

	ICON PRO ST-I User Manual	ELABORATED Lorena C. Carvalho	REV. 01
		APPROVED Pedro Braga	PAG 1/30 DATE 13/09/21

User Manual ICON PRO ST-I

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 1/30
		APPROVED Pedro Braga	DATE 13/09/21

Contents

1	Introduction	3
2	Product overview	3
2.1	Mainly advantages	3
2.2	Related documents	4
2.3	Accessories	4
2.4	Environment	5
2.5	Connector	5
2.5.1	Part Numbers	5
2.5.2	Pinout	6
2.6	Cabinet	6
2.7	Assemble holes	8
2.8	Mass	9
3	Electrical specifications	9
3.1	Inputs and outputs	9
3.1.1	Inputs	9
3.1.1.1	Ignition	9
3.1.1.2	Digital inputs	10
3.1.2	Outputs	10
3.2	Source interface	10
3.2.1	Load dump protection	10
3.2.2	Reverse bias	11
3.2.3	Operational energy consumption	12
3.3	Interface Serial	12
4	Installation guide	12
4.1	Installer qualifications	12
4.2	IMEI	12
4.3	Choosing the assemble place	13
4.4	Assembling ICON PRO ST-I	14
4.4.1	Fixation base	14
4.4.2	Cabinet fixation on the base	15
5	Test Software	16
5.1	Configuration and physical connections test at ICON's software	16
5.2	Testing and configuring ICON PRO ST-I	17
5.2.1	Serial - (1)	19
5.2.2	Device's information - (2)	19
5.2.3	Parameters - (3)	19

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 2/30
		APPROVED	DATE
		Pedro Braga	13/09/21

5.2.3.1	Inputs	19
5.2.3.1.1	Input source - ADC	20
5.2.3.2	Outputs	21
5.2.3.3	Communication	22
5.2.3.3.2	Satellite protocol formatting	22
5.2.3.3.3	Communication channels	23
5.2.3.4	Messages queue	23
5.2.3.5	Events LOG	24
5.2.4	Parameters - (4)	24
5.2.4.1	GPS	25
5.2.4.2	Tracker	25
5.2.4.3	Positioning	26
5.2.4.4	Virtual fence	27
5.2.5	Events and actions - (5)	27
5.2.6	Tools - (6)	28
5.2.7	Finalizing configuration	29
6	Modification Register	30

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 3/30
		APPROVED	DATE
		Pedro Braga	13/09/21

1 Introduction

Thank you for purchasing ICON PRO ST-I.

In this manual you will find the procedures to correctly install and utilize ICON PRO ST-I. For more information Effortech's support team can be reached anytime at suporte@effortech.com.br.

2 Product overview

ICON PRO ST-I is a bidirectional satellite communication device with embedded intelligence that allows remote asset to transmit and receive messages through satellites from all over the world. It uses Iridium™ low orbit constellation. It was idealized to work outdoor so the circular connector is waterproof and the cabinet has IP67 protection rate. The device also has serial communication, digital inputs and outputs, compatible GPS with GPS and Glonass constellations. The source voltage allowed is between 9 and 32 V making it possible to operate in automotive applications, agriculture, utilities, IoT and more. The device supports up to 340 bytes being sent of uplink to 270 of downlink, in other words, up to 340 bytes is for MO messages (originated by the module) and 270 bytes is for MT messages (sent to the module). The messages are directed to the Iridium™ Gateway that get connected safely with the application server through TCP/IP.

The device's embedded intelligence allows it to be used in stand alone mode. It means that the device does not need a second command or dependence hardware, so all the peripherals and sensors communication and data processing can be done by the device only whether monitoring sensors, sending GPS location, doing routines for actions inside events or even work in operate mode where the device answers to a second hardware only.

This device can be used for RS232 or RS485 serial communication. In the RS232 version, ICON can answer a Leaf protocol command or even in a configured version like transparent channel where is sent to the satellite everything that is received from serial communication. In the RS485 version the device must go through a different development process so it can be adjusted to the client's protocol because it can be used as a peripheral in the existing RS485 network, answering to the network commands or even being the network master.

2.1 Mainly advantages

The mainly advantages of utilizing ICON PRO ST-I are:

- IP67 protection rate cabinet;
- Sturdy voltage source protected against Load Dump that accord to ISO 7637- 2:2004 - Pulse 5 for 12V and 24V systems;
- Low latency because a low orbit constellation is used;
- Geopositioning through GPS and Glonass;
- Anatel homologation;

	ICON PRO ST-I User Manual	ELABORATED Lorena C. Carvalho	REV. 01
		APPROVED Pedro Braga	PAG 4/30 DATE 13/09/21

- Embedded intelligence;
- Inputs and outputs that can be used in a lot of applications;
- Market's main trackers integration;
- Stand alone mode which makes possible IoT connectivity with purely satellite communication.

2.2 Related documents

1. Iridium Short Burst Data Service Developers Guide
2. ICON PRO ST-I Datasheet
3. Parameters' table - ICON PRO ST-I
4. RS232 Serial Protocol
5. ICON PRO ST-I Satellite Protocol
6. Command examples - ICON PRO ST-I

2.3 Accessories

ICON PRO ST-I comes with some accessories so the assemble can be done. See section 4 for more details on the installation process.

Fig. 1 shows ICON PRO ST-I kit along with its accessories:

- 1 ICON PRO ST-I
- 1 fixation base
- 1 LLT model 12 gauges external electrical whip
- 1 LTT sealed circular connector (counterpiece)
- 3 fixation screws
- 3 covers for the screws' hole

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 5/30
		APPROVED Pedro Braga	DATE 13/09/21

Figure 1: ICON PRO ST-I complete kit



2.4 Environment

The environment conditions so the ICON PRO ST-I can be operated are listed in the following table.

Table 1: Operating Conditions

Parameter	Value
Operational temperature	-20 a +85°C
Dust and water ingress	IP67

2.5 Connector

2.5.1 Part Numbers

In Fig. 2 there is a sealed circular connector (male) M16 with 12 pins (LLT, Shenzhen Lilutong Connector). The part numbers can be seen in table 2 and also the recommended coupling connector.

Table 2: Connector specifications

Parameter	Value
Connector type	M16 - 12 gauges (male)
Connector's part number	LLT-M16-05012F1051
Coupling connector	M16 - 12 pins (female) IP67
Recommended part number	LLT-M16-05010F1051

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 6/30
		APPROVED Pedro Braga	DATE 13/09/21

2.5.2 Pinout

The pin positions can be seen in fig. 2 and the pin descriptions are in the following table.

Figure 2: Male connector pin position

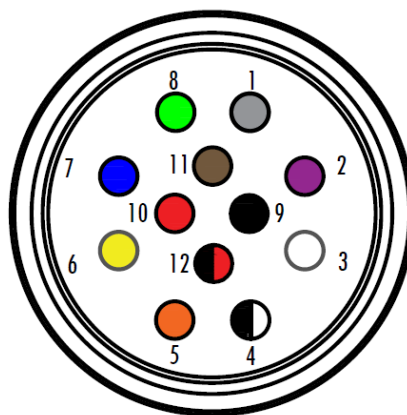


Table 3: ICON PRO ST-I pinout

Pin	Wire color	Signal	Description
1	Gray	TX-RS232	Serial communication output
2	Violet	RX-RS232	Serial communication input
3	White	IN 2	GND enabled digital input
4	Black and white	IN 3	GND enabled digital input
5	Orange	OUT 1	GND enabled output
6	Yellow	OUT 2	GND enabled output
7	Blue	IN 4/IGN	High level enabled digital input
8	Green	IN 1	GND enabled digital input
9	Black	GND	GND reference signal
10	Red	VBAT	9V-32V
11	Brown	-	-
12	Black and red	-	-

2.6 Cabinet

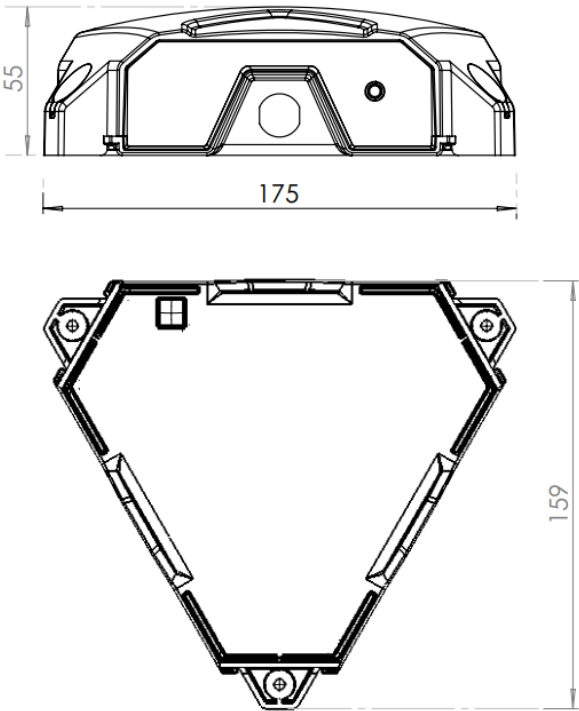
ICON PRO ST-I cabinet dimension scratch and its fixation base can be seen in the following figures along with a real photo of it.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 7/30
		APPROVED Pedro Braga	DATE 13/09/21

Figure 3: ICON PRO ST-I



Figure 4: Side and bottom views



	ICON PRO ST-I User Manual	ELABORATED Lorena C. Carvalho	REV. 01 PAG 8/30
		APPROVED Pedro Braga	DATE 13/09/21

Figure 5: Cabinet side view with the fixation base

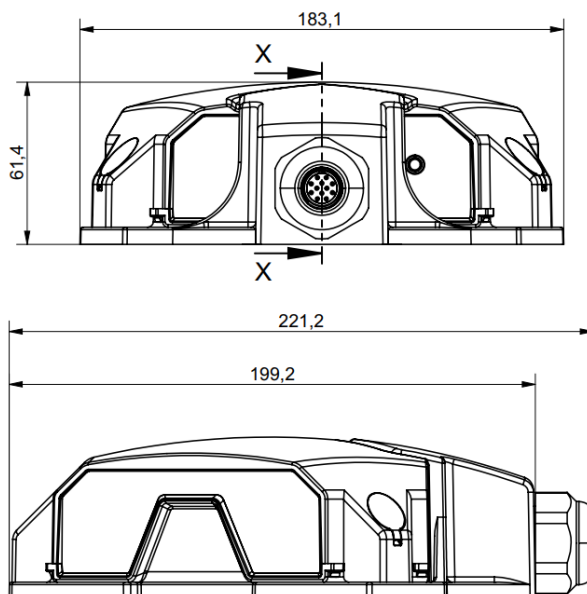


Table 4: Cabinet specifications

Parameter	Value
Length	159mm
Width	175mm
Height	55mm

2.7 Assemble holes

There are 3 holes on the ICON PRO ST-I extremities for the cabinet to be coupled on the fixation base. The following table shows the assemble hole specifications and the recommended fixation screw.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 9/30
		APPROVED Pedro Braga	DATE 13/09/21

Table 5: Assemble hole specifications

Parameter	Value
Screw hole diameter	4mm
Screw head clearance diameter	8mm
Hole length	23,7mm
Remommended screw	Stainless steel M4 Allen Cylindrical Head Screw X 8mm

2.8 Mass

ICON PRO ST-I mass specifications are in the following table.

Table 6: Mass specifications

Parameter	Value
Main module mass	376g($\pm$ 0.5g)
Fixation base mass	144g($\pm$ 0.5g)
Set mass	520g($\pm$ 0.5g)

3 Electrical specifications

3.1 Inputs and outputs

3.1.1 Inputs

ICON PRO ST-I has 3 low level (GND) enabled digital inputs and 1 high level enabled digital input (usually used for ignition).

3.1.1.1 Ignition

ICON PRO ST-I ignition input is high level enabled. It means that for the device to recognize ignition is enabled its voltage must be between 9 and 32VDC. It also has an ADC functionality that makes possible a lot of applications like an analog sensor reading, for example (this application is still in development, for more information get in contact with commercial or support team).

This input supports non-recurrent pulse up to 60VDC and **does not have additional protection**. It means that existed functionalities and protections assures this input working only up to the mentioned limits.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 10/30
		APPROVED Pedro Braga	DATE 13/09/21

3.1.1.2 Digital inputs

There are other 3 inputs. Those 3 are enabled through low voltage level (GND). It supports up to 60VDC and **DOES NOT** have more protection,

3.1.2 Outputs

ICON PRO ST-I has 2 low level enabled outputs. Output characteristics that must be followed for correct functioning are shown in the table below:

- Protection against short circuit: 700mA;
- Load maximum voltage: 40V.

The protection works opening the output and turning off the load for currents higher than 700mA.

It is not recommended to directly install inductive loads in the outputs, if it is done the recommendation is to include a freewheeling diode, for example.

3.2 Source interface

Table 7: Source specifications

Parameter	Value
Input range	9-32V DC
Protection against reverse bias	-40V DC

The protection circuit can bear up to 200V.

3.2.1 Load dump protection

The voltage source has protection against load dump, according to ISO 7637-2:2004 – Pulse 5. It means the device is protected against voltage spike that can be caused by device's source voltage. This effect is really common in automotive applications.

ISO 7637-2 norm is about load dump as voltage spike occurred in the alternator when it is disconnected from the battery or is in its activation moment. This spike has different values for batteries with 12V or 24V source voltages. For light vehicles or vehicles with 12V batteries, the voltages can be 65V up to 87V when the load dump effect is happening. For heavy vehicles or vehicles with 24V batteries, this effect can make occur peak voltages of 123V up to 187V and the time period of it can be 40ms up to 400ms. Said that, the devices connected to those source voltages need to be prepared for it.

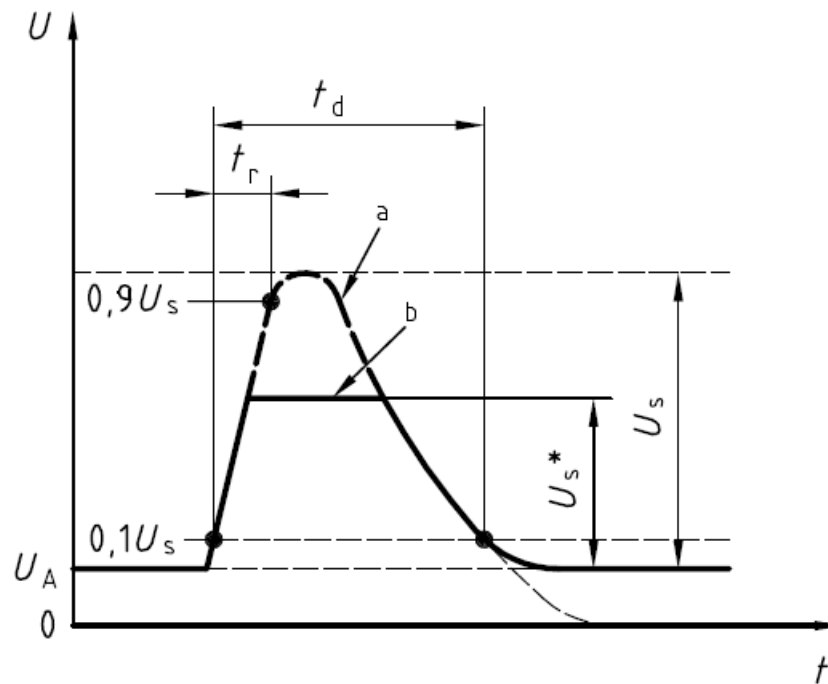
Fig. 6 shows a graph that exemplifies a generic voltage spike occasioned by vehicle's alternator in the source voltage of the devices that share the same line. That is the case for devices powered by vehicle's battery.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 11/30
		APPROVED	DATE
		Pedro Braga	13/09/21

As we can see in fig. 6 the curve represented by letter 'a' is the voltage level when the load dump effect occurs and the curve represented by letter 'b' shows how the protection circuit must behave in the voltage point of view. That said, the voltage is "mowed" after achieving a maximum limit voltage and its value is kept till voltage levels are adjusted. Another option would be to cut the voltage source, it means that a device is used to open the circuit so that there is not a voltage source anymore when it recognizes a voltage level that is higher than the value expected till the voltage is back to normal.

ICON PRO ST-I protection system is based in a MOSFET utilization. The MOSFET works as a switch, when the voltage value surpasses 38V the MOSFET "opens" leaving the circuit with no voltage source and the voltage source only is re-stabilized when the voltage level is normalized. In other words, for voltages that are above the limit the device does not work and will only start working again when the voltage is below the limit.

Figure 6: Battery voltage source Voltage x Time graph



3.2.2 Reverse bias

Reverse bias is a protection that assures the device will work properly even in cases where there is inversion on the voltage source polarity, in other words, when the device has its source connections inverted (GND pin is connected in the VCC pin and vice-versa). ICON PRO ST-I assures it will not burn out when the voltage source is up to -40V.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 12/30
		APPROVED Pedro Braga	DATE 13/09/21

3.2.3 Operational energy consumption

Table 8: Operational energy consumption

Parameter	Value
Stand by (data reception)	~50mA
Transmission	Mean 150mA, peak 2A

3.3 Interface Serial

ICON PRO ST-I has RS232 or RS485 serial interface. In its default configuration RS232 serial is used. The host device connected to ICON must have the baud rate configurations that are shown in the next table.

Table 9: Baud rate configurations

Parameter	Value
Baud Rate	38400 b/s (default)*
Data Bits	8
Parity	None
Stop Bits	1

Communication speed as well as other configurations can be changed through the test and parameterization software (offered in Effortech's site or by support team).

Serial communication line is protected against short circuit and overvoltage up to 500V.

4 Installation guide

In this section you will find ICON PRO ST-I installation guide.

4.1 Installer qualifications

The installation must be done by a qualified installer and with experience installing satellite communication electronic equipment.

4.2 IMEI

Before the installation, the ICON PRO ST-I IMEI number and its installing localization must be registered. The IMEI number is the ICON PRO ST-I network address and it is used for provisioning, charging, sending or receiving messages from the device or to the device.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 13/30
		APPROVED Pedro Braga	DATE 13/09/21

The IMEI number can be found in the tag that is under the cabinet (fig. 7).

Figure 7: Etiqueta com o IMEI na parte de baixo do gabinete



Alongside ICON PRO ST-I there is one more extra tag with the IMEI number. Therefore, if the device is installed in a place that the access is difficult or in a way that the tag is covered, this extra tag can be fixated in a more accessible side where the IMEI number can be seen.

4.3 Choosing the assemble place

The assemble place is a very important matter for the installation to be succeeded. The following orientations must be followed:

- The place must provide a safe installation avoiding the cabinet to be exposed to solid object impacts;
- ICON PRO ST-I goal is not destined to work near people. You must always confirm if the device is assembled in a place that is more than 20cm far from people because of the conformity that established the RF exposure limits;
- The place chosen must be horizontal and flat if you want a ideal uniform performance of the satellite;

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 14/30
		APPROVED Pedro Braga	DATE 13/09/21

- Check if the assemble place has a clear and unblocked vision by 360 degrees sky related in all directions. Usually, it means to choose a assemble place in the top of an asset;
- Do not install ICON PRO ST-I inside a construction zone or on a metallic surface.
- Check if the assemble place does not heat the device in a way that the maximum operational temperature is exceeded. If the surface can become warm, specifically by the sun, a insulating material must be used between the assemble surface and ICON PRO ST-I;
- Never assemble ICON PRO ST-I near other devices or communication antennas;
- Never install ICON PRO ST-I in a place where water can be accumulated.

4.4 Assembling ICON PRO ST-I

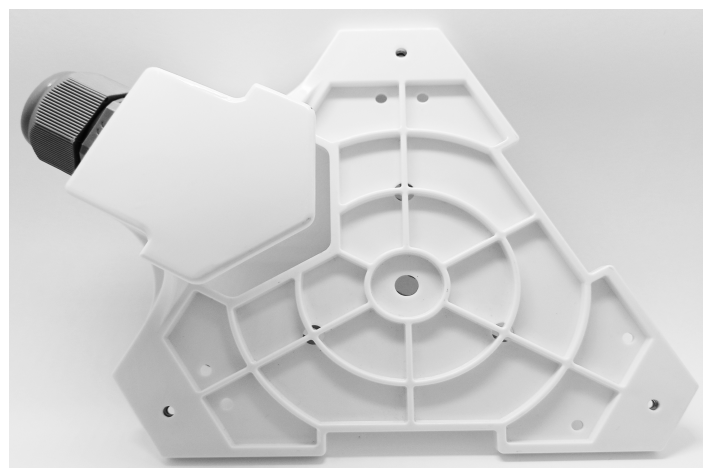
The assembling using double sided tape is for permanent installations. The device installed can't have the fixation base removed or the double sided tape removed without being damaged.

4.4.1 Fixation base

ICON PRO ST-I fixation base allows the cabinet to be removed if necessary and it does not impact the device's assurance.

Fig. 8 represents ICON PRO ST-I fixation base.

Figure 8: Fixation base top view.



- You must be sure of where the fixation base with the double sided tape is, the stability is permanent.
- Check if the assemble place is clean and flat making sure there aren't abrasions on the surface.
- Mark the fixation place and the edges to the wanted place for ICON PRO ST-I.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 15/30
		APPROVED Pedro Braga	DATE 13/09/21

- Clean with alcohol the assemble surface.
- Remove the plastic guides that cover the double sided tape.
- Carefully presses ICON PRO ST-I on the marked place.
- Places ICON PRO ST-I cabinet to the fixation base already surface glued.

If ICON PRO ST-I fixation base need to be removed does not remove it from the asset by force. Lifting or pulling it can damage the base and the surface assemble. It's recommended to remove the base sawing it with a fine wire so the double sided tape can be cutted.

The recommended fixation method is the one that uses the double sided tape, but the device can also be fixated with strews, there are holes that allows that and the strew needed is one with 4mm of diameter.

4.4.2 Cabinet fixation on the base

- **Remember to pass the electrical whip through the fixation base with the screwing cable gland according to fig. 9.**
- The cabinet is fixated on the base with the ICON PRO ST-I kit strews.
- After the screwing process, the kit's lids must be fitted in as in fig. 10.

Figure 9: Fixation base with the uncouple cable gland



	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 16/30
		APPROVED Pedro Braga	DATE 13/09/21

Figure 10: Base fixed cabinet with the lids



5 Test Software

At ICON PRO ST-I area in Effortech's site there are the devices' manual and configuration software. If a more detailed documentation for integration is needed, you must get in touch with the support team.

5.1 Configuration and physical connections test at ICON's software

The following items are necessary to utilize the test software in a computer:

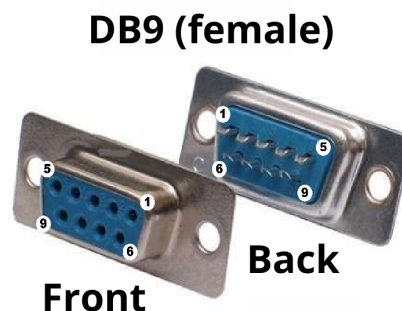
- Software .exe file;
- ICON PRO ST-I;
- RS232 USB converter;
- DC voltage source.

With the items already cited before the correct connection the source equipment, transmission wires and data reception electric connection must be done.

It is recommended to use a DB9 female connector (fig. 11) for the ICON PRO ST-I electric whip connection in USB/serial converter.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 17/30
		APPROVED Pedro Braga	DATE 13/09/21

Figure 11: DB9 connector pinout



With ICON PRO ST-I electrical whip description table (table 3) and DB9 connector numeration, what must be done is follow the connection description on table 10.

Table 10: RS232 connection between ICON electric whip and RS232 USB converter

ICON PRO ST-I	DB9 (female)
TX (Purple)	Pin 2
RX (Gray)	Pin 3
GND (Black)	Pin 5

Always check if all the GND connections are connected with each other, source and reference GND. It is very important that TX and RX are connected correctly for the correct device functioning.

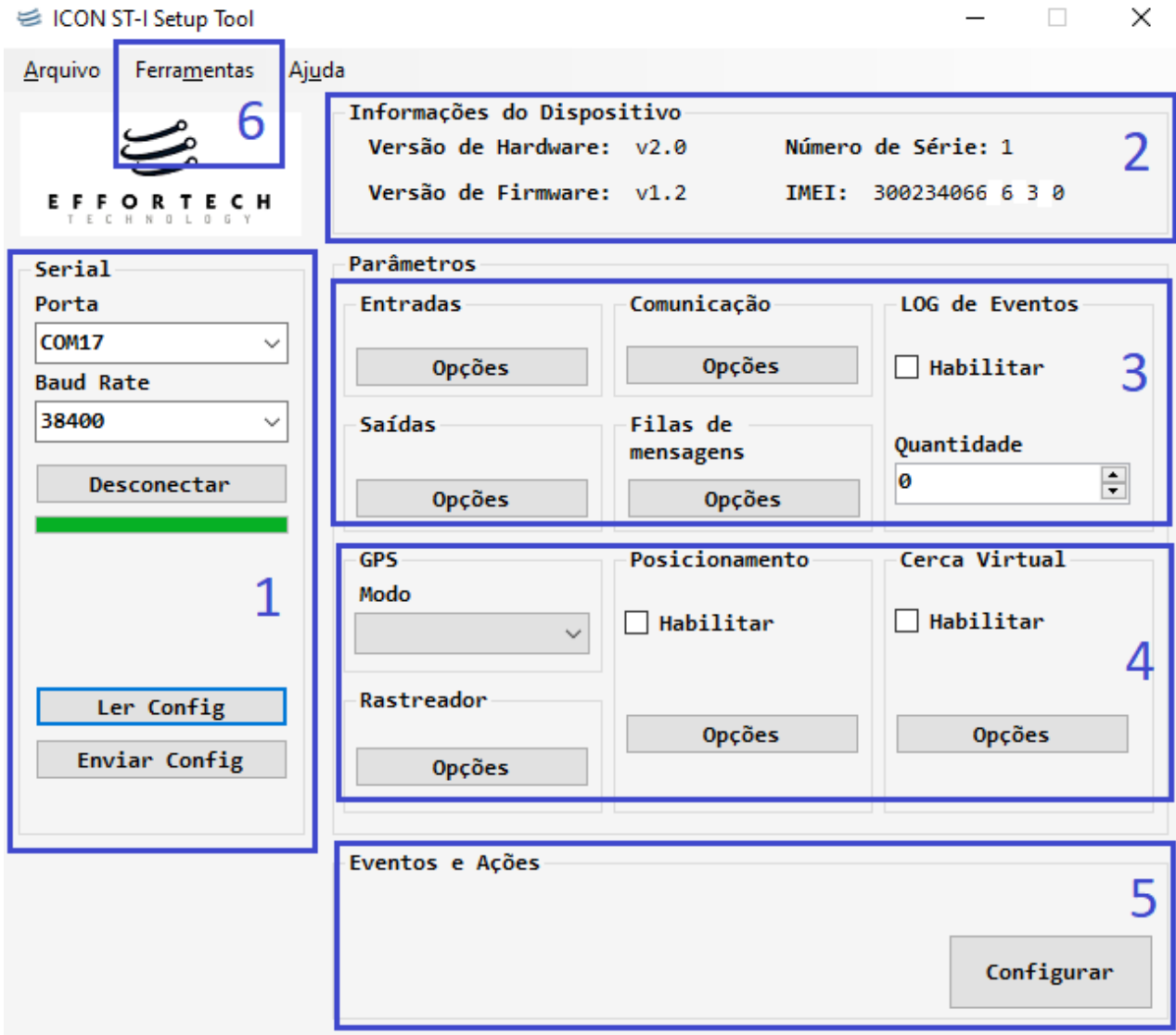
5.2 Testing and configuring ICON PRO ST-I

There is one folder called "Software de testes (test software)" among the folders Effortech gave you, inside this folder there is another folder called "ICON PRO ST-I Setup Tool" with all the test software versions. It is recommended to always use the most recent software (SW) version because the software version number will follow the firmware (FW) version which means, for example, for FW 1.4 the software should be SW 1.4. If you have any doubts reach the support team (suporte@effortech.com.br).

After the download of all the .exe files and after executing them, a shortcut will be created in your desktop with the test software. Said that you must open it so the interface in fig. 12 will show up (still without device and serial information).

To use the software it is necessary to firstly fill in the blank fields "porta (port)" with the COM port used in your computer for the RS232/Serial converter and the device default communication baudrate (usually 38.400b/s). After that, you should click in "conectar (connect)".

Figure 12: Test software initial screen with the device's information



After those steps, if all the physical connections are correct (it is important to check if the ICON's TX is connected in your device's RX and vice-versa), ICON's information will be shown on section 2 of fig. 12.

Fig. 12 was divided in 6 sections for a better explanation of all software functions. The following sections are about every one of them.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 19/30
		APPROVED Pedro Braga	DATE 13/09/21

5.2.1 Serial - (1)

In fig. 12 section 1 there is the COM port information used for serial communication along with the baud rate (devices' speed communication). Both fields should be correctly filled in by the user so the connection can be done. Right below there is the **"Desconectar (disconnect)"** button used for a virtual disconnection or for the serial port closure.

There is also the **"Ler config (read configuration)"** option that recognizes and sets all software configuration already setted in the device before like input and output, event pairs and actions, communication, etc.

The button **"Enviar config (send configuration)"** when pressed sends all configurations made in the software, thus, after choosing all button routines and functions, it is necessary to go back to the main screen and press the **"Enviar config (send configuration)"** button so the configuration changes can be sent to the device. A success message should be sent in your screen after configuration sending.

5.2.2 Device's information - (2)

In fig. 12 section 2 there are all connected device information. It is also useful to firstly check if the serial connection is working.

Utilized IMEI, hardware and firmware versions can also be checked.

5.2.3 Parameters - (3)

Inside fig. 12 section 3 there are five configuration possibilities.

5.2.3.1 Inputs

The first one is the input configuration. ICON PRO ST-I has 4 digital inputs where 3 of them are low level enabled and 1 is high level enabled (usually used for ignition).

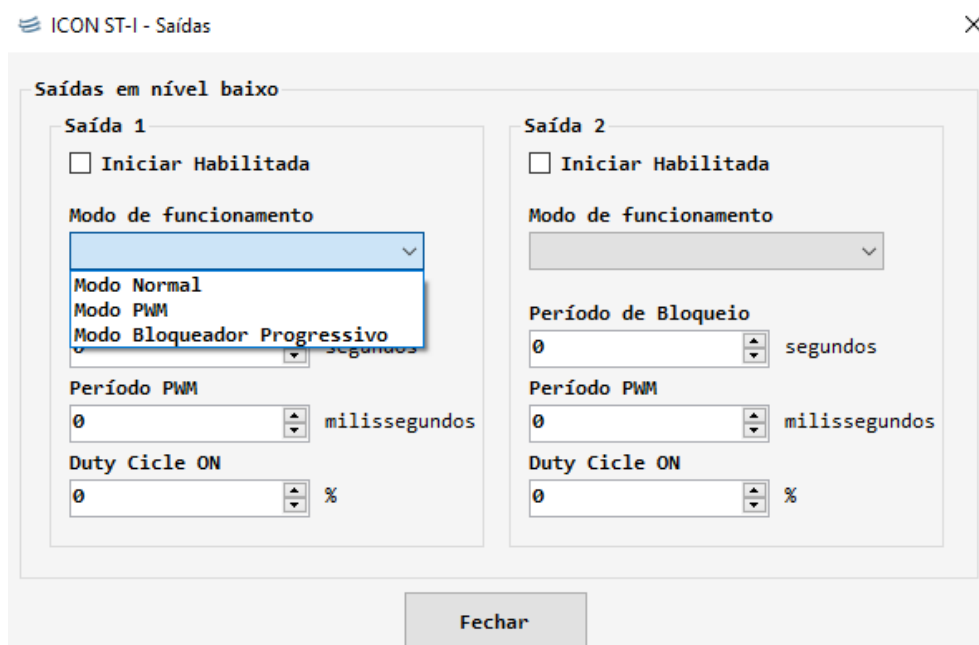
After clicking on input's **"Opções (options)"** button the screen shown in fig. 13 will show up. In the options screen we can see every input characteristics (high or low level), it is also possible to change enabled or disabled debounce. Debounce is the period of time in seconds the device will wait to recognize the input as enabled or disabled, it is also useful to check if there are false enabling by waiting a period of time til the signal is established.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 21/30
		APPROVED Pedro Braga	DATE 13/09/21

5.2.3.2 Outputs

The second configuration option is referred to the outputs. ICON PRO ST-I has low level enabled outputs, in other words, these outputs show GND signal or voltage equals to 0VDC after being enabled. Fig. 14 shows the screen after clicking on output's **"Opções (options)"**.

Figure 14: Output configurations



There is a checkbox in both output configurations which if being marked the output will always start enabled, in other words, at GND. The **"modo de funcionamento (operating mode)"** list has 3 options that can be marked:

- **"Modo normal (normal mode)"**: a simple triggering is done maintaining the output voltage at GND.
- **"Modo PWM (PWM mode)"**: enables the output by PWM cycles which are configured in the fields below:
 - **"Período PWM (PWM period)"**: where the PWM cycle's total period of time in milliseconds is chosen;
 - **"Duty cycle"**: it is the PWM period's period of time in percent where the output stays enabled, in other words, if 50% is marked, the output will stay enabled for half the PWM's period of time and disabled the other half.
- **"Modo Bloqueador Progressivo (progressive blocker mode)"**: it exists if you want to uses ICON's output like a trigger's blocker where the block must occur in a gradual way. The block also works by

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 22/30
		APPROVED	DATE
		Pedro Braga	13/09/21

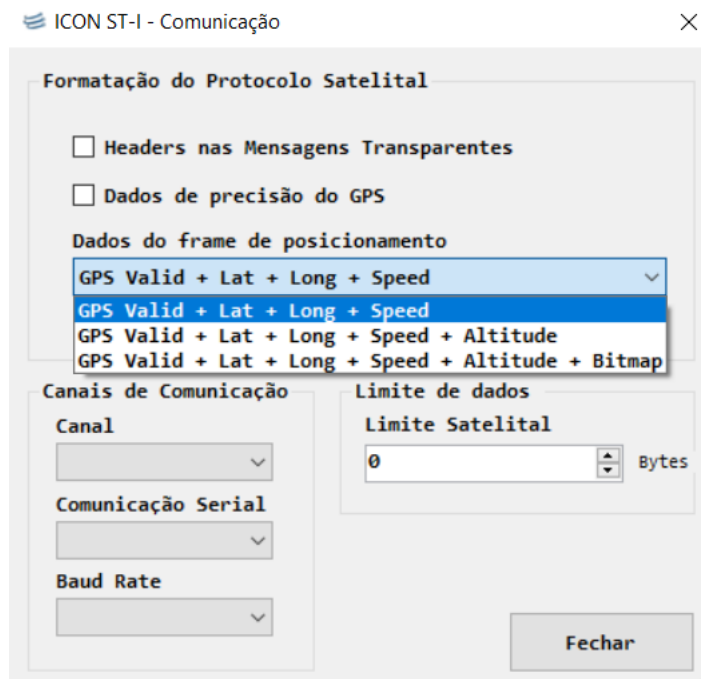
PWM, only the block's total period is marked and the output will be enabled with higher frequencies til the output is totally triggered.

All in all, the **blocker's period** is only used in the **progressive blocker mode** and is configured in seconds. The **PWM period** and **duty cycle ON** fields are only used in PWM mode, where the first one is used to configure the total PWM functioning cycle period of time in milliseconds (period of time enabled + period of time disabled) and the second one is the period's active time in percent (the calculations for this percentage can be found in this device's protocol).

5.2.3.3 Communication

The **comunicação (communication)** field is the first satellite communication configuration field. Through the "**opções (options)**" communication button the screen in fig. 15 can be seen.

Figure 15: Communication configurations



5.2.3.3.2 Satellite protocol formatting The first two checkboxes are to receive or not headers in the transparent messages sent by satellite, in other words, if the first checkbox is checked, in every received message will have timestamp and a command message indicating message's date, hour and type. The second checkbox configures the sent or not of GPS accuracy data, if this checkbox is checked HDOP (horizontal dilution of precision) and satellite number will be sent in the sent data frame.

	ICON PRO ST-I User Manual	ELABORATED Lorena C. Carvalho	REV. 01 PAG 23/30
		APPROVED Pedro Braga	DATE 13/09/21

There is a list in the "**Dados do frame de posicionamento (positioning frame data)**" so you can choose what information will have in the message sent by the device. It is only necessary to select what is related to your application.

5.2.3.3.3 Communication channels The first parameter to be configured here is the "**canal (channel)**". The channel is where the messages will be sent to from the ICON PRO ST-I (by serial, satellite or both).

- **Serial:** in this mode ICON travels and send its messages only through serial communication;
- **Satellite:** in this mode the messages will be sent directly to Iridium satellites;
- **Both:** in this mode the messages are sent through serial communication as well as through satellite.

It is also defined "**comunicação serial (serial communication)**" way of use and how the messages that arrive by this path are processed. There are 2 options:

- **Normal:** device's communication through Effortech's Leaf protocol;
- **Bypass Satelital:** this option is also named "**canal transparente (transparent channel)**" because ICON PRO ST-I sends to the satellite all messages that arrives at the serial through this format.

There is also the "**Baud Rate**" which is the device communication speed in bits/seconds.

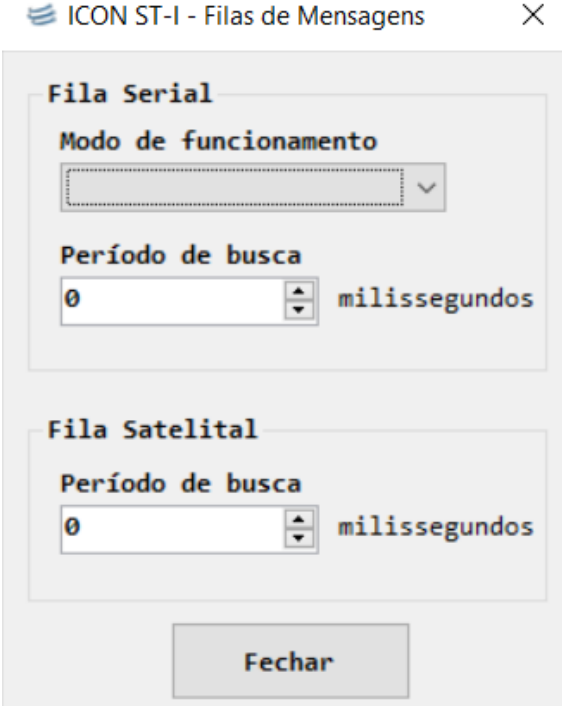
Lastly, on communication screen's right side there is a value in bytes related to "**limite satelital (satellite limit)**" to be configured. The value can be chosen by the user and it works as data traffic management, thus, when the bytes' limit is exceeded an event is generated for the user.

5.2.3.4 Messages queue

In this section we will configure ICON's memory messages queue format sent through satellite. The screen in fig. 16 will be open by clicking on the "**opções (options)**" button.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 24/30
		APPROVED Pedro Braga	DATE 13/09/21

Figure 16: Messages queue configuration



ICON ST-I - Filas de Mensagens

Fila Serial

Modo de funcionamento

Período de busca: 0 milissegundos

Fila Satelital

Período de busca: 0 milissegundos

Fechar

Messages' queue "**modo de funcionamento (operating mode)**" is divided in 3 scenarios that can be "**desabilitado (disabled)**", "**habilitado (enabled)**" or "**temporizado (temporized)**". In disabled mode, the event will be sent as soon as it happens.

In enabled mode, the event enters a queue and waits a polling so it can be sent.

Finally, in temporized mode it is defined a period of time in milliseconds at "**período de busca (search period)**" field, so pending events can be search in memory. In "**fila satelital (satellite queue)**" a period of time in seconds is configured for the verification of the message buffer that will be sent to the satellite.

5.2.3.5 Events LOG

To end configuration software's section 3 there is a checkbox to enable or not the event LOG sending. If it is enabled, events generated by ICON will be saved in memory. Also, these events generated by ICON quantity will be defined and it should be unloaded when required through an action.

5.2.4 Parameters - (4)

Fig. 12's section 4 contain configurations related to geolocalization.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 25/30
		APPROVED Pedro Braga	DATE 13/09/21

5.2.4.1 GPS

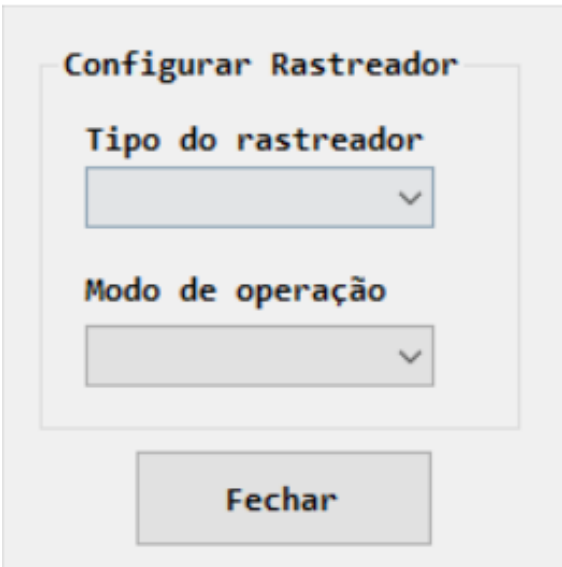
In GPS field it is possible to choose GPS' operating mode. The list with the options to be chosen has 3 operation modes: "**desabilitado (disabled)**", "**habilitado (enabled)**" and "**low power mode**" (GPS module's low power consumption mode).

5.2.4.2 Tracker

Like Effortech's majority devices, ICON PRO ST-I was created to attend the tracking sector needs. That said, ICON has a "**rastreador (tracker)**" mode. It has configurations that allows operating with the market's main trackers.

Fig. 17's screen will show up when you click on tracker's "**opções (options)**".

Figure 17: Tracker configurations



Icon ST-I - Rastreador

Configurar Rastreador

Tipo do rastreador

Modo de operação

Fechar

In "**tipo do rastreador (traker's type)**" you will choose on the list, when applicable, the tracker that will be used along with ICON.

In "**modo de operação (operating mode)**" you will choose the operating mode the tracker is configured to work. If the tracker does not have a operating mode, choose "**modo normal (normal mode)**".

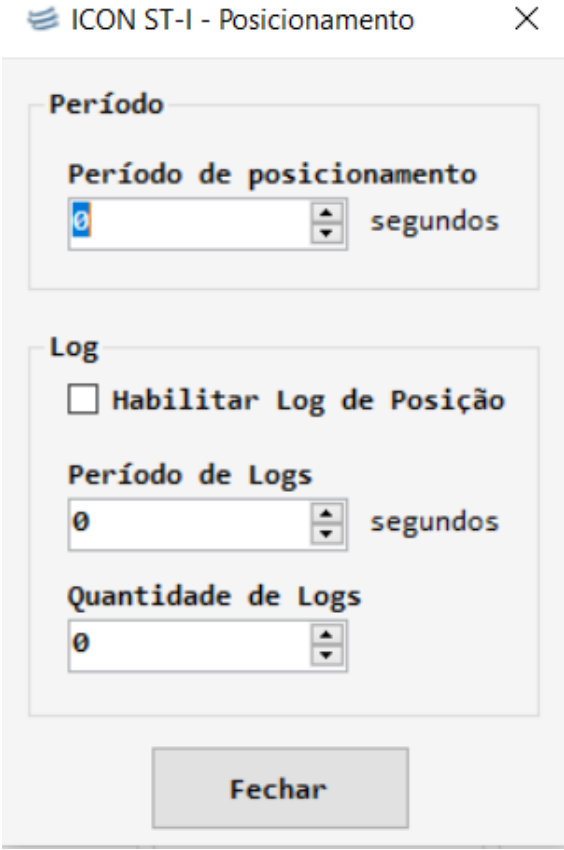
	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 26/30
		APPROVED Pedro Braga	DATE 13/09/21

5.2.4.3 Positioning

One of the main characteristics of ICON is the periodic positioning that can be used to security and tracking applications and satellite redundant tracking.

The first checkbox in positioning fields serves to enable or not device's periodic positioning. If enabled the "**opções (options)**" field should be open and a screen like in fig. 18 will show up.

Figure 18: Positioning configurations



In "**período de posicionamento (positioning period)**" you will choose the period of time in seconds periodic sending will have. The minimum period of time is 30 seconds.

Below it, you can enable or not the "**log de posição (positioning log)**" sending. If it is enabled "**período de logs (logs' period)**" and "**quantidade de logs (logs' quantity)**" must be chosen.

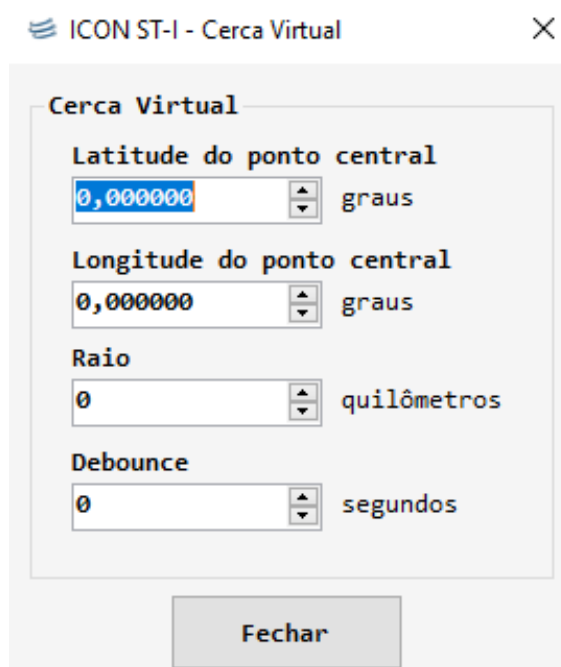
	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 27/30
		APPROVED Pedro Braga	DATE 13/09/21

5.2.4.4 Virtual fence

This functionality creates a virtual delimitation in a delimited space on the map. It can monitor when any event related to this delimited space happens like a unwanted departure or a undue place entry.

You should click on "**opções (options)**" to configure "**cerca virtual (virtual fence)**" field. Fig. 19 will show up.

Figure 19: Virtual fence configuration



Firstly choose "**latitude do ponto central (central point latitude)**" and "**longitude do ponto central (central point longitude)**" in degrees, in other words, we will be choosing the exact central point the virtual fence will be. After that, by choosing the "**raio (radius)**" in kilometers, a circular area will be created around it. Lastly, a debounce can be chosen so a period of time in seconds is waited til the localization is stabled and an event can be generated after entering or exiting the fence.

5.2.5 Events and actions - (5)

Fig. 12's section 5 is related to events and actions' pairs configuration. Thus, you can create routines so the device can answer to actions in determined events.

Click on events and actions "**opções (options)**" button so fig. 20 and 21 can show up.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 28/30
		APPROVED	DATE
		Pedro Braga	13/09/21

Figure 20: Events' list

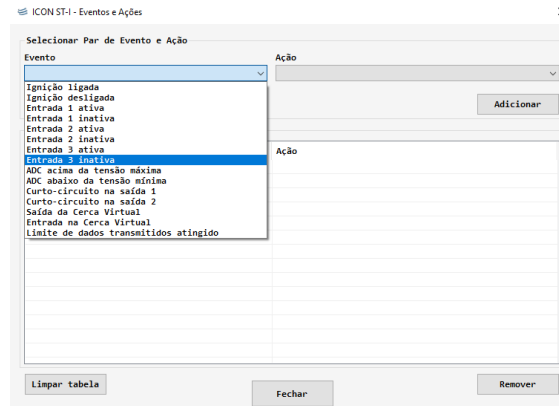
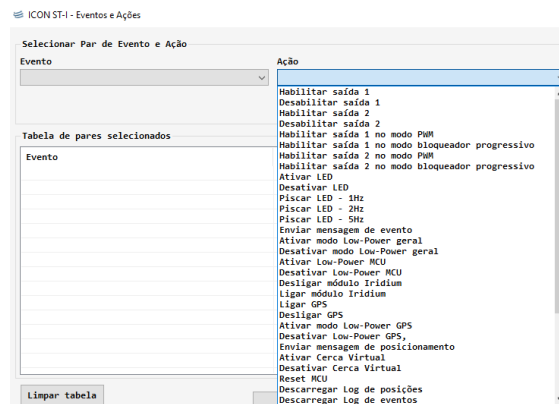


Figure 21: Actions' list



That is, we can use the list shown in fig. 20 to choose an event and for every event an action shown in fig. 21 can be chosen.

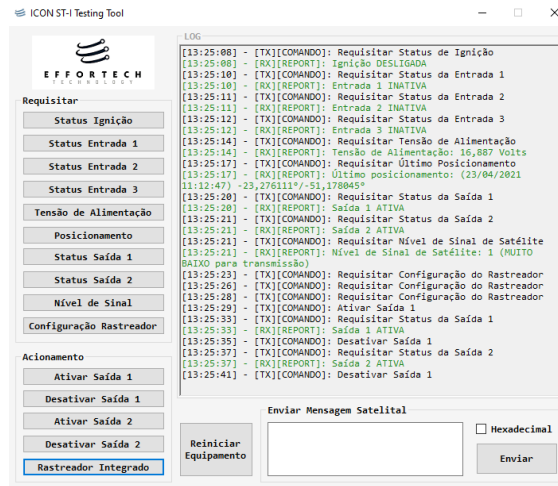
For example, for the event "**ignição ligada (ignition ON)**" you can choose the "**habilitar saída 1 (enable output 1)**" action so every time ignition is ON output 1 will be turned on also. A blocker relay can be connected to the output, for example. That said, a lot of events and actions' pairs can be configured.

5.2.6 Tools - (6)

In fig. 12's section 6 there are 2 options. If you click on "**ferramenta de testes (testing tool)**" the screen in fig. 22 will show up.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 29/30
		APPROVED	DATE
		Pedro Braga	13/09/21

Figure 22: Testing tool



We can see the communication LOGs at fig. 22 and in the left side there are some command buttons (these commands will be sent every time you press them). The commands are divided in "requisitar (requisition)" and "acionamento (trigger)". On the first part you can solicit some pre-configured piece of information like input and output status, voltage source, etc. The answers to those requisitions will be shown on the central screen.

The second button part shows the "**acionamentos (triggers)**" that can be done. Those triggers are mainly used to the outputs enabling and disabling them.

On the bottom part of fig. 22 there are the reset buttons that resets the device. There is also a blank space where messages can be write down and send to the device through serial communication (if a hexadecimal protocol is used its checkbox needs to be checked).

Finally, there is the "**enviar (sending)**" button so the message wrote can be sent to ICON.

IMPORTANT: the messages must follow Effortech's leaf protocol.

5.2.7 Finalizing configuration

After all the configurations done, following the steps already shown, it is necessary to go back to the initial screen shown in fig. 12. Click on "**enviar config (send configuration)**" so the configurations done can be send to the device.

After that, ICON is able to be used in your application.

	ICON PRO ST-I User Manual	ELABORATED	REV. 01
		Lorena C. Carvalho	PAG 30/30
		APPROVED Pedro Braga	DATE 13/09/21

6 Modification Register

Date	Modification	Person in charge
15/05/2020	Inicial version	Frank H. Lima
17/05/2023	English translation	Lorena C. Carvalho