PT40
OEM User Manual
Version 1.0

Table of Contents

1 Version Tracking

Version	Date	Change
0.1	11/19/2017	Initial Version
0.2	9/17/2018	Updated
0.3	9/18/2018	Comments from CC
1.0	1/28/2019	Published

2 OEM Notice

This user manual is provided to OEM and Resellers of Pacific Track's products. It is not intended to be used by end users.

OEM and Resellers should include the following notices in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed:

Product Marketing Name: Telematics Device

FCC ID: 2ALBDPT40
IC :   23259-PT40

This equipment complies with FCC radiation exposure limits and Canada radiation RF exposure limits set forth in CFR 47 Sections 2.1091 and ISED RSS-102 for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and the body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux rayonnements de la FCC et aux limites d'exposition aux rayonnements RF du Canada énoncées dans les sections 2.1091 du CFR 47 et ISED RSS-102 pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 20 cm entre le radiateur et votre corps. Cet émetteur ne doit pas être colocalisé ou fonctionner en conjonction avec une autre antenne ou émetteur.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device complies with Industry Canada's license-exempt RSSs. 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."

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

3 Product Overview

The PT40 is a cellular device that can be used for both simple and complex telematics application. In simple application the PT40 can be powered with a basic power-only connection. In more complex

application, the PT40 cab be connected to digital inputs and outputs, temperature sensors, iButton™ and additional devices over a serial connection.

The PT40 can also be connected to vehicle bus to augment the telematics data with information collected directly from the vehicle. The PT40 supports J1939, J1708/1587 and OBD-II (CAN only).

Thanks to the integrated Bluetooth Low Energy interface, the PT40 can also communicate with an external device such as a smartphone or tablet.

Finally, the PT40 can be programmed to run complex applications schemes based on locally generated events and states.

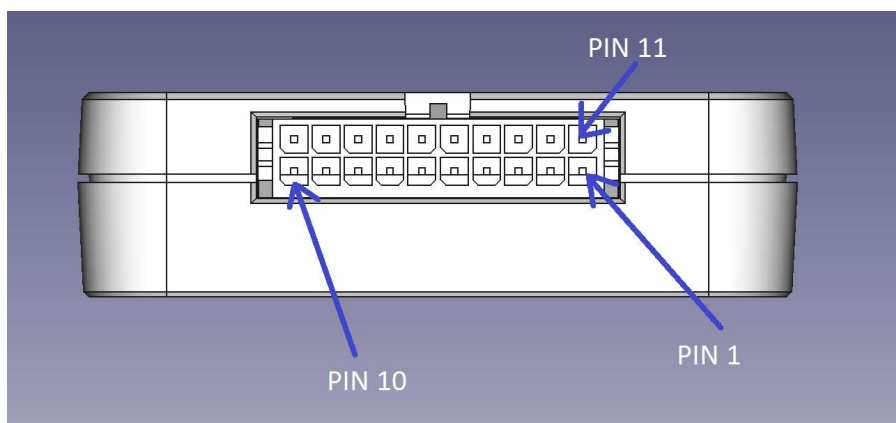# 4   External Interfaces

4.1   Overview

The PT40 uses a single external interface. The interface is a 20-pin connector Molex Micro-Fit 3.0™ P/N 04304-52009.

The mating connector is the Molex 04302-52000.

Pacific Track has approved the substitution of the Molex connector with other brands that have met a series of tests conducted internally.

4.2   Pinout

The pinout of the connector is specified is the following table:

PIN	FUNCTION	DETAILS / RANGE
1	POWER_OUT	+3V switched power
2	UART RX	Accessories UART Receive
3	BATTERY	Internal Battery (do not use)
4	OUTPUT 2	Open Drain Output
5	1-WIRE	1-Wire™ Interface
6	INPUT 4	3 to 32V
7	INPUT 2	3 to 32V
8	J1708+	J1708 Interface
9	CAN HIGH	J1939 or OBD-II
10	POWER IN	6 to 32V
11	GND	Ground for accessories
12	UART TX	Accessories UART Transmit
13	VDC	DC/DC converter Output (do not use)
14	OUTPUT 1	Open Drain Output
15	GND	Ground for 1-Wire
16	INPUT 3	3 to 32V
17	INPUT 1	3 to 32V
18	J1708-	J1708 Interface
19	CAN LOW	J1939 or OBD-II
20	POWER GND	0V

The device should be powered from pins 10 and 20.

