astra telematics

AT241 LPWA–GPRS–GNSS-BLE Tracking Device

User Guide

Document Version:	1.1
Device Hardware Version:	1.3
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Abbreviations

ADC   Analogue to Digital Converter
ASCII   American Standard Code for Information Interchange (computer character set)
BLE   Bluetooth Low Energy
BT   Bluetooth
CAN   Controller Area Network
DC   Direct Current
FET   Field Effect Transistor
GIS   Geographic Information System
GNSS   Global Navigation Satellite System
GPRS   General Packet Radio Service (part of GSM)
GPS   Global Positioning System
GSM   Global System for Mobile communication
IP   Internet Protocol (part of TCP/IP)
LED   Light Emitting Diode
LPWAN   Low Power Wide Area Network
LTE   Long-Term Evolution (wireless mobile communication standard)
MEMS   Micro Electro-Mechanical System
NMEA   National Marine Electronics Association (defined a GPS output format)
OTA   Over the Air (remote configuration of devices)
PC   Personal Computer
PCB   Printed Circuit Board
PDU   Protocol Description Unit (describes a binary SMS format)
RFID   Radio Frequency Identification
SIM   Subscriber Identity Module
SMS   Short Message Service
SMSC   Short Message Service Centre
SV   Satellite Vehicle
TCP   Transmission Control Protocol (part of TCP/IP)
UDP   User Datagram Protocol
WGS84   World Geodetic System 1984 (global co-ordinate system used by GPS)

Product Overview

The AT241 is full-featured vehicle tracking device, housed in a sturdy ABS enclosure, sealed to IP67 specifications. Communications are via GSM/2G, LTE Cat-M1 or NB-IoT with internal antennas and micro SIM card format. Positioning is via a GNSS module supporting all available satellite systems, combined with an internal 25mm ceramic patch antenna. The heart of the device is the latest STM32L4 Cortex M4 low-power 32 bit microcontroller. BLE 4.2 is a factory-fit option with the AT241. As with all other Astra Telematics devices, the AT241 comes with a back-up battery, accelerometer, FOTA and a 5 year guarantee as standard.

Features

The main features of the AT241 are highlighted below:

- Compact size
- IP67 water-resistant
- Cortex M4 STM32L4 low-power family ARM Processor
- ublox EVA-M8M GNSS
- Quectel BG600L-M3 GPRS + LTE Cat M1 + NB-IoT communications
- Internal GSM and Bluetooth antennas - PIFA PCB trace, high-sensitivity
- Internal GNSS antenna, 25mm ceramic patch
- Low power consumption (near zero current drain when vehicle ignition is off)
- 3 axis accelerometer (2/8g)
- CANBus
- ADC inputs, 5V and 15V range
- 6 digital inputs
- 5 digital outputs
- 1-wire / Dallas interface
- Auxiliary 3.3 and 4.5V outputs for use with accessories
- 2 RS232 Port (TTL level option)
- Internal back-up battery, lithium-polymer, 510mAh
- Tamper detection
- Configuration by RS232, SMS or TCP/UDP
- Fast and reliable over the air firmware update
- Modular communications protocol X
- TCP or UDP mode
- Non-volatile storage for 2000 reports
- SDK available for rapid development of client customised applications
- Approved to: EC Reg.10 and EU Directive 2014/53/EU

Technical Specifications

GSM-EGPRS / LTE Cat M1 / Cat NB2 Communication

Communications Module:	Quectel BG600L-M3
GSM EGPRS Frequency Bands:	850/900/1800/1900 MHz
LTE Cat M1 Frequency Bands:	B1/B2/B3/B4/B5/B8/B12/B13/B14/B18/B19/B20/B25/B26/B27/B28/B66/B85
Cat NB2 Frequency Bands:	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26/B28/B66/B71/B85
GSM Antenna:	Internal PIFA PCB trace
Data Transfer Modes:	TCP or UDP

GNSS Location

GNSS Antenna:	Internal 25 x 25 x 4mm ceramic patch
	External active antenna (option) via SSMB connector
GNSS Receiver:	Quectel LG77L
GNSS Chipset:	Mediatek MT3333
L1/B1 Receiver:	GPS L1 C/A: 1574.397–1576.443 MHz
	GLONASS L1: 1597.781–1605.656 MHz
	BeiDou B1 C/A: 1559.052–1563.144 MHz
Position Accuracy:	< 2.5m CEP @ –130dBm
Receiver Sensitivity:	–162dBm (GPS + GLONASS, tracking & navigation)
TTFF: Cold start	< 15 sec (average) @ –130 dBm
Hot start	< 1 sec (average) @ –130 dBm

BLE 4.2 (option)

