

AT241 LPWA-GPRS-GNSS-BLE Tracking Device

User Guide



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Abbreviations

ADC	Analogue to Digital Converter
ASCII	American Standard Code for Information Interchange (computer character set)
BLE	Bluetooth Low Energy
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)
FOTA	Firmware update Over The Air
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 warranty 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
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 – 60 VDC (65V absolute maximum)
Internal Battery:	3.7V, 450mAh
Battery Life:	7 hours continuous operation 9 days operation in low-power mode @ 1 hour reporting 25 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

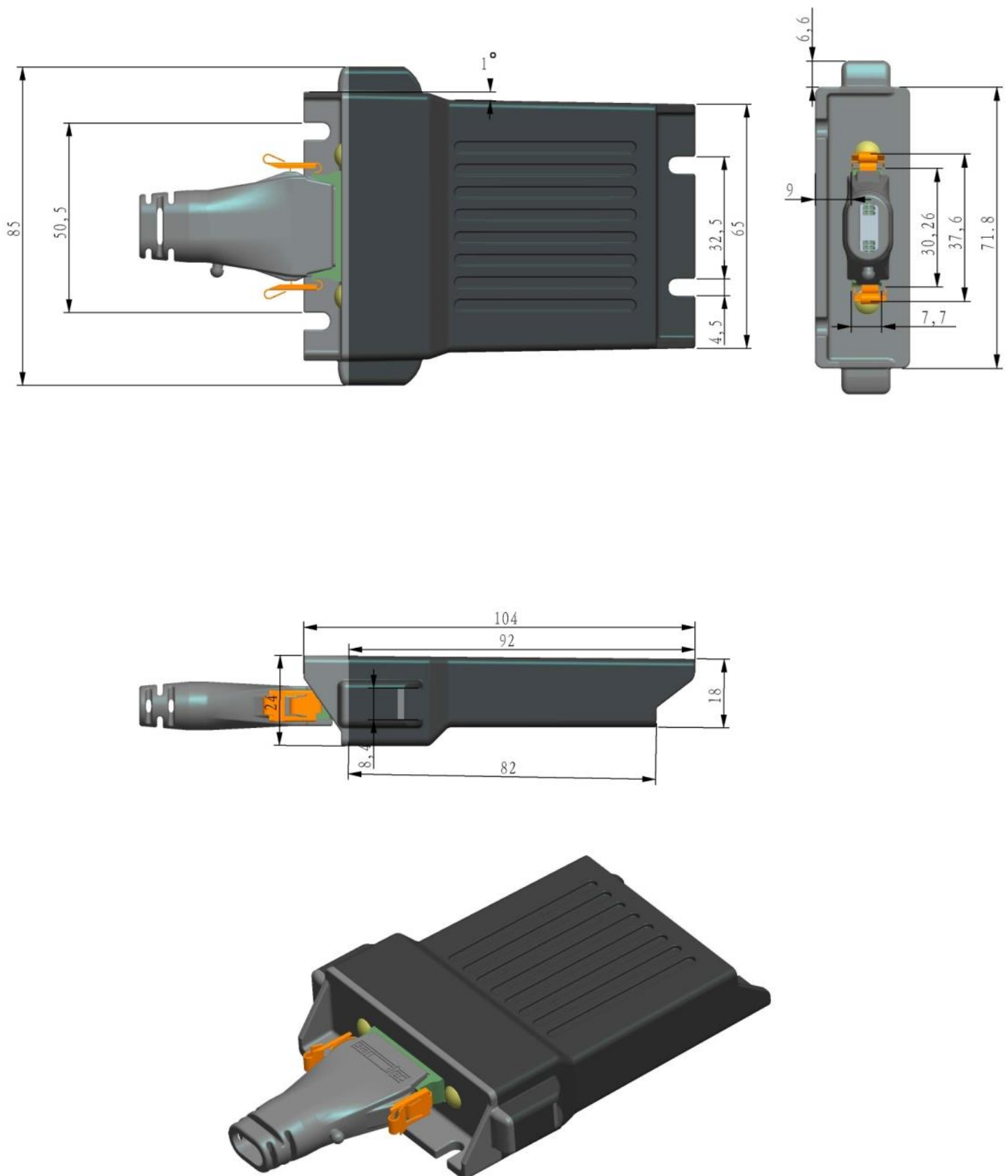
Configuration:	Astra Generic Configuration commands over SMS / TCP / RS232 / BLE
Firmware update:	Firmware Update Over-The-Air (FOTA)
Memory:	Total 1024k on-board non-volatile flash memory
Report storage:	6000 reports
Communication Protocol:	Astra Telematics Modular Protocol X via TCP / UDP sockets

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
Dimensions

100g
104 x 85 x 24 mm



Hardware Description

Enclosure Sealing

When fitting the enclosure cover, please ensure that both clips are snapped into place to guarantee IP67 sealing.