4.3 USB-C

For debugging purpose, the PT40 also includes a USB-C connector. The USB-C connector can be used to connect USB 2.0 equipment (PC, laptop or smartphone) to the PT40.

Note that the PT40 cannot be powered from the USB-C connector nor can the connector provide power to a connected accessory.

5 LED's

5.1 Overview

The PT40 includes three LEDs (ORANGE, GREEN and BLUE).

Note: This document describes the current default behavior of the LEDs. This behavior can be changed by the user.

5.2   ORANGE LED

The following table summarizes the functionality of the ORANGE LED;

LED State	Meaning
Off	GPS power management engaged. GPS is turned off, GPS backup clock in ON.
Blinking	GPS is in acquisition mode
On	GPS signal is locked

Note: In production mode, the GPS chipset will go into power management mode (GPS OFF, RTC ON) to save power.

5.3   GREEN LED

One short blink every 10 second

5.4   BLUE LED

The following table summarizes the functionality of the BLUE LED;

LED State	Meaning
Off	The cellular subsystem is off
One blink / 10s	The cellular subsystem is not searching
Fast blink	The cellular network has rejected the device
Slow Blink	The cellular subsystem is searching
On	The cellular subsystem found a network

Note: The GPS may go into power management mode for example when the PT40 detects that the vehicle is not moving.

6   Power Supply

The PT40 is powered with a circuit that has been tested to meet the requirements of ISO 16750-2.

The circuit provides the following benefit:

1) Protected against reversed polarity
2) Protected against over current with a resettable fuse
3) Filtered against noise present on the power line

4) Protected against the overvoltage/overshoot present in the automotive and industrial environments with a Transient Voltage Suppressor (TVS) which has a peak power dissipation of 1500W

7   Testing Environment

To test the PT40, the following shall be provided:

- A reliable power supply (at least one amp at 12V)
- A SIM card for the targeted operator
- A PC or laptop
- A USB cable to connect a PC or laptop to the PT40 such as this one:

8   Software Tools

It is recommended to use a terminal emulation program called Tera Term. The latest version is 4.100 and it can be found at: https://osdn.net/projects/ttssh2/releases/

Do not use other branches of the Tera Term projects such as 2.x or 3.x

9   Initial setup

1. Insert the SIM card in the PT40
2. Power the device
3. Connect the USB connector to the PC/Laptop and to the device
4. On a recent operating system (Windows 10), you will be prompted to install a device named "STM32 Virtual ComPort" and the driver will be automatically installed
5. Start Tera Term

6. Click on File ➔ New Connection ➔ Serial and select the port that was just installed

7. Click OK

8. Click on Setup ➔ Serial Port and select the following options:

    - Speed: 115200

    - Data: 8 bit

    - Parity: none

    - Stop bits: 1 bit

    - Flow control: none

9. Click OK

10. It might be convenient to store those settings by going to:

    Setup ➔ Save setup and click Save

10 Control Interface

At that point the user should be able to enter commands to control and query the device. Note that there is no echo unless the command character ('!') is first entered. To test the interface, type the following commands:

`!H<cr>`   (<cr> is the carriage return character which is sent when the Enter key is pressed)

11 Cellular Information

11.1 Query normal

The Cellular interface can be queried with the following command:

`!CI<cr>`

Here below is an example answer to this query:

```
H/W
 Model:      SARA-R410M-02B
 Revision:   L0.0.00.00.05.06
 IMEI:       352753090114156
 CAT-M:      B2 B4 B5 B12
SIM
 Status:     OK
 ICCID:      89011703278144196279
 IMSI:       310170814419627
NETWORK
 Registered: Yes
```

```
 Roaming:       No
 RSSI:          26
 Network:       310410
 LAC:           FFFE
 CID:           08720B0F
OK
```