BLE Module:	Silicon Labs BGM123
TX Power:	+3dBm
Sensitivity:	–90dBm
Bluetooth Compliance:	4.2 and earlier

Power

|	
External Voltage Source:	6 – 65 VDC
Internal Battery:	3.7V, 510mAh
Battery Life:	5 hours continuous operation
	12 days operation in low-power mode @ 1 hour reporting
	?? days operation in low-power mode @ 1 day reporting
Current Consumption, max:	300mA @ 13.8 VDC (battery charging at max. rate)
Current consumption, average:	25mA @ 13.8 VDC (typical)
Current consumption, sleep:	< 100uA

Features

Configuration:	Astra Generic Configuration commands over SMS / TCP / RS232 / BLE
Firmware update:	Supports Firmware Update Over-The-Air (FOTA)
Memory:	Total 1024k on-board non-volatile flash memory
Report storage:	6000 reports
Communication Protocol:	Astra Telemetics Modular Protocol X via TCP / UDP sockets

Interconnections

	4 digital pull-up inputs
	2 digital pull-down inputs
	5 digital outputs, 60V, 0.5A maximum, open drain (optional 3.3V drive)
	1-wire (dallas)
	ADC inputs, 0-5V and 0-15V range
	CANBus / FMS 2.0 / OBD2
	2 RS232 serial port (TTL levels option)
	3.3V Auxiliary Output
	4.5V Auxiliary Output
SIM:	Micro SIM 3FF Format, push-push style
POWER & DATA:	30-way Samtec RC5 IP68 rated

Weight	100g
Dimensions	104 x 85 x 24 mm
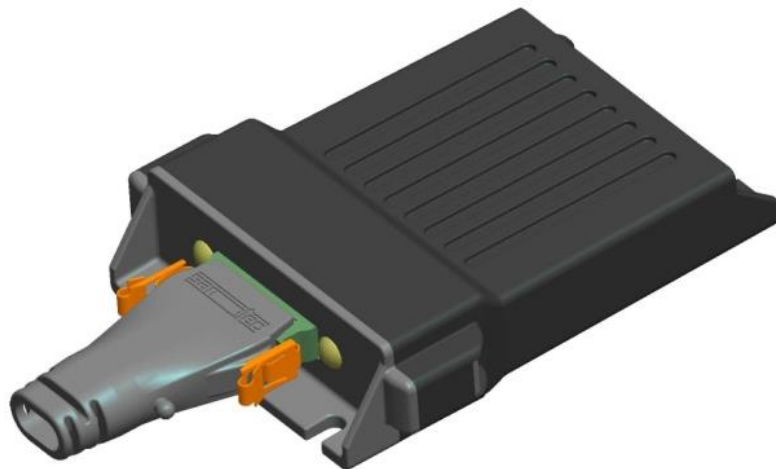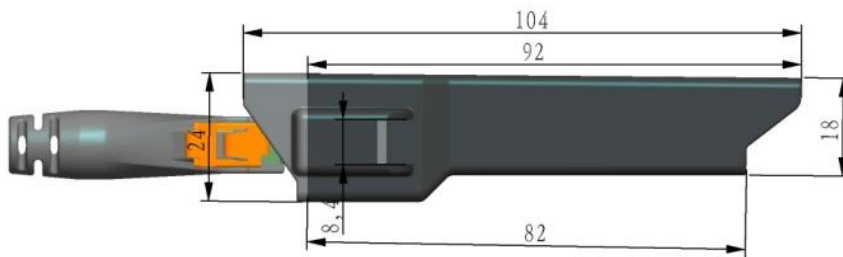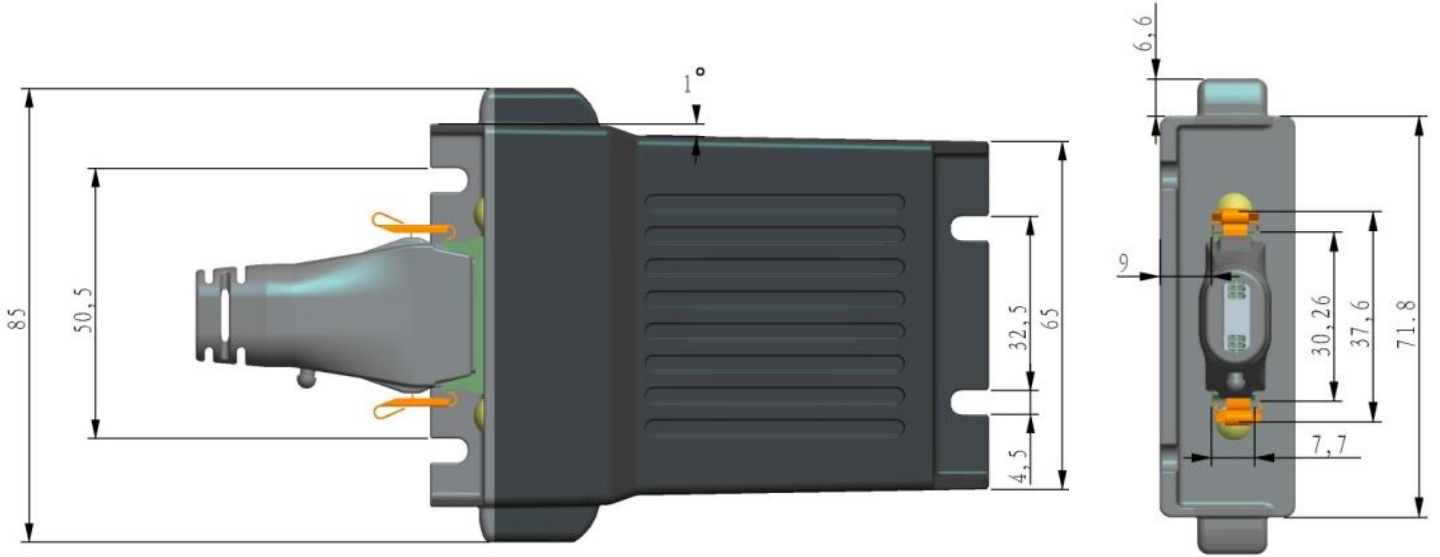
Hardware Description

