



MiniTax V10

rev 4. BT

1. METROLOGICAL PROPERTIES OF THE TAXIMETER

1.1. Permissible error limits

Before installing the taximeter in the vehicle

- for the elapsed time, 0.2s or 0.1% whichever is greater
- for the distance traveled, 4m or 0.2% whichever is greater
- for the fare calculated, 0.1%

Allowance shall be made for the rounding of the least significant digit of the fare indication

After installing the taximeter in the vehicle

- for the elapsed time, 0.2%
- for the distance traveled, 2%
- Adjust the taximeter constant, k, to the vehicle on which the taximeter is mounted as close as possible to zero error where applicable compensating for wear and tear of the tires of the vehicle

1.2. Measuring range

Measuring ranges are in direct dependence on the initial distance, the initial time interval, the basic distance, and the basic time interval. The specified sizes can be programmed in the following ranges:

- initial distance: up to 50000m;
- initial time: up to 255min;
- step (jump value): up to 99999.99 monetary units;
- initial charge for all tariffs: up to 99999.99 monetary units;
- travel price indicator (6 digits): 999999 or 99999.9 or 9999.99 monetary units;
- supplementary charge indicator (4 digits): up to 99.99 monetary units;
- the "K" constant of the taximeter: from 500 imp/km to 65000 imp/km

1.3. Operating conditions

Temperature: -25°C to 55°C
Power Supply: 9V to 16V

1.4. Purpose of the taximeter

The taximeter is an instrument with the task to measure duration and the distance on the basis of a signal received from a distance measurement device and to calculate and indicate the fare to be paid on the basis of the measured distance and/or duration (to determine the price of taxi transportation).

2. PRINCIPLE OF WORK AND BASIC CHARACTERISTICS OF THE CONSTRUCTION

Distance measurement transducer provides taximeter with information about travelled distance. The taximeter receives the signal from the transducer and signal from the time measurement. These two signals are used by the taximeter to calculate fare, totalize values, display data and store the results for a finished fare. Calculations are performed based on a specified tariff, length and duration of the journey.

The principle of the taximeter is based on the measurement of travelled distance, according to the speed of the drive wheels of the vehicle, when the vehicle moves at a speed greater than the cross-over speed and on the measurement of the time of travel when the vehicle is moving at a speed less than the cross-over speed or when standing.

Taximeter MiniTax V10 is a taximeter in the form of rear-view mirror. It is based on CMOS technology. The central processing unit is a flash microcontroller.

The taximeter program is located in a flash memory of the microcontroller. All necessary textual expressions for the printer are stored in a flash memory.

All the parameters are located in EEPROM memory of the central unit (tariff parameters, taximeter constant, increment value). Total value counters, trip value counters and driving data are stored in EEPROM.

Event log data is stored in external FRAM memory.

The electronics of the taximeter are placed in a plastic ABS casing dimension 290x90x24mm on which the mirror is placed. The taximeter is mounted on an existing mirror in the vehicle cabin using grips on the rear of the casing.

The taximeter has a real time clock/calendar. RTC is powered from main system power supply, or from a 3V battery when the taximeter is not on the electrical installation of the vehicle.

The taximeter is programmed only by programming software using the computer with appropriate hardware and software. Only the authorized person of the taximeter manufacturer has access to programming. The taximeter is protected against unauthorized programming by a plastic insert that completely closes the opening at the bottom-right of the case and with tamper-proof seal so that the insert can't be removed. When programming, the date and time of the last programming are recorded and this can be seen on the printout of the parameters. The constant "K" can be programmed in the range from 500imp/km to 65000imp/km. Taximeter can be programmed with up to 8 tariffs with independent values for the starting price, price per kilometer, price per 1 hour of waiting, prices for the initial time interval and the price for the initial distance. The tariff can be changed automatically or manually. Other parameters such as increment value, taximeter constant, taximeter serial number and tariff number are common for all tariffs.

For the operation of a taximeter on vehicles that show the speed and the traveled distance using a flexible cord, a pulse encoder is used that generates 4 pulses per rotation. The transmitter uses the Hall sensor to generate a pulse, and the power supply is direct. In the event that a taximeter is placed on a vehicle that shows the speed and the distance traveled by using the impulse from the vehicle, no special adapter is needed, but the connection is done directly through the appropriate connector.

The taximeter is operated with five pushbuttons:

- "1" or "Free" ("For Hire", "Vacant")
- "2" or "Occupied" ("Hired")
- "3" or "To pay" ("Stopped")
- "4" or "TAXI"
- "5" or "Test"

Using these push-buttons, the taximeter can be brought into three basic working positions: "Free", "Occupied" and "To pay" position. Additionally, there are positions "Test" and "System" which are used for inspection, programming, etc...

In each operating position active pushbuttons are illuminated. Pushbuttons without attached function will have backlights off

The displays were assembled with seven-segment red LED indicators, 10mm height:

- 6-digit display for the driving price
- 1 digit display for the tariff and
- 4-digit display for the supplementary charge.

The brightness of the display can be adjusted in several levels, using push-buttons.

The control and display units have multiple roles during operation and depending on the selected operating mode of the taximeter.

During power-up or after system reset, display test will be executed.

Taximeters can be supplied with additional devices (printer, GPRS, GPS) operating at TTL logic level. Also, as an option taximeter can be equipped with Bluetooth module, that enables wireless connection to different additional devices.

The taximeter is without the main power switch and power supply is constantly connected. During operation in a vehicle supply voltage is constantly present. In situation when there is a loss of power (intentionally or accidentally), the meter is equipped with gold-cap capacitor which will enable 30sec of operation without main supply. During this period device will operate normally in all operating modes, with brightness automatically set to minimum. If the power is restored during this period, device will continue with normal operation. Loss of power and restore of power are logged in the Event log. If the main power is disconnected for more than 30sec, device will switch to idle. After the power is restored, device will reset. If the power loss happened in "**Occupied**" position, current fare is canceled.

If operator wants to conserve the energy from the vehicle battery, it is possible to place the meter to "**Idle**" mode. From the operating position "**System**", pressing the push button "**5**" will switch off the display and place the microcontroller to low power mode. Push button "**4**" is illuminated with minimal brightness. Pressing the pushbutton "**4**" will reset the device and resume normal operation in position "**Free**".

Taximeter automatically manages the TAXI sign on the vehicle's roof through a relay located in installation box.

Automatic change of tariff

Using the programming software, it is possible to set preprogrammed conditions for automatic change of tariff during operation of the device. The taximeter has been configured with **LO-TARIFF** (for example, tariff 1) and **HI-TARIFF** (for example, tariff 2). Following conditions have been implemented:

- Auto Tariff change based on special date

Technician can select up to four dates (holydays, anniversaries, special dates ...) at which corresponding tariff will be applied for the whole day. Technician has to input date of the month (1..31), month (1..12) and a year (last two digits) at which the tariff will be valid. Date can be recurrent (each year) if value for the year is "**99**". Also, if the value for tariff is "**0**", corresponding date will not be compared with current values for time and date.

This option can be chosen together with other auto tariff options and has priority over other options.

- Auto tariff change based on week day or time of day.

Technician can select a day (or days) in a week and hours in a day during which taximeter will automatically select high tariff (if item was selected) or low tariff (if item was unselected).

If current week day was selected for auto-tariff, preset high tariff will be active. If current week day was not selected, then software will examine if the current hour in a day was selected for automatic high tariff. If current hour was not selected for auto tariff, then preset low tariff will be automatically selected.

This option is valid in operating positions "**Free**" and "**Occupied**".

Selected tariff will remain for the duration of the travel, unless option "**Manual tariff in DRIVE**" was selected, which enables manual selection of tariff in position "**Occupied**".

Next condition for automatic selection of tariff will be triggered when weekday or hour in a day changes.

- Auto tariff change based on travelled distance.

Technician can select travelled distance in meters. When selected distance has been travelled, taximeter will automatically select HI-TARIFF. Selected tariff will remain for the duration of the travel, unless option "**Manual tariff in DRIVE**" was selected, which enables manual selection of tariff in position "**Occupied**".

- Auto tariff change based on duration of travel.

Technician can select duration of the travel in minutes, after which HI-TARIFF will be automatically selected. Selected tariff will remain for the duration of the travel, unless option "**Manual tariff in DRIVE**" was selected, which enables manual selection of tariff in position "**Occupied**".

Influence of option "Manual tariff in DRIVE" on automatic selection of tariff and taximeter functionality

Depending on selected options, following modes of operations are possible:

1. Auto-tariff is **not selected**, manual selection of tariff in “**Occupied**” is **not selected**
Operator can select tariff in mode “**Free**” before the fare has been started. After the fare is started, selected tariff will remain for the duration of the fare, without the possibility to change the tariff.
2. Auto-tariff is **not selected**, manual selection of tariff in “**Occupied**” is **selected**
Operator can select tariff in mode “**Free**” before the fare has been started. After the fare is started, selected tariff will remain for the duration of the fare, unless the tariff is manually changed by the operator. When the fare is finished, mode “**Free**” will be entered with tariff which was selected before the start of the fare.
3. Auto-tariff is **selected**, manual selection of tariff in “**Occupied**” is **not selected**
 - a) If auto-tariff option “Weekday/hour of a day” was selected, on each change of a weekday and/or hour, conditions for automatic selection of low/high tariff will be examined in mode “**Free**”. Before the start of the fare, operator can manually override automatic tariff selection. Manually selected tariff will remain active for the period of 60sec, after which auto-tariff condition will be applied.
If the fare is started before the 60sec period elapses, manually selected tariff will be used for the duration of the fare and auto-tariff function will be canceled. Any further change of tariff, manual or automatic **is not possible**.
If the fare is started after the 60sec period elapses and/or with auto-selected tariff, the auto-tariff function will be active during the started fare and can automatically select low or high tariff during the fare. Manual change of tariff **is not possible**.
After the fare is finished, before entering the mode “**Free**”, auto-tariff conditions will be verified and applied as necessary.
 - b) If auto tariff modes based on travelled distance or duration of travel were selected, fare is started with manually selected tariff. When auto-tariff conditions are fulfilled, high tariff will be selected for the remaining of the fare. Manual change of tariff **is not possible**. After the fare is finished, mode “**Free**” will be entered with last tariff selected before the fare was started.
4. Auto-tariff is **selected**, manual selection of tariff in “**Occupied**” is **selected**
 - a) If auto-tariff option “Weekday/hour of a day” was selected, on each change of a weekday and/or hour, conditions for automatic selection of low/high tariff will be examined in mode “**Free**”. Before the start of the fare, operator can manually override automatic tariff selection. Manually selected tariff will remain active for the period of 60sec, after which auto-tariff condition will be applied.
If the fare is started before the 60sec period elapses, manually selected tariff will be used for the duration of the fare and auto-tariff function will be canceled. Manual change of tariff is possible during the started fare, automatic change of tariff is not active.
If the fare is started after the 60sec period elapses and/or with auto-selected tariff, the auto-tariff function will be active during the started fare and can automatically select low or high tariff during the fare. Manual change of tariff is also possible. On each change of hour or weekday, automatic tariff selection is examined and can override manual tariff selection.
After the fare is finished, before entering the mode “**Free**”, auto-tariff conditions will be verified and applied as necessary.
 - b) If auto tariff modes based on travelled distance or duration of travel were selected, fare is started with manually selected tariff. When auto-tariff conditions are fulfilled, high tariff will be selected for the remaining of the fare. Manual change of tariff is possible. After the fare is finished, mode “**Free**” will be entered with last tariff selected before the fare was started.

S/D (single/double) tariff mode

Each tariff can be selected as single or double tariff mode.

Single tariff mode is fare calculation based on application of the time tariff below the cross-over speed and application of the distance tariff above the cross-over speed (fare is calculated from time-counting below the cross-over speed and from distance-counting above the cross-over speed in accordance with the selected tariff).

Double tariff mode is fare calculation based on the combined application of time tariff and distance tariff over the whole journey (the fare is calculated from combined time-counting and distance-counting in accordance with the selected tariff).

EEprom, Flash and Firmware memories

The EEprom (electrically erasable and programmable ROM) memory holds parameters important for fare calculation, such as:

- taximeter constant,
- value of increment,
- value of discount,
- VAT rate,
- parameters for automatic change of tariff,
- number of tariffs,
- tariff parameters: start price, price per km, price per hour, additional charge, protected length, protected time),
- etc...

Only service technician during commissioning has the possibility to change values in this memory. Second part of EEPROM contains values which are calculated during operation of the taximeter in **"Free"** and **"Occupied"** positions:

- total counters,
- trip counters,
- values calculated in **"Occupied"** position which are used for recipe printout

These memory locations were programmed during commissioning and remain unchanged during normal operation of taximeter.

Firmware memory of microcontroller stores main application software of the taximeter.

Second part of internal Flash memory contains all texts that appear on various printouts:

- text lines for fare recipe,
- text lines for total and trip counters,
- user header text which appear at the beginning of the recipe,
- "promo" text which can be added (optionally) at the end of recipe.

External FRAM memory holds event log table.

Real time clock

Built-in real time clock will correctly display current time and date, day of a week and will store the indicator if DST "Daylight Saving Time" is active or not. Also, if option **"Calculate DST"** was selected, it will make corrections for CET or CEST calculation of time:

- at last Sunday in March, clock are turned from 02:00:00 to 03:00:00 and DST is started
- at last Sunday in October, clock are turned from 03:00:00 to 02:00:00 and DST is ended

During setting of the configuration, technician should take care to correctly set time, date, day of the week and especially DST marker. It is recommended to use current time and date loaded from the PC.

Bluetooth module

Taximeter is equipped with Bluetooth module that provides transfer of data to external devices (Bluetooth printer, mobile phone, tablet, gps device, etc...). Data transfer is unidirectional, from the taximeter to connected devices. Transferred data are used for recipe printout, data processing on server of a taxi company, etc...

3. OPERATING POSITIONS

3.1. Position "Free"

Push-buttons have following functions:

- **"1"** will start print-out of the last recorded receipt
- **"2"** will switch operating position to **"Occupied"**
- **"3"** will select other programmed tariffs. Each press of the pushbutton will increase the tariff number to the highest programmed tariff and then returns to the first tariff
- **"4"** will toggle Taxi sign on the roof of the vehicle on and off. Button will flash to indicate that TAXI sign was switched off manually.
- **"5"** will switch operating position to **"Test"**. Longer press (>5sec) of the pushbutton will activate operating position **"System"**. **"Test"** and **"System"** can be accessed only from position **"Free"**, when the vehicle is stationary.

On the tariff display current tariff is shown. With selected tariff all fare calculation will be carried out. The label **"Free"** is illuminated. The current time is displayed in the field for driving price and the current date is displayed in the field for additional charge. The vehicle movement indicator is off, and the TAXI sign indicator is on.

As the vehicle moves, the taximeter measures and stores the total distance traveled.

3.2. Position **"Occupied"** – driving

Push-buttons have following functions:

- "1" will change the tariff to the lower number
- "2" will change the tariff to the higher number
- "3" will change operating positions to **"Paid"**
- "4" doesn't have function
- "5" doesn't have function

"Occupied" position can be reached from the **"Free"** position or from the **"To Pay"** position by pressing the **"Occupied"** push-button.

The "Tariff" label and "Driving cost" label are illuminated and the LED "Busy" is on. The indicator "TAXI" is OFF.

At the beginning of the fare, in the driving cost field, the starting price (start value) is displayed. This value is then increased in equal steps by the charging rate for the route traveled if the vehicle moves at a speed higher than the minimum speed, or by the charging rate for the waiting time if the vehicle is moving at a speed less than the minimum speed.

When the vehicle is moving / standing, the vehicle wait indicator is off or on. The indicator is on when the vehicle is standing or moving at a speed less than the minimum speed.

The tariff field shows the tariff for which the calculation is made

During the operation in this position, the taximeter records:

- total kilometers traveled
- total kilometers traveled in the position occupied
- price of the fare
- tariff
- time when the fare was started
- time when the fare ended

3.3. Position **"To Pay"**

Push-buttons have following functions:

- "1" will start the printout of the receipt for the fare (if this option is programmed) and the device switches operating position to **"Free"**
- "2" will switch operating position back to **"Occupied"** with last memorized values as starting values and the fare will resume
- "3" doesn't have function.
- "4" will add supplementary charge (if programmed) to the driving price. Button will flash to indicate that function is active.
- "5" will calculate Bonus for the driving price, if programmed in the current tariff. Button will flash to indicate that function is active.

In this position of the taximeter, in the field for the tariff the last tariff with which the calculation was made remains. The "Payment" indicator is on, and the "TAXI sign" indicator is off.

In the driving cost field, the basic driving cost is displayed, calculated with tariff parameters.

In this mode, supplementary charge and/or bonus calculation can be entered if these tariff parameters are programmed.

If the vehicle continues to move, after 100m the taximeter will automatically return to the "Occupied" position.

3.4. Position **"Test"**

For test selection the push-buttons have following functions:

- "1" will exit **"Test"** and will return to operating position **"Free"**.
- "2" will manually start the test display procedure
- "3" decrease display brightness
- "4" increase display brightness
- "5" will start viewing of parameters

The taximeter has possibility to display the programmed parameters which are used for metering function of the taximeter (device constant, tariff, etc...). The display of programmed values and

reports is done in the "Test" position on the driving price display and can also be printed on the printer.

The "Test" position can only be entered from the "Free" position, and only when the vehicle is not moving, by pressing the push-button "5". In this position, internal clock can be adjusted and all the programmed parameters of the taximeter can be viewed and printed.

Upon entering "Test" position text "Select test" will be displayed.

3.4.1. Parameters view

Push-buttons have following functions:

- "1" will return to operating position "Free"
- "2" doesn't have function
- "3" will make a print-out of the values for the selected submenu
- "4" will increment parameter number
- "5" will loop through submenus of parameters view

In the "PA" (parameters) submenu the operator can view a list of general parameters and tariff parameters:

- PA.00 - serial number of taximeter
- PA.01 - constant "K" in imp/km
- PA.02 - number of programmed tariffs
- PA.03 - number of decimal places for the driving cost (upper display)
- PA.04 - number of decimal places for the supplementary charge (lower display)
- PA.05 - (free slot)
- PA.06 - price increment value (driving price step) in CU
- PA.07 - (free slot)
- PA.08 - bonus / discount (in %) which could be given to the customer on special occasions
- PA.09 - VAT in %
- PA.0A - (free slot)
- PA.0B - (free slot)
- PA.0C - (free slot)
- PA.0D - (free slot)
- PA.0E - (free slot)
- PA.0F - (free slot)

Next, list will advance through tariff values (where x stands for tariff number):

- PA.x0 - initial fee in CU
- PA.x1 - cost per kilometer (distance mode) in CU/km
- PA.x2 - price for waiting time (time mode) in CU/h
- PA.x3 - supplementary charge increment in CU
- PA.x4 - initial distance in meters
- PA.x5 - initial time in minutes
- PA.x6 - single or double tariff mode

In the "TT" (total) submenu, the following total values (which can't be erased) are displayed:

- TT.00 - start of record: date
- TT.01 - start of record: time
- TT.02 - total fare price
- TT.03 - total kilometers driven
- TT.04 - total number of km in the "occupied" position
- TT.05 - total number of fares
- TT.06 - total number of fare increments
- TT.07 - total amount of supplementary charges

In the "TP" (trip) submenu, the following total values of the taximeter are displayed for a certain period of time, which can be erased:

- TP.00 - start of the record: date
- TP.01 - start of the record: time
- TP.02 - trip total fare price
- TP.03 - trip total kilometers driven
- TP.04 - trip total number of km in the "occupied" position
- TP.05 - trip total number of fares
- TP.06 - trip total number of fare increments

- TP.07 – trip total amount of supplementary charges
Pressing push-button “2” will erase trip data.

In the “**Checksum**” submenu service technician can verify checksums for different memory areas and settings of the device:

- CS E - checksum for EEprom memory
- CSF1 - checksum for external Flash memory (constant values)
- CSF2 - checksum for external Flash memory (changeable values)
- CS P - checksum for program (firmware) memory

In the “**Event log**” submenu device will display total number of recorded Events. Pressing push-button “2” while test connector board is connected will erase event log. Pressing push-button “3” will make a printout of the log table. During operation, taximeter will make log of following events, with time/date mark:

- Fare started
- Fare ended
- Programming activated
- Measure mode activated
- Power supply lost
- Entered “Idle” position
- Reset
- Tariff changed
- Undefined (if undocumented event happened)

3.5. Position “System”

In operating position “**Test**” the operator can only view important parameters primarily related to taximeter settings. In operating position “**System**” service technician has the possibility for some important adjustments of the device. Operating position “**System**” can be activated only from position “**Free**” by long-press (>5sec) of button “5”.

Push-buttons have following functions:

- “1” will exit “**System**” and will return to operating position “**Free**”.
- “2” will start the function “**Measurement**”
- “3” will activate “**Programming**” mode
- “4” will activate “**Clock calibration**” mode
- “5” will put the device to “**Idle**” mode (switch-off)

Operating positions “**Measurement**”, “**Programming**” and “**Clock calibration**” can be accessed only by service personal and only if the test connector board has been connected.

3.5.1. Position “Measurement”

This position enables the service technician to measure constant of the vehicle. Constant is measured as number of pulses received while driving along certain length of road (for example 1km). It is expressed as imp/km (number of pulses per 1km). Obtained value is programmed (with other parameters) using the programming software.

Push-buttons have following functions:

- “1” will exit “**Measurement**” and will return to operating position “**Free**”.
- “2” doesn’t have function
- “3” doesn’t have function
- “4” clears measurement counters
- “5” pause/resume the measurement

In this position service technician only measures vehicle constant. It is not possible to change previously programmed value directly from this operating position.

3.5.2. Position “Programming”

In this position the technician can load the device with data necessary for proper operation: tariffs, texts for recipe printout, totals printout, clock setting...

Common taximeter parameters and tariff values are stored in devices EEprom Memory.

All texts, labels, etc... which are specific for a taxi company and which appears on recipe printout, parameters printout, total and trip printout which are also programmed using PC software are stored in Flash (FRAM) memory. During normal operation, this set of values remains unchanged (constant).

Also, during regular operation all calculated fare values, total and trip values are stored in Flash memory. These values change during driving (with and without customer).

This position can be exited either by downloading main taximeter parameters or by pressing reset button on test connector board.

Further instructions about using the programming software can be found in "Programming software manual".

3.5.3. Position "Clock calibration"

In this operating position, technician has the possibility to adjust the clock-period of the internal real-time clock and to compensate for inaccuracies of used quartz crystal. Under ideal conditions, frequency of quartz crystal for real-time clocks should be exactly 32768Hz. This frequency would produce exact clock period of 1Hz. Due to different characteristics of the crystals, clock period could be slightly longer or shorter than 1Hz. As a result, our clock could be late or running ahead of actual time. To adjust the clock period as close to 1Hz as possible, built-in real-time controller has calibration procedure which is used to trim the clock.

This is realized by writing digital value -256 to +256 to calibration register of real-time clock. 1Hz clock period of the real-time controller is created by counting 32768 pulses of external quartz crystal. Each digit written in calibration register will add (or subtract) 2 clock pulses to standard 32768 pulses, effectively making 1Hz period longer or shorter by 61µsec per digit.

In this operating position, push-buttons have following functions:

- "1" will exit "**System**" and will return to operating position "**Free**".
- "2" will decrease calibration value by 10
- "3" will decrease calibration value by 1
- "4" will increase calibration value by 1
- "5" will increase calibration value by 10

After two seconds of inactivity, adjusted calibration value will be written to calibration register of real-time clock. New value is effective immediately. Writing digital value 0 means no calibration. Value is stored in static RAM of real-time clock. If real-time controller or backup battery is replaced, calibration value will be lost and reset to 0.

Actual period of 1Hz real-time clock signal could be monitored on test connector board, using output T1-OUT. With precise measuring device, 1sec period can be monitored and adjusted in "Clock calibration" position.

4. BLOCK DIAGRAM OF THE TAXIMETER