Power requirements

The AT241 operates from a DC Voltage between 5 and 60 Volts. We recommend that a permanent power source is used to supply the AT241. If current drain is of concern, please refer to the generic Command Reference Guide for options to minimise vehicle battery drain when stationary for long periods.

Back-up battery

Each AT241 is supplied with a 450mAh 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

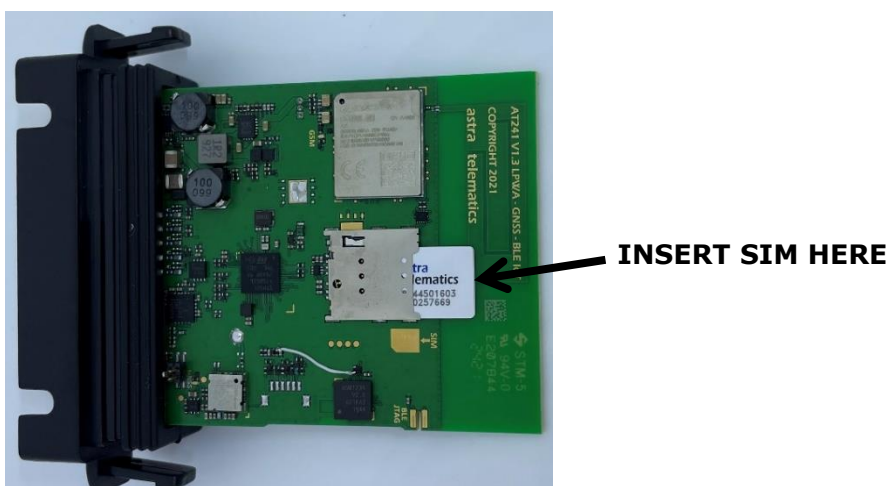
The AT241 operates from a DC Voltage between 6 and 60 Volts (65V absolute maximum). We recommend that a permanent 'live' power source is used to supply the AT241. If current drain is of concern, please refer to the power down options which can be specified with the IGMM command.

Fuse Recommendations

Typical current drain is 25mA @ 13.8VDC and 14mA @ 27.6VDC, although maximum peak current can be around 0.5A for short periods. We recommend the use of 1A fuses in the power feeds and ignition sense wires.

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.



Status LEDs

GNSS Status:	Constant ON Double Flash @ 1Hz Slow Flash @ 0.2Hz Fast Flash (<2Hz)	Searching for initial fix GPS 3D navigation Lost GPS navigation Test mode – contact astra
COMM Status:	200 ms ON / 1800 ms OFF 1800 ms ON / 200 ms OFF Constant OFF	ON / SEARCHING registered on network 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 GNSS 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 inputs 5 and 6 are normally high, for use in pull-down applications. Simply switch to GND to activate these inputs.

Note: damage may be caused to the AT241 device if a voltage source is applied to digital inputs 5 and 6!

Digital Output

The AT241 is capable of switching 5 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 digital output switches are protected by internal fuses, rated at 0.63A. These fuses are not user-replaceable, and are not covered by warranty, hence any replacements are chargeable. An external fuse, rated at 0.5A will avoid internal damage to the AT240 device.

Analogue to Digital Converter (ADC) Input

ADC1 can be used to measure analogue voltages up to 5.0V maximum

ADC2 can be used to measure analogue voltages up to 15.0V 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 $\pm 2g$ 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.

1-wire / iButton (Dallas Key) Interface

This can be used with iButton devices for the purpose of driver ID, or with DS18B20 temperature probes. Please refer to the appropriate application notes for more details of how to use these features.

4.5V and 3.3V Outputs

These are reserved for use with external devices. The 3.3V regulated output can be used as a reference voltage for external temperature sensors and used with the ADC1 input. These outputs are fused at 150mA, maximum recommended current drain is 100mA.

Device Configuration / Settings

For device configuration options and related commands, please refer to the Astra Telematics Command Reference document, which describes our generic commands, which can be used with all our devices.

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