The following line:

```
CAT-M:         B2 B4 B5 B12
```

Shows which LTE bands that have been enabled on that specific module. The following bands should be active:

Operator	Country	Bands
AT&T	US	2, 4, 5 and 12
Verizon	US	4 and 13
Orange	FR	3 and 20

11.2 Query no SIM

If the SIM card is not present or not detected, the following is displayed:

```
H/W
 Model:         SARA-R410M-02B
 Revision:      L0.0.00.00.05.06
 IMEI:          352753090114156
SIM
 Status:        No SIM
NETWORK
 Registered:    No
OK
```

12 GPS Information

The GPS subsystem can be queried with the following command:

```
!G<cr>
```

Here below is an example answer to this query:

```
GPS STATUS
Mode:    Power ON
Lock:    1
```

```
Sat U:   11
Sat V:   14
Time:    09/17/2018 22:12:51
Lat:     48.858343
Lon:     2.294705
Spd:     0.0
Hea:     257
Alt:     23
DOP:     0.8
Age:     1 s
RTC:     09/17/2018 22:12:50
Lock:    35
Relock:  35
OK
```

13 Input/Outputs

13.1 Overview

The PT40 includes the following interfaces:

- 4 Digital inputs
- 2 Open-drain outputs
- A 1-Wire™ interface
- A serial UART

For debugging purpose, these interfaces can be controlled locally. In actual deployments, these interfaces can be controlled remotely over an IP connection or SMS messages

13.2 Digital inputs

The inputs can be verified with the following command:

```
!INP<cr>
```

The result is as shown below:

```
4 3 2 1
0 1 1 0
OK
```

In that case, inputs 2 and 3 are high (more than 3V on the input) and inputs 1 and 4 are low.

13.3 Open-drain outputs

The outputs can be controlled with the following command:

```
!OUT=<OUTPUT>,<LEVEL>
```

```
<OUTPUT> is 1 or 2
<LEVEL> is 0 or 1      (1 activates the open-drain which grounds the
                        output))
```
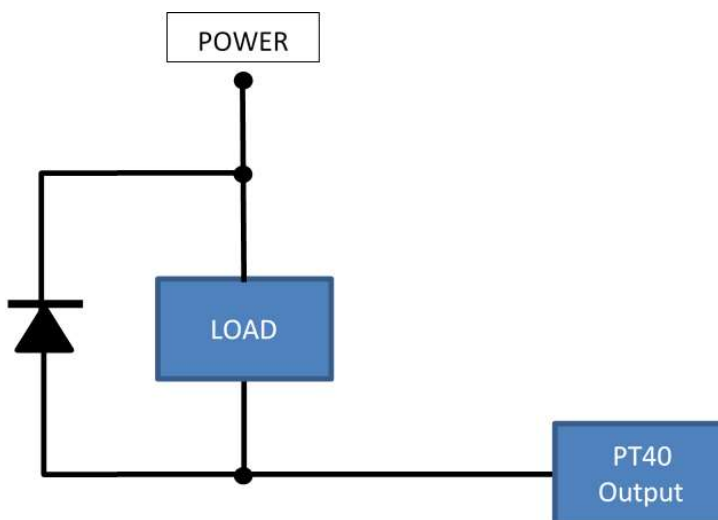
Example 1: activate output #2:

```
!OUT=2,1
```

Example 2: deactivate output #1:

```
!OUT=1,0
```

13.4 Connecting a load

The load can be connected to any of the two PT40 outputs using the following schematic:

Please note the following:

- The POWER applied to the load does not need to be the same as the one powering the PT40
- When using separate power sources, the two grounds (PT40 and load) must be connected together
- The diode shown above <u>must be present</u> if the load is not purely resistive. If a non-resistive load such as a relay is switched without the diode, the PT40 output will be immediately destroyed.
- The maximum voltage for the load is 60V (note that this is different from the maximum voltage supported by the PT40 itself)
- The maximum current is 3 Amps.

13.5 1-Wire™ interface
The PT40 supports iButton™ and temperature sensors.

13.6 Serial interface
Please contact Pacific Track to discuss the supported devices.