Back-up battery
Each AT241 is supplied with a 510mAh internal lithium-polymer back-up battery.

Basic electrical connections
A permanent connection to +12V/+24V vehicle power should be provided to the AT241 using the RED and BLACK wires, via a 1A fuse. If using a wired ignition-sense, connect this to digital input 1, again we recommend the use of a 1A fuse:

RED	+12 / +24V	1A FUSED
BLACK	GROUND	1A FUSED
WHITE	IGNITION	1A FUSED

All unused wires should be insulated to avoid undesired behaviour.

For a full table of AT241 connections please see page 7.

Power requirements
The AT241 operates from a DC Voltage between 6 and 60 Volts (65V absolute maximum). We recommend that a permanent 'live' power source is used to supply the AT241. If current drain is of concern, please refer to the power down options which can be specified with the IGNM command.

SIM installation
The SIM should be inserted in the slot at the rear of the device (with ABS enclosure fitted). The image on the device gives guidance for correct orientation. Note that the AT241 powers up when the SIM is inserted. For shipping with SIM fitted, we suggest extracting the SIM a few millimetres to power off the device.

INSERT SIM HERE
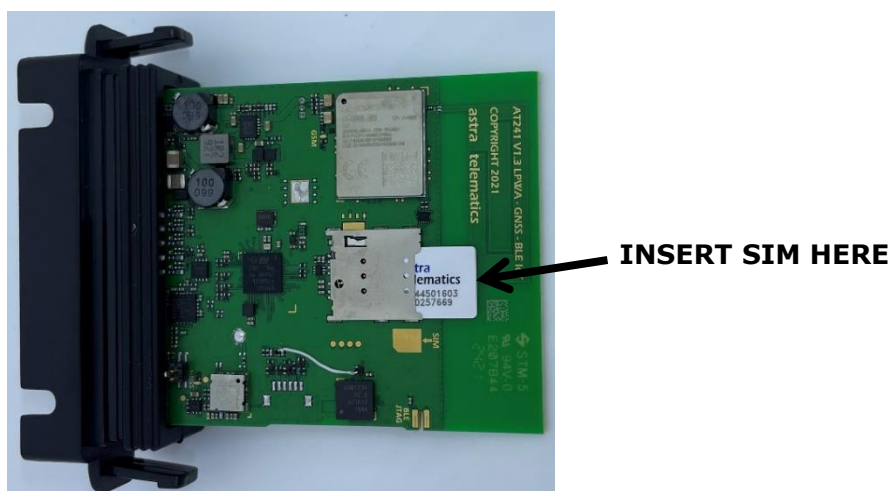
Status LEDs

GNSS Status:	Constant ON	Searching for initial fix
	Double Flash @ 1Hz	GPS 3D navigation
	Slow Flash @ 0.2Hz	Lost GPS navigation
COMM Status:	200 ms ON / 1800 ms OFF	ON / SEARCHING
	1800 ms ON / 200 ms OFF	registered on network
	Constant OFF	Modem OFF

Mounting

We recommend mounting the AT241 by either of the following methods:

- Double sided foam adhesive tape, using de-greaser / solvent on the vehicle surface
- Secure to vehicle using a cable tie, 5.0mm width to suit the cable tie guides on the device

Orientation

For optimum GPS performance, please mount the AT241 with the 'SKY SIDE' facing the sky.

Interconnections

All connections to the AT241 are provided by a single 16-way connector.

AT241 Pin Applications and Colour Code

Pin Number	Application	Wire Colour
1	supply voltage 5-50 VDC	black
2	Digital input 5 (pull-down)	brown
3	GND	red
4	Digital input 3	orange
5	Digital output 4	yellow
6	Digital input 1 – Ignition	green
7	Digital input 2 – Panic	blue
8	ADC1 (0-5V)	purple
9	Digital input 4	grey
10	GND	white
11	Digital input 6 (pull-down) – Private mode	pink
12	Digital output 2	light green
13	ADC2 (0-15V)	black / white stripe
14	GND	brown / white stripe
15	GND	red / white stripe
16	Digital output 1	orange / white stripe
17	GND	green /white stripe
18	Digital output 5	blue / white stripe
19	iButton / temperature probe (1-wire)	purple / white stripe
20	4.5V output (unregulated), 150mA fused	red / black stripe
21	SWDIO (SDK users only)	orange / black stripe
22	SWCLK (SDK users only)	yellow / black stripe
23	Digital output 3	green / black stripe
24	3.3V output (regulated), 150mA fused	grey / black stripe
25	RS232-TX1	pink / black stripe
26	RS232-TX2	pink / red stripe
27	RS232-RX1	pink / blue stripe
28	RS232-RX2	pink / green stripe
29	CANH	light blue
30	CANL	light blue / black stripe

Digital Inputs
Digital inputs 1 and 2 are suitable for use in 'power-take-off' applications and can be connected directly to 12/24V vehicle circuits.

Digital Output
The AT241 is capable of switching 2 external loads of up to 60V, 0.5A using MOSFET Low Side Switches (open drain), which must be used to switch the GND side of the load. The use of a 1A in-line fuse with these switches is essential to prevent any damage through fault scenarios.

Analogue to Digital Converter (ADC) Input
ADC1 can be used to measure analogue voltages up to 80.0V maximum

CANBus
The AT241 has integrated CANBus. Please refer to CANBus and FMS Application Notes for details of supported protocols and features.

> **IMPORTANT NOTE:** The CANBus pins are ESD protected to 15kV, but can only withstand a continuous voltage of 12V maximum. These pins must not be used for any other application to avoid damage to the device.

Integrated Accelerometer
The AT241 has a built in 3 axis MEMS accelerometer that operates in the range ±2g and is used to measure driver behaviour (acceleration and braking) during normal driving conditions.

The accelerometer also allows the AT241 to wake from sleep on movement, with configurable thresholds. Please refer to the $MEMS parameter for more details.

iButton (Dallas Key) Interface
This can be used to read iButton devices for the purpose of Driver Identification. See the Driver ID Application Note for more details of how to use this feature.

Configuration
The AT241 shares a common set of configuration commands with our other devices. Please refer to our Generic Device Configuration Reference for details.

Electrical Parameters

Operating Conditions

Parameter	Min	Max	Units
Power Supply Input Voltage	+6	+60	V
Digital Input High Voltage Threshold	+5.0	-	V
Digital Input Low Voltage Threshold	-	+2.0	V
Digital Output Maximum Voltage	-	+60.0	V
Digital Output Maximum Current	-	0.5	A

Absolute Maximum Ratings

Parameter	Min	Max	Units
Power Supply Input Voltage	-32	+65	V
Voltage on Digital 1-2	-32	+32	V
Voltage on RS232 RX	-25	+25	V
Voltage on RS232 TX	-13	+13	V
Voltage on iButton/Dallas Interface	-5	+5	V
Current sunk by MOSFET low side switches		500	mA
Voltage rating of MOSFET switches	-	+60.0	V
Storage Temperature	-40	+85	°C
Operating Temperature (without battery)	-20	+60	°C
Operating Temperature (with battery)	0	45	°C

Typical Power Consumption

Operating Mode	Current @ 13.8V	Current @ 27.6V	Power Consumption
Fully Operational	25mA	14mA	< 400mW
Battery charging	500mA	275mA	< 7W
Sleep (no battery)	0.5mA	0.3mA	7mW
Sleep (with battery)	< 10uA	< 10uA	0.1mW

Environmental Specifications

Parameter	Specification
Storage temperature	-40 to +85 °C
Operating temperature (no battery)	-20 to +60 °C
Operating temperature (with battery)	0 to +45 °C (note: no charging below 0°C)
Ingress Protection	N/A
Vibration, broadband random	Complies with IEC60068-2-64
Shock	Complies with IEC60068-2-64
Humidity	N/A