (12.5 kHz) 8FSK FEC ON: 19200 bps (25 kHz) 9600 bps (12.5 kHz) 16FSK FEC ON: 28800 bps (25 kHz) 14400 bps (12.5 kHz)	
Data Formats	Asynchronous data	
Air Interface Encryption	AES128	Programmable
Modulation	4FSK, 8FSK, 16FSK, GMSK	

	GENERAL	Note
Operating Voltage	+12 … +30 Vdc +/- 10% Vdc	External DC supply
Temperature Range	Type approval condition: -25 ... +55 °C.	
Battery pack	2S1P, 7.4V 3350 mAh Li-Ion	
Charging condition	0 °C ... +45 °C	
Temperature Ranges	-25 °C ... +60 °C	Battery operated
	-40 °C ... +85 °C	Operational
	-25 °C ... +55 °C	Complies with standards
	-40 °C … +85 °C	Storage
Antenna Connector	50 Ω, TNC female	
Housing	Shielded / bare PCB inside metal / plastic housing	
UHF Antenna	External	
Bluetooth antenna	Internal	
Size L x W x H	165 mm x 55 mm x 55 mm	overall height
IP rating	IP67	30min / 1meter
Mechanical Properties	IEC60068-2-32, ISO9022-36-08, ISO9022-31-06, ISO9022-33-06	
Weight	420 g	

	OTHER MEASURES	Note
ESD-failure threshold	8 kV contact, 15 kV air discharge	
Immunity test	10 V/m	

Values are subject to change without a notice.

Note 1: Power consumption is measured using an external power source.

8 MODEM SETTINGS

8.1 Default settings

The radio modem is delivered with the following default settings (unless otherwise specifically ordered):

DEFAULT VALUES OF THE USER ADJUSTABLE SETTINGS		
Setting	**Default value**	**Range**
Radio frequency		
Operating TX frequency	438.000 MHz	Range: 403-473 MHz
Operating RX frequency	438.000 MHz	Range: 403-473 MHz
Reference Frequency	438.000 MHz	Range: 403-473 MHz
Channel Spacing	25 kHz	12.5, 20 (uses 12.5kHz channel width), 25 kHz
Radio settings		
TX Power	1000 mW	Range: 100, 200, 500 or 1000 mW
Signal threshold	-115 dBm	- 80 … -118 dBm
TX-Start Delay	0 ms	0-65535 ms
Radio Compatibility	SATELLINE 3AS	SATELLINE 3AS PacCrest-4FSK PacCrest-GMSK TrimTalk450s(P) TrimTalk450s(T) PacCrest-FST SATEL-8FSK-1 (FEC OFF) SATEL-8FSK-2 (FEC ON) SATEL-16FSK-1 (FEC ON)
Addressing		
RX Address	OFF	ON/OFF
TX Address	OFF	ON/OFF
Serial port		
Data speed	115200 bps	1200 – 115200 bps
Data bits	8	8
Parity bits	None	None, Even, Odd.
Stop bits	1	1

Handshaking		Handshaking lines apply to the DATA-port.
CTS	TX buffer state	Clear to send, TX buffer state
CD	*not supported*	RSSI- threshold, Data on channel, Always ON.
RTS	Ignored	Ignored, Flow Control, Reception Control.
Pause length	3 bytes	3….255
Additional setup		
Error correction, FEC	OFF	ON/OFF
Error check	OFF	OFF, CRC8Partial, CRC8Full, CRC16Full
Repeater Mode	OFF	ON/OFF
SL-commands	ON	ON/OFF
TX Delay	0	0 …. 65535 ms
Over-the-Air-Encryption	OFF	ON/OFF
Use Channel List	OFF	ON/OFF
Power Save Mode	OFF	ON/OFF
Add RSSI to Data	OFF	ON/OFF

8.2 Configuration

The configuration of settings can be changed easily - the next chapters describe the details:

SATEL NETCO Mobile application
When mobile application is used a Bluetooth is needed for data transmission.
Mobile application can be downloaded from Android PLAY-shop with the name of "SATEL NETCO Mobile".

SATEL Configuration Manager PC software
This clear to use software suits in most cases. Additional to other tools, it includes the channel list editor for creating the channel lists.

SL commands
A terminal device can command or configure the radio modem by using special commands. SL commands are applied especially in cases where radio modems are to be integrated seamlessly inside a system behind the integrator's own user interface.

8.2.1 Using SATEL NETCO Mobile application

SATEL Compact-4BT configuration can also be modified by Mobile application NETCO Mobile.
When mobile application is used a Bluetooth is needed for data transmission.
Mobile application can be downloaded from Android PLAY-shop with the name of "SATEL
NETCO Mobile".

Once the application is installed, an icon is placed on a
home screen of the device.

To be able to use SATEL Compact-4BT with Bluetooth it first should be paired with the user
device where SATEL NETCO is installed. The pairing is similar what other Bluetooth devices use
in general and in Android devices pairing is done through "Settings" → "Bluetooth".

Pairing is allowed only if the blue LED is blinking. After two minutes blue LED turns to red, now
only paired devices can connect. There is a memory of ten (10) most recent paired devices which
are sequentially replaced when new devices are paired.

When Bluetooth red LED is blinking and pairing is no longer possible, turn off the Bluetooth and
restart it by again pushing the Bluetooth button. This will start a new two minute period for
pairing.

Once the pairing is accomplished, using the application is very straightforward. Open the SATEL
NETCO Mobile application and search for nearby Bluetooth devices. Once the SATEL Compact-
4BT is found, simply connect to it.

1. Choose the connection style "Bluetooth"
2. Connect to a found device "CP-4BT"
3. Choose "Configuration" to change modem parameters.

8.2.2 SATEL Configuration Manager software

SATEL Configuration Manager is the PC software for the configuration of SATELLINE-M3-R/TR, SATEL-R/TR –module based radio models, covering most of the SATEL radio products.

Minimum requirements: PC (Win10 OS) with equipped with a COM port (USB-RS adapters available) and the radio modem, powered up, to be configured.

The software is available from the dealers or at https://www.satel.com/support-and-services/downloads/.
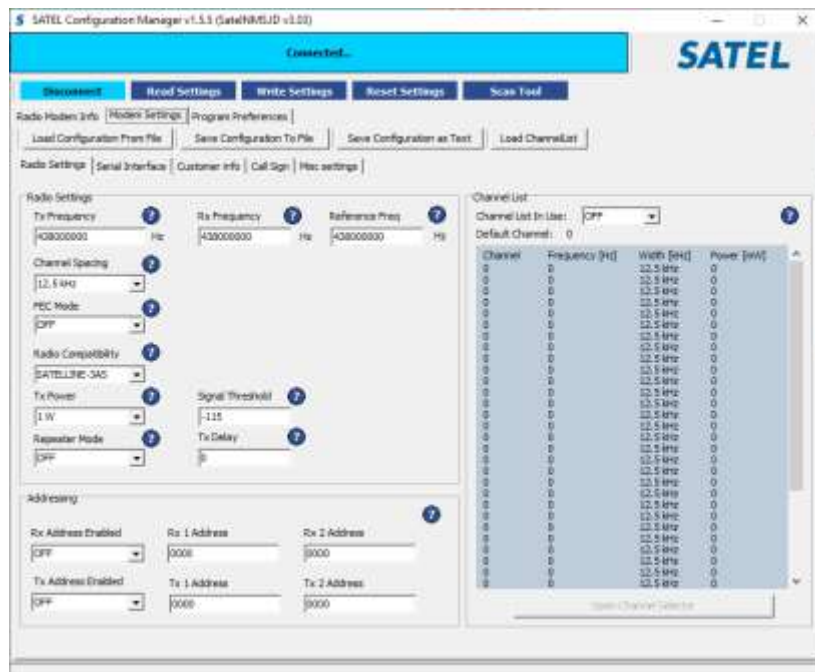
8.2.2.1 QuickStart

Preliminary settings:

- Save the SATEL Configuration Manager, SATEL_Configuration_Manager.help and the SatelNMS.ID to the same directory. If available, save also the Firmware to the same directory.
- Connect the modem module to the PC using either YC0401 DC/USB or YC0400 DC/RS232 or Bluetooth.

- Connect supply power to the module. Check that you have the correct Supply Voltage.

- Open the SATEL Configuration Manager program. Check from the "Program Preferences" tab, that you have selected correct COM-port number and that the Baud rate is set to

9600 (when programming adapter is used, and according to the modem serial port data rate, when the direct data cable is used.)

- To establish connection between the modem and the PC, press the blue Connect tab. To get the radio modem info, press blue Read Settings tab. Now all the information from the modem is available.

- Changed serial interface parameters are taken in use immediately.

For more information about Configuration Manager can be found from User Guide.
www.satel.com

8.2.3   Changing parameters using SL commands

The controlling terminal device can change the configuration settings of the module. This is accomplished with the help of SL commands. SL commands can be used to change e.g. the frequency or addresses. It is also possible to ask the radio transceiver module to show current settings which are in use.

8.2.3.1 SL Commands

The controlling terminal device can change the configuration settings of a radio. This is accomplished with the help of SL commands, which can be used during data transfer. SL commands can be used to change e.g. the frequency or addresses. It is also possible to interrogate a radio modem in order to gain information concerning current settings that are in use. SL command -setting must be enabled before they can be used.

An SL command is a continuous string of characters, which is separated from other data by pauses which are equal or greater than time defined by Pause length parameter (default=3 characters) in the set-up. No extra characters are allowed at the end of an SL command. Serial interface settings are the same as in data transfer. SL command is properly recognised also in the case when the command string is terminated by <CR> (=ASCII character no. 13, Carriage Return, 0x0d) or <CR><LF> (<LF> = ASCII char. no. 10, Line Feed, 0x0a). If multiple SL commands are sent to the module, the next command can be given after receiving the response ("Ok" or "Error") of the proceeding command. In addition, it is recommended to implement a timeout to the terminal software for recovering the case when no response is received from the radio module.

The transceiver module will acknowledge all commands by returning an "OK" (command carried out or accepted) or the requested value, or an "ERROR" (command not carried out or interpreted as erroneous) message.

In order to get information of the latest and/or special SL commands please contact SATEL, Technical.support@satel.com.

8.2.3.2 SL Command Mode

When the SL commands are enabled there are possibilities that the user data may start with the characters "SL" which is handled as the SL command. This has caused the firmware to go to the continuous SL command search mode and any data has not been sent or even an "ERROR" acknowledgment has been received. To avoid this kind behaviour the user can disable the SL commands.

The SL commands can be disabled or enabled by using SL commands or toggling the "SL Command mode" parameter via the SATEL Configuration Manager, version v1.3.15 or newer.

9 SERIAL PORT

The radio modem is referred to as DCE (Data Communication Equipment) whereas the device connected to it, typically a PLC or a PC, is referred to as DTE (Data Terminal Equipment).

In order to transfer data, the physical interface between DCE and DTE must be compatible and properly configured. This chapter describes shortly the basics of the physical interface options, the related settings and the operation of the serial interface.

Before connecting DTE (Data Terminal Equipment) to the radio modem, make sure that the configuration matches the physical interface (electrical characteristics, timing, direction and interpretation of signals).

9.1 Pause length

The modem recognises a pause on the serial line (a pause is defined as a time with no status changes on the RS-232 interface TD-line). The pause detection is used as criteria for:
End of radio transmission - When the transmit buffer is empty and a pause is detected, the modem stops the transmission and will then change the radio to the receive mode.
SL command recognition - For a SL command to be valid, a pause must be detected before the actual command character string.
User address recognition - In order for the start character to be detected, a pause must precede it in transmission.

Traditionally, in asynchronous data communication, pauses have been used to separate serial messages from each other. However, the use of non-real-time operating systems (frequently used on PC-type hardware) often adds random pauses, which may result in the user data splitting into two or more separate radio transmissions. This may cause problems especially in the systems including repeater stations.

In order to match the operation of the radio modem to the user data, the Pause length parameter can be adjusted on the programming menu. It may have any value between 3 and 255 characters. The default value is 3 characters.

Notes:
The absolute time of Pause length is depending on the serial port settings. For example, 1 character is ~1.04 ms at 9600 bps / 8N1 (10 bits).
The maximum absolute time is always 170 ms independent from the value of the Pause length given in the set-up.
An increase in the Pause length increases the round trip delay of the radio link correspondingly; this is due to the fact that the radio channel is occupied for the time of the Pause length after each transmission (the time it takes to detect a pause). If this is not acceptable, the TX delay setting may also be useful in special cases.

9.2 Data buffering

Whenever the radio modem is in *Data Transfer Mode* it monitors both the radio channel and the serial interface. When the terminal device starts data transmission the radio modem switches to transmission mode. At the beginning of each transmission a synchronisation signal is transmitted and this signal is detected by another radio modem, which then switches into receive mode. During the transmission of the synchronisation signal the radio modem buffers data into its memory. Transmission ends when a pause is detected in the data sent by the terminal device, and after all buffered data has been transmitted. When the serial interface speed is the same or slower than the speed of the radio interface, the internal transmit buffer memory cannot overflow. However, when the serial interface speed exceeds the speed of the radio interface, data will eventually fill transmit buffer memory. In this instance, it will take a moment after the terminal device has stopped transmission of data for the radio modem to empty the buffer and before the transmitter switches off. The maximum size of transmit buffer memory is one kilobyte (1 kB). If the terminal device does not follow the status of the CTS-line and transmits too much data to the radio modem, the buffer will be emptied and the transmission is restarted.

In the receive mode, the buffer works principally in the above described way thus evening out differences in data transfer speeds. If the terminal device transmits data to a radio modem in receive mode, the data will go into transmit buffer memory. Transmission will start immediately when the radio channel is available.

10 RF interface

The antenna interface is a 50 Ω coaxial connector. Matching networks are not included on the module and should be placed in the host application if the antenna is not 50 Ω.

> **NOTE!**
> Setting the transmitter output power to such a level that exceeds the regulations set forth by local authorities is strictly forbidden. The setting and/or using of non-approved power levels may lead to prosecution. SATEL and its distributors are not responsible for any illegal use of its radio equipment, and are not responsible in any way of any claims or penalties arising from the operation of its radio equipment in ways contradictory to local regulations and/or requirements and/or laws.

10.1 Transmitter

The output power of the transmitter is adjustable (see the table below for available values). The greatest allowable power depends on limits set by local authorities, which should not be exceeded under any circumstances. The output power of the transmitter should be set to the smallest possible level such that it still ensures error free connection under variable conditions. Excessively high output power levels used in short link spans can cause interferences and affect to the overall operation of the system.

Transmitter output power levels		
Output power (mW)	Output power (dBm)	403-473 MHz
100 mW	+20 dBm	✓
200 mW	+23 dBm	✓
500 mW	+27 dBm	✓
1000 mW	+30 dBm	✓

The antenna (or a 50 Ohm attenuator) should be always connected to the antenna connector while the transmitter is being used in order to guarantee the maximum lifetime of the transmitter.

10.2 Receiver

The sensitivity of the receiver depends on the channel spacing of the radio modem (=data speed of the radio interface) and on the mode of the FEC (error correction).

Receiver sensitivity			
Frequency range	Channel Spacing	FEC OFF	FEC ON
403 – 473 MHz	25 kHz	-108 dBm	-111 dBm
	12.5 kHz	-111 dBm	-114 dBm

The radio modem measures the received signal strength (RSSI) of the receiver constantly. The Signal Threshold setting determines the received signal level above which the search for the radio messages is active. It is recommended that values given in the table above are used as a basis. If the threshold is set too low, it is possible that the receiver is trying to synchronise itself with noise. In such a case the actual data transmission might remain unnoticed. If the threshold is set too high, the weak data transmissions will be rejected although they could be otherwise receivable. Signal threshold should only be changed for a reason - for example in the following cases:

Continuous interference is present and the desired signal is strong. In this case the signal threshold can be increased to prevent the modem from synchronising to the interfering signal(s) and /or possible noise.

Maximum sensitivity should be achieved and the desired signal is very weak. In this case the sensitivity could increase by decreasing Signal threshold. This type of situation is usually a sign of a poorly constructed radio network / contact. Bit errors and momentary loss of signals can be expected in this kind of a situation. Some data might be successfully transferred.

The RSSI can be requested also locally by using a special SL command (SL@R?). The RSSI value is available 7s after the receiving the message. After that the value is returned to zero.

10.3 Encryption

Data security is often a concern when using radio communication. In the SATELLINE-M3-TR3, –TR4 and -R4 product family, including the SATEL-Compact 4BT, an AES128-bit encryption (CTR-mode) on the air-interface ensures privacy in the radio network. The principle of encryption in the radio path is to collect a certain amount of data to a shift register and manipulate it according to a certain rule. Every data packet is encrypted individually. The process of encryption adds 10 ms delay in the data flow to each sent data packet (<5 characters) and must be avoided in the cases where low latency is the most important requirement.

AES is open source software from public domain. Author: Brian Gladman (U.K). The CTR-mode is SATEL's in-house implementation.

Separate product model available with support of the encryption for the RF interface. The models supporting this feature and encryption level can be viewed in SATEL WEB sites at www.satel.com/products/. The radio models that does not support the encryption feature are compatible with the radio models with the encryption when the feature is disabled. It is not possible to update/change the models NOT supporting the encryption to support this feature in the field. This task can be executed is SATEL factory premises and will be charged according to the service price list. The factory default value for the encryption feature is OFF state. The setting state with the static, distributed encryption keys have to be set equally to the radios in the same radio network.

Please contact SATEL for more detailed information regarding the radio network compatibility settings in radio network between different models (channel width, radio frequency etc.).

The encryption password key is generated by using Main and Aux –keys + in the beginning of the data packet transferred changing 32-bit string. It is mandatory to insert both information keys with the mentioned length keys. Options for generating the encryption keys are:
- Manually via terminal connection:
- SL commands
- Automatically with password via Configuration Manager software (generates automatically the Main and Aux keys)

It is recommended to set up a radio network with encryption enabled by using only one selected configuration way. The equivalency of the encryption keys between radio modems can be verified from the Key Hash –information field. Last 4 marks indicates the equivalency [0-9, A-F].

NOTE! The encryption works ONLY in SATELLINE-3AS –radio compatibility mode.

10.4 Priority RX/TX

Priority setting selects the priority between reception and transmission. The setting can be changed either with Configuration Manager SW or via SL commands. By default, transmission has higher priority than reception i.e. the default value is Priority TX.

Priority TX means that the device attached to a radio modem decides the timing of the transmission. The transmitter is immediately switched on when the terminal device starts to output data. Should reception be in progress, the radio modem will stop it and change to a transmit state. There is no need to use any handshaking for the control of timing.

Priority RX means, that a radio tries to receive all data currently in the air. If a terminal device outputs data to be transmitted (or an SL command) it will be buffered. The radio modem will wait until the reception has stopped before transmitting the buffered data. This will result in timing slacks to the system, but decreases the number of collisions on the air; this is particularly useful in systems based on multiple random accesses.

10.5 Forward Error Correction (FEC)

FEC improves the reliability of data transfer over the radio by adding additional correction information to the radio messages. Based on that information, the receiving radio modem will be able to correct erroneous bits provided the ratio of erroneous and correct bits is reasonable. However, the use of FEC decreases the data throughput, because the amount of transmitted data increases about 30 % (see Appendix 11.2). FEC should be used on long distance links and/or if the radio channel is "noisy" in other words suffering from interfering signals.

> **NOTE!** All radio modems, which are to communicate with each other, must have the same setting for FEC (ON or OFF). If the transmitting radio modem and the receiving radio modem has different settings, data will not be received.

10.6 Error checking

When the error checking is switched on, the radio will add a checksum to the transmitted data. When the data is received, the checksum is verified before data is forwarded to the serial port. Options for error checking can be accessed either via SL commands or Configuration Manager SW. Setting must be set equally for all radio modems in the same network. Error Check modes:

OFF (default setting). Received data is not verified at all. In practice, this is the fastest way to operate, because the data is given out from serial port immediately after it has been received. This is recommended method, if the application protocol already includes error checking functions.

CRC8 Partial verifies the data in small blocks and they are delivered to DTE as sub messages after validating. Once an error is detected, the rest of the message is ignored. In practice, if the error appears in the middle of the message, the first part is forwarded to DTE and the data in erroneous sub-message and after that will be lost.

CRC16 Full and CRC 8 Full check adds checksum characters accordingly at the end of the user data message. At the reception end the receiver receives first the whole package and if the checksum matches the data message is forwarded to the serial port.

10.7 TX Delay

The transceiver can be configured to delay the beginning of a radio transmission by 1…65000 ms. The function can be used to prevent packet contention in a system, where all substations would otherwise answer a poll of a base-station simultaneously. During this delay data sent to the radio modem is buffered. Even when the priority setting is "RX", the radio modem is prevented to change over to the receiving mode during the period of the TX delay. If TX delay is not needed, its value should be set to 0 ms.

10.8 Separate TX/RX frequencies

Modem can transmit (TX-frequency) and receive (RX-frequency) on separate frequencies. The switch between the frequencies introduces an extra 40 ms delay in the data transfer that must be taken account when designing the system.

10.9 Channel list

A list of predefined radio channels can be stored in the memory in order to change the radio settings simply by switching between the channels. Each channel carries the following info:
- Channel number (any number -32767...32767)
- Transmitter/Receiver frequency
- Channel width (12.5, 20 or 25 kHz)
- Transmitter power level (optional)

Additionally, the default channel that the radio modem uses after a reset is defined.
Channel lists can be created and utilized by using either SATEL Configuration Manager Software or SL commands.

SATEL Configuration Manager software provide a channel list editor (snapshot below) for creating and saving a channel list in the radio modem, or in a file for later usage.

Channel Selector
Default Channel Set

Clear	Load	Save	Add	Edit	Up	Down	Set default	Delete	Close

#	User Channel	Frequency	Channel Width	Tx Power
1	0	430000000	12500	1000
2	-5	438000000	12500	100
3	123	468200000	25000	500
4	12345	430000000	12500	200

SL commands provide an interface for a host device to command the radio modem directly. An example of the procedure for creating or replacing a channel list:

1. Clear existing channel list (SL$C=0)
2. Set channel info for each of the channels to be created starting from index 0 (SL$L=)
3. Set number of channels in channel list (SL$C=)
4. Set the default channel (SL$D=)
5. Verify the new configuration:
> Get number of channels in channel list (SL$C?)
> Get channel info for each of the channels (SL$L?)
> Get the default channel (SL$C?)
7. Enable Channel list (SL$M=1) in order to activate the Channel list
8. Save the settings (SL**>)

10.10 Repeater —mode

Repeaters and addressing may be used to extend the coverage area of a radio modem network, and to direct messages to selected radio modems in the network. In large systems, with several repeaters and formed repeater chains, it is often practical to use routing instead of plain addresses.

In circumstances where it is necessary to extend the coverage area of a radio modem network, modem can be used as repeater stations.

The maximum size of a repeated data packet is 1kB (kilobyte). The Repeater Function is switched on in the radio settings. In the repeater mode the radio modem will function as a totally independent unit. Other devices are not necessary.

A radio modem acting as a repeater can also be used to receive and transmit data. In repeater mode the radio modem will transmit the received data to the serial interface in a normal fashion. The difference being that the received data will be buffered into the buffer memory. After reception the radio modem will re-transmit the buffered data using the same radio channel as in reception. Data received through the serial interface a radio modem in repeater mode will transmit normally.

The same network may include several repeaters, which operate under the same base station. Repeaters may also be chained; in which case a message is transmitted through several repeaters. In systems with more than one serially or parallelly chained repeater, addressing or routing protocol must be used to prevent a message ending up in a loop formed by repeaters, and to ensure that the message finally reaches only the intended radio modem.

Please contact SATEL for more information of Repeater- and Addressing –features.

10.11 Pacific Crest and TRIMTALK compatibility

This product supports additional to the original SATELLINE-3AS data transfer also:

- Pacific Crest FST compatible data transfer over the air, if the opponent Pacific Crest modems operate in the transparent mode/FEC ON/Scrambling ON that is the most common setup among RTK applications. The other modes are currently not supported.

- TRIMTALK® 450s compatible data transfer over the air.

Following radio compatibility options:

- SATEL   Original "SATEL 3AS"(default) 4FSK data transfer mode (option 0)
  SATEL-8FSK-1 (option 20) 8-FSK/FEC OFF
  SATEL-8FSK-2 (option 21) 8-FSK/FEC ON
  SATEL-16FSK-1 (option 22) 16-FSK/FEC ON

- PacCrest-4FSK   Transparent mode/FEC ON/Scrambling ON (Option 1)
  Transparent mode/FEC OFF/Scrambling ON (Option 23)
  Transparent mode/FEC OFF/Scrambling OFF (Option 26)
  Transparent mode/FEC ON/Scrambling OFF (Option 28)

- PacCrest-GMSK   Transparent mode/FEC ON/Scrambling ON (Option 2)
  Transparent mode/FEC OFF/Scrambling ON (Option 24)
  Transparent mode/FEC OFF/Scrambling OFF (Option 27)
  Transparent mode/FEC ON/Scrambling OFF (Option 29)

- TrimTalk450s(P)   Trimtalk450s GMSK Rx fitted to PacCrest transmitters (Option 3)

- TrimTalk450s(T)   Trimtalk450s GMSK Rx fitted to Trimble transmitters (Option 4)

- PacCrest-FST   (Option 5)

Notes:
Supported compatibility options may vary depending on the model and factory configuration.

All radio modems of a system must have identical FEC setting (ON or OFF) in SATELLINE-3AS mode.

The implementation of Radio compatibility options is based on the reference measurements and the available public data of the following radio modems manufactured by Pacific Crest Corporation: ADL, RFM96W, PDL HPB, PDL LPB. TRIMTALK is a trademark of Trimble Navigation Ltd.

10.11.1 Settings in compatibility modes

In order to use the Pacific Crest/TRIMTALK modes implemented in SATELLINE radios:

PACIFIC CREST modems must have:
- Protocol Mode
- Transparent w/EOT Timeout (when using Pacific Crest modulations)
- TrimTalk 450s (when using TRIMTALK GMSK modulation)
- Modulation Type depends on the system
- GMSK (default, always selected when using TRIMTALK 450s mode)
- 4-Level-FSK
- FEC = ON
- Scrambling = ON
- Data Security Code set to = 0 (=not used)
- Local Address= 0…254 (0 by default)
  Pacific Crest modems receive messages from SATELLINE modems that have their TX1 address matching the Local Address.

Remote address=0…255 (255 by default, that is the broadcast address to be received by all). SATELLINE modems receive the message from a Pacific Crest radio, provided their RX1 address matches the Remote Address of a Pacific Crest transmitter (or if the message has the broadcast address 255).

SATELLINE modems must have the following key settings:
- FEC OFF (because the FEC here means SATEL 3AS FEC, not Pacific Crest/TRIMTALK FEC)
- Error check OFF
- Error Check mode OFF
- Radio Compatibility Option 1 in case of Pacific Crest 4FSK
- Radio Compatibility Option 2 in case of Pacific Crest GMSK
- Radio Compatibility Option 3 in case of TRIMTALK GMSK

When TX address is selected ON, then TX1 address is used like PDL Remote address that is the destination address for the transmitted messages. Default value is 0x00FF (=255) (note the hexadecimal format of the setting).
When RX Address is selected ON, then RX1 address is used like PDL Local address. Default value is 0x0000 (=0) (note the hexadecimal format of the setting).
Addresses are NOT applicable in TRIMTALK 450s mode so SATELLINE modems must have their RX/TX addresses OFF with Option3.

The configuration tools and settings are different between SATELLINE and Pacific Crest modems:
Pacific Crest modems are configured via the serial port using PDLCONF WindowsTM program that sends binary control messages to the serial port of the modem.
SATELLINE-EASy radio modems are configured via the serial port using SL commands or SATEL Configuration Manager PC-program.

The table below shows the analogy of settings between Pacific Crest and SATELLINE radio modems.

Pacific Crest setting	Corresponding SATELLINE setting
Identification: Owner	not implemented
Identification: Channel Bandwidth	Channel spacing
Identification: RF Power	TX power
Radio Link: Channel Selection Type (Manual)	Radio frequency
Radio Link: Current Channel	Radio frequency
Radio Link: Link Rate	Radio compatibility mode and channel spacing determine the link rate
Radio Link:Modulation Mode	Radio compatibility
Radio Link:Scrambling	ON by default
Radio Link:Transmit Retries	not implemented
Radio Link:TX ACK Timeout	not implemented
Radio Link:Csma Monitoring	Priority (RX=ON, TX=OFF) Default: RX
Radio Link: AutoBase/AutoRover	not implemented
Radio Link:Digisquelch	Signal threshold
Radio Link:Forward Error Correction	ON by default Note: SATELLINE-EASy FEC must be OFF!
Radio Link:Local Address (0 by default)	Primary RX address (RX1) (OFF by default)
Radio Link:Remote Address (255 by default)	Primary TX address (TX1) (OFF by default)
Serial Interface:Protocol Mode	Radio compatibility
Serial Interface:BREAK to Command	not implemented
Serial Interface:Modem Enable: Yes	not applicable
Serial Interface:Soft Break Enable	not implemented
Serial Interface:EOT value (in 0.01s units)	Pause length (in serial port byte intervals)
Serial Interface:Digipeater Delay	not implemented
Serial Interface:Local Node Repeater	not implemented
Frequency Table	Radio frequency
Data Security Code (must be 0=not used)	not implemented
Potential conflicts: FEC setting applies only to the SATELLINE-3AS mode, the other radio compatibility modes have their own FEC bindings (although some previous or special firmware versions differ in the way FEC setting is handled - in case of doubt please contact technical support) Error check and Full CRC16 check must be OFF in SATELLINE modem FCS (Free Channel Scanning) feature is not supported by Pacific Crest radios SATELLINE RX/TX addressing does not use ARQ scheme like Pacific Crest radios.	

10.11.2 Repeater function

The implemented Pacific Crest/TRIMTALK modes support also the repeater function. The repeater function is configured either by using the SL commands:
- "SL@M=R" (Repeater ON)
- "SL@M=O" (Repeater OFF)

or by selecting Repeater OFF/ON in the Radio Settings –tab in the Configuration Manager SW.

Note 1. If error correction is ON (FEC ON) and TRIMTALK mode is activated by using "SL@S=3" command, the firmware automatically switches SATEL FEC OFF temporarily, and turns it back at the mode return.

Note 2. Unlike SATELLINE-3AS and Pacific Crest -compatibility modes, TRIMTALK

10.11.3 Support for Local / Remote addresses

If the modem has TX address ON then primary TX address is handled in the same way as Remote address in Pacific Crest PDL modems. The default value is 0x00FF (255 in decimal format) i.e. the broadcast address.

If the modem has RX address ON then primary RX address is handled in the same way as PDL Local address in Pacific Crest PDL modems. The default value is 0x0000 (0 in decimal format). SATELLINE modem needs to have TX Delay 50ms or more in order to avoid messages from colliding in case it is to be placed in a Pacific Crest system that uses addressing and acknowledging scheme.

In case only broadcast messages are used (like in RTK applications) there is usually no need for TX Delay, except if the transfer delays identical to Pacific Crest modems are preferred – in such cases an appropriate value of TX Delay is 34 ms.

Note 1. SATELLINE-modems do not support Pacific Crest retransmit/acknowledge scheme. However, that has no effect in RTK applications because they utilize only broadcast messages.

10.11.4 Transmission delays

The original SATELLINE-3AS is the fastest mode – the transfer delays are presented Appendix A.

In the PacCrest-4FSK, PacCrest-GMSK and Trimtalk450s modes the whole message is first read from the serial port. The end of the message is detected when there is a pause in data. After that

data is framed and transmitted over the radio. Likewise the reception is done fully before outputting the message to the serial port.

Symbol rates of the compatibility modes The actual raw data rate is appr. 2/3 of the symbol rate.		
Compatibility mode	Symbol rate on 12.5 kHz channel	Symbol rate on 25 kHz channel
PacCrest 4FSK	9600 bps	19200 bps
PacCrest GMSK	4800 bps	9600 bps
Trimtalk450s	4800 bps	9600 bps
PacCrest FST	9600 bps	19200 bps

The typical latency vs. the size of a message is shown in the tables below for each radio compatibility mode. <u>The delays are measured from the end of transmitted data to the end of received data on the serial interface.</u>

Pacific Crest 4FSK mode on 12.5 kHz channel - Transfer delays				
Bps	1 byte	10 bytes	100 bytes	500 bytes
9600	74 ms	82 ms	302 ms	1293 ms
19200	73 ms	77 ms	249 ms	1031 ms
38400	72 ms	74 ms	222 ms	900 ms

Pacific Crest 4FSK mode on 25 kHz channel - Transfer delays				
Bps	1 byte	10 bytes	100 bytes	500 bytes
9600	43 ms	51 ms	208 ms	911 ms
19200	41 ms	46 ms	155 ms	650 ms
38400	39 ms	43 ms	127 ms	519 ms

Pacific Crest GMSK mode on 12.5 kHz channel - Transfer delays				
Bps	1 byte	10 bytes	100 bytes	500 bytes
9600	93 ms	101 ms	445 ms	2011 ms
19200	91 ms	97 ms	393 ms	1750 ms
38400	91 ms	92 ms	366 ms	1619 ms

Pacific Crest GMSK mode on 25 kHz channel - Transfer delays				
Bps	1 byte	10 bytes	100 bytes	500 bytes
9600	52 ms	62 ms	281 ms	1272 ms
19200	50 ms	55 ms	226 ms	1009 ms
38400	48 ms	51 ms	198 ms	878 ms

Trimtalk450s modes on 12.5 kHz channel - Transfer delays				
Bps	1 byte	10 bytes	100 bytes	500 bytes
9600	153 ms	177 ms	421 ms	1505 ms
19200	151 ms	172 ms	368 ms	1244 ms
38400	151 ms	168 ms	341 ms	1113 ms

Trimtalk450s modes on 25 kHz channel - Transfer delays				
Bps	1 byte	10 bytes	100 bytes	500 bytes
9600	82 ms	98 ms	267 ms	1017 ms
19200	80 ms	93 ms	215 ms	756 ms
38400	79 ms	89 ms	187 ms	625 ms

Radio compatibility Option 5 - Pacific Crest FST on 12.5 kHz channel				
Bps	1 byte	10 bytes	100 bytes	500 bytes
9600	47 ms	71 ms	261 ms	1145 ms
19200	45 ms	64 ms	207 ms	883 ms
38400	48 ms	65 ms	184 ms	756 ms

Radio compatibility Option 5 - Pacific Crest FST on 25 kHz channel				
Bps	1 byte	10 bytes	100 bytes	500 bytes
9600	31 ms	48 ms	190 ms	840 ms
19200	29 ms	41 ms	136 ms	578 ms
38400	28 ms	38 ms	109 ms	447 ms

11 MECHANICAL DIMENSIONS
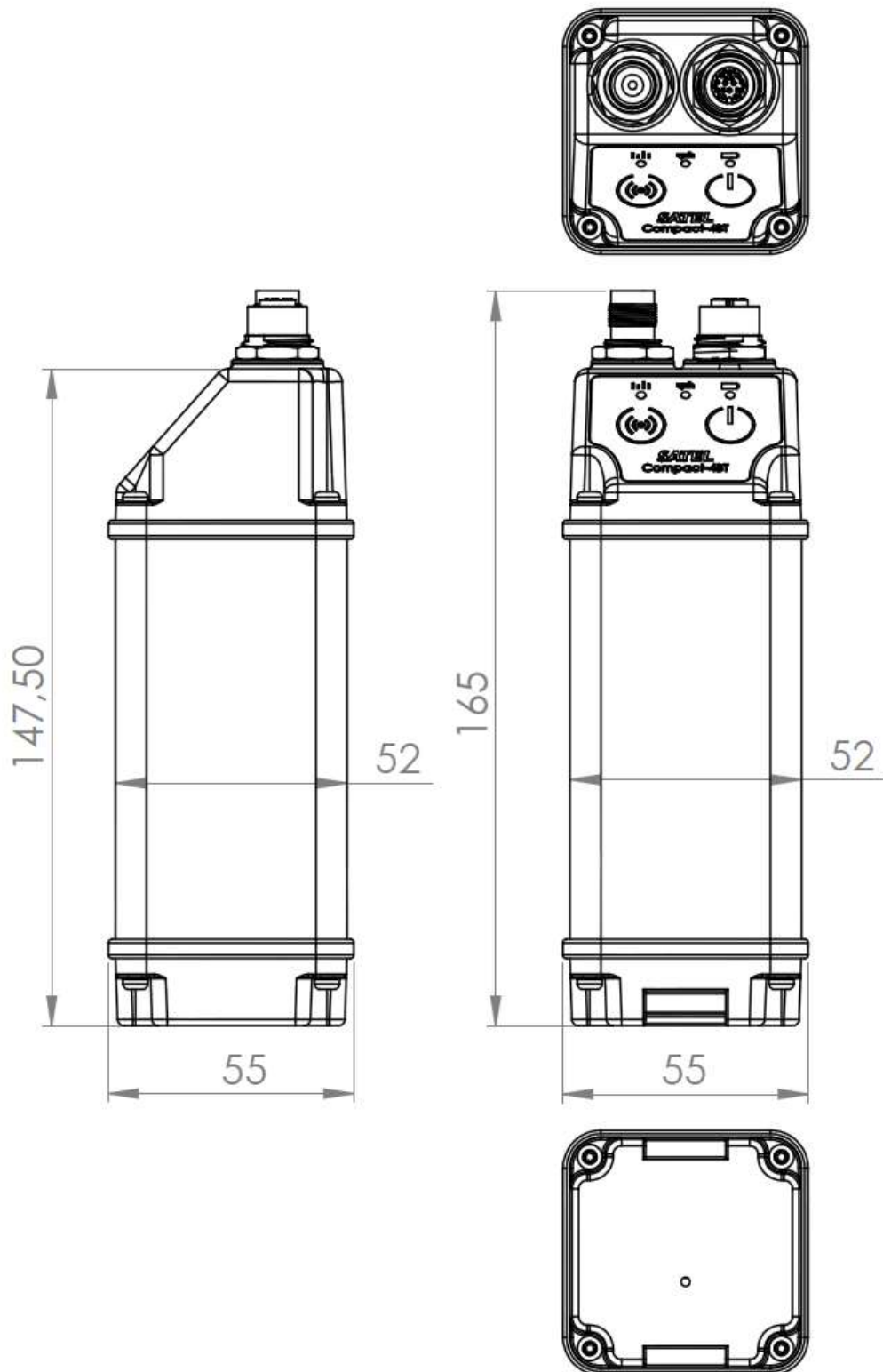
Figure 1.3 Mechanical dimensions

12 ACCESSORIES

12.1 Data cables

SATEL Compact-4BT can be connected to a terminal device by two additional cables, YC0401 DC/USB and YC0400 DC/RS232.

YC0401 is intended for RS-232 serial transmission and YC0400 is intended for USB transmission. Cables allow the interconnection to USB port or to RS-232 port by D-SUB 9pin female connector. There is also on both cables a DC plug of 5.5 mm / 2.1 mm to the external DC supply.

M12 cable connector has an alignment notch to position itself together with the connector on the device. Do not turn the connector against the counterpart to find the alignment notch as this might damage the connector. Find the correct position before trying to mate the connectors. Once they mate, press the connector down and lock it by turning the knurled ring till the connector is fully locked.

D-SUB9 has a securing screws which should be closed for reliable connection.

DC-plug does not have a locking mechanism and is based on a friction only.
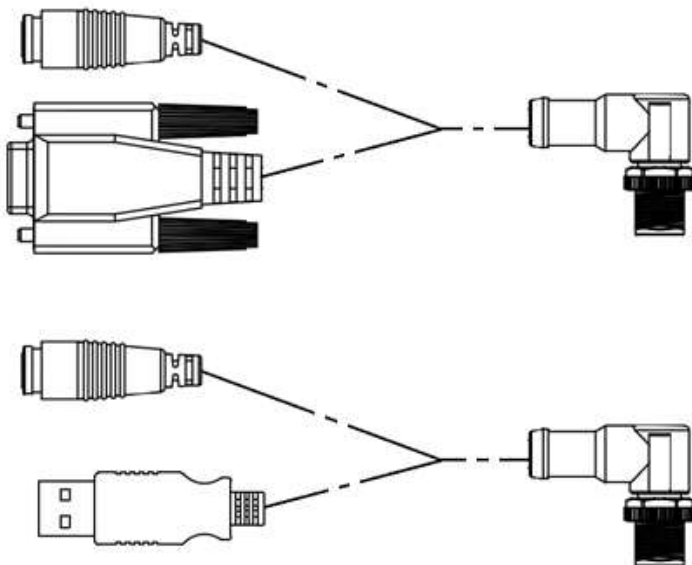
Figure 1.4 Cable assemblies YC0401, YC0400   Figure 1.5 Alignment notch
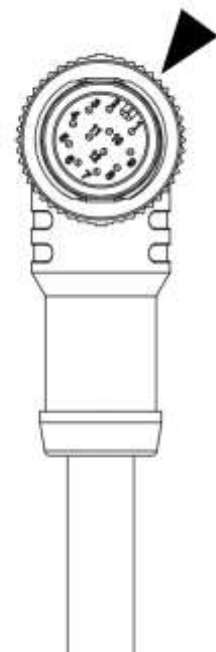
12.2 <u>Mechanical attachments</u>

SATEL Compact-4BT can be attached in multiple ways to, wall, tripod, pole or round objects by selecting the right mechanical attachment method.
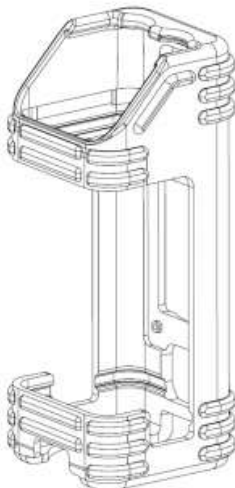
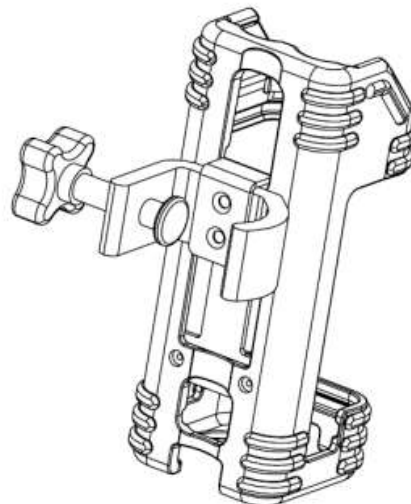Installation parts in the WP0200 packet:

Multipurpose brackets
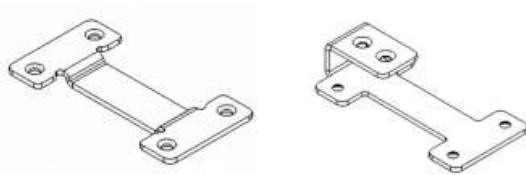
Clamp attachment
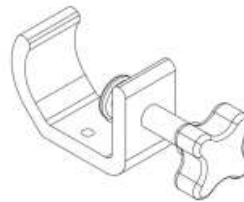
Rubber cover

Clamp attachment with a rubber cover

12.2.1.1 <u>Rubber cover</u>

Rubber cover (MD0037) can be used to minimize the handling impacts from all directions creating a robust shield to resist, shock, vibration and drop. It also can hold a multipurpose metal insert to function as a platform for screws, belts or straps (ME0532) and acts as a hook to hang on to a tripod (ME0531).

Cover can be attached without tools just simply sliding it over the SATEL Compact-4BT by pushing the top of the device first from the front side in to its position and then bottom should follow. Some slight bending of the cover should be used to get the cover to its position.
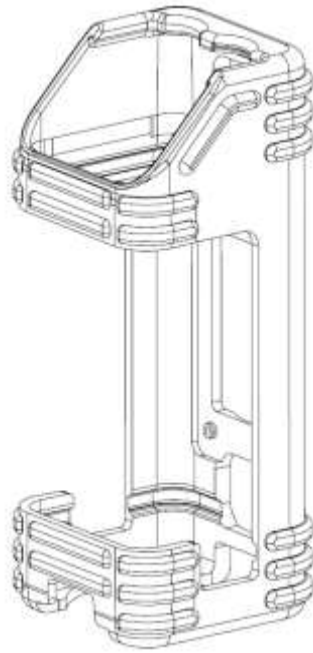
Figure 1.6 Rubber cover

12.2.2 Multipurpose attachment bracket

SATEL Compact-4BT can be attached to different locations by using metal brackets. These multipurpose brackets should be combined with the rubber cover to become functional. Bracket is first inserted to its position inside the rubber cover before its usage. Bracket B is specially used for hooking setups for tripods or other similar positions. Bracket A is used for wall or tree/mast/pole attachments using a strap. Bracket A and B are 2 mm thick, stainless steel.
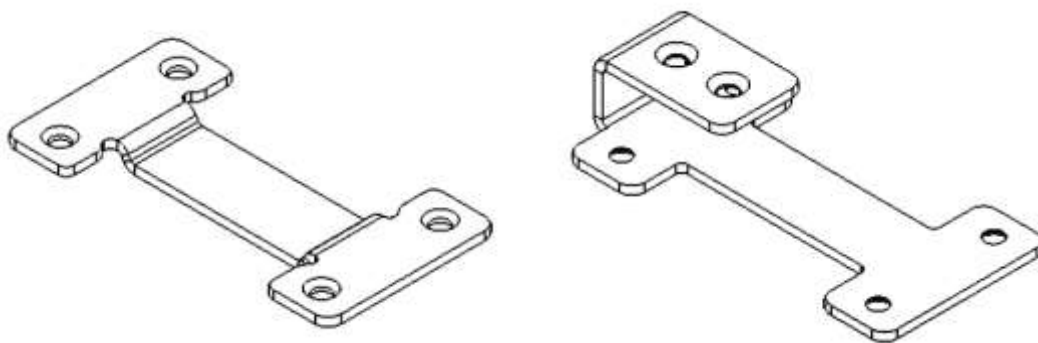
Figure 1.7 Multipurpose brackets A (ME0532) and B (ME053)
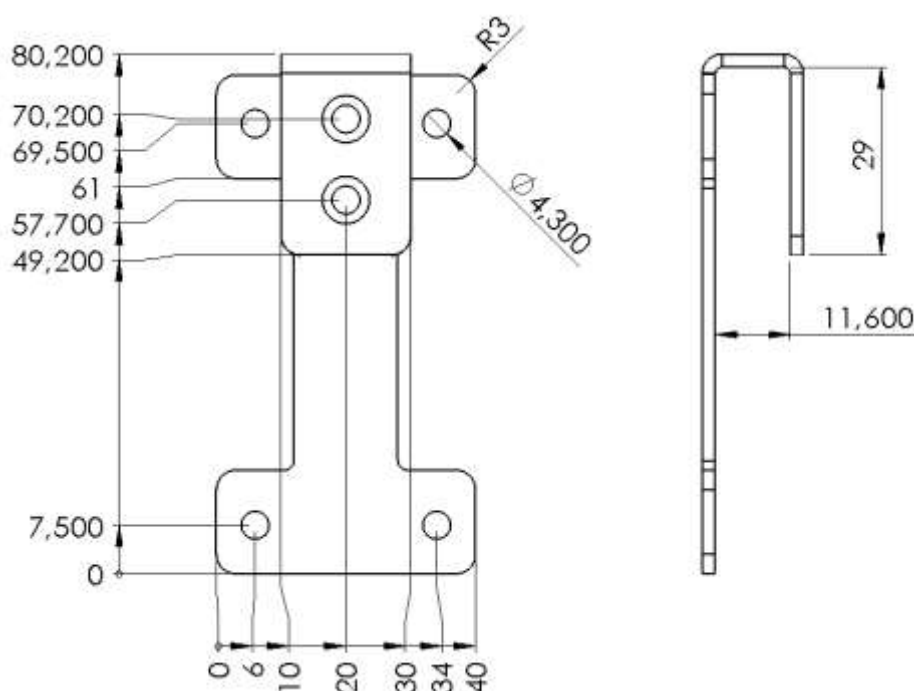
Figure 1.8 Multipurpose bracket B dimensions

12.2.3 Clamp attachment

SATEL Compact-4BT can be attached to a rigid object, like pole, with an adjustable clamp. The clamp allows user to attach the device quickly and remove it for charging or for transportation. The clamp is used with a multipurpose bracket B and the rubber cover with UNC 8#-32 x 3/8 screws (supplied with the clamp). Suitable diameter to clamp to can be between 18–40 mm.
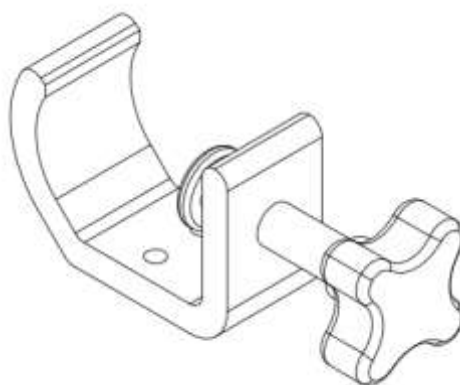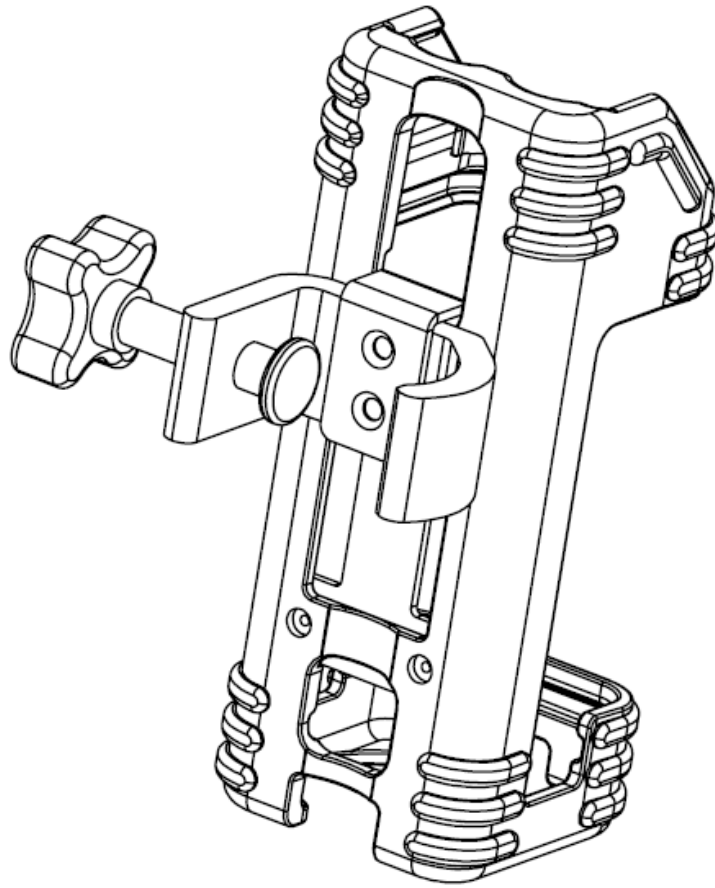

Figure 2.0 Clamp mechanism.

Figure 2.1 Clamp attachment with a rubber cover.

12.3 Power source

To connect the device to an external DC supply a power source of YP1240 AC adapter 40W can be used. Any other power source do as well as long as it comply the voltage- and current requirements given in this manual. Power supply DC jack is 5.5 mm / 2.1 mm. Inner pin is positive. AC inlet connector is: (IEC 60320-2-2) type E (C14) male.
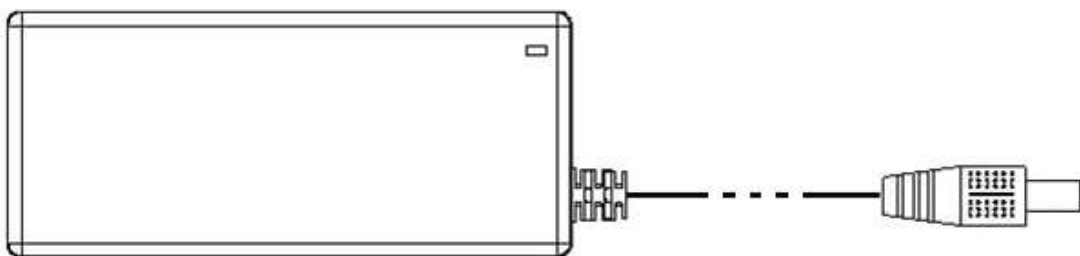

Figure 2.2 Power supply 240 AC / 12VDC, YP1240

12.4 <u>Car cigar lighter plug</u>

Mobile charging can be carryout by a car cigar lighter plug cable YP0130. This allows SATEL Compact-4BT to be charged from any vehicle having a socket for this universal plug. This cable has an internal fuse protection (5A).
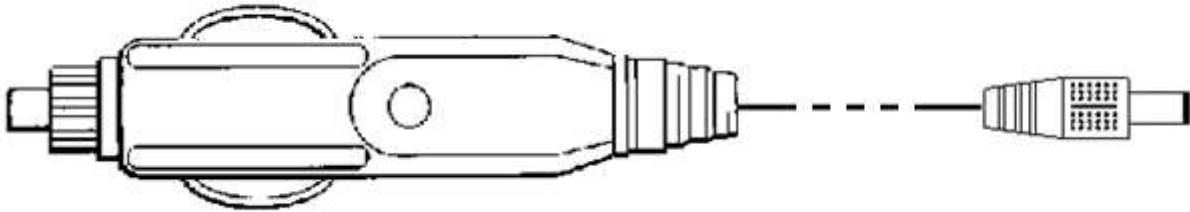

Figure 2.3 Car cigar lighter plug cable, YP0130

13 CUSTOMER SUPPORT AND FEEDBACK

In a case you need a support or have a question, you can contact us by an e-mail info@satel.com or Technical.Support@satel.com or your local distributor https://www.satel.com/where-to-buy/

Follow us at https://www.satel.com, Facebook or LinkedIn for recent updates and news.

14 VERSION HISTORY

Version history:

Version:	Date:	Remarks:
2.0	28.5.2020	Multiple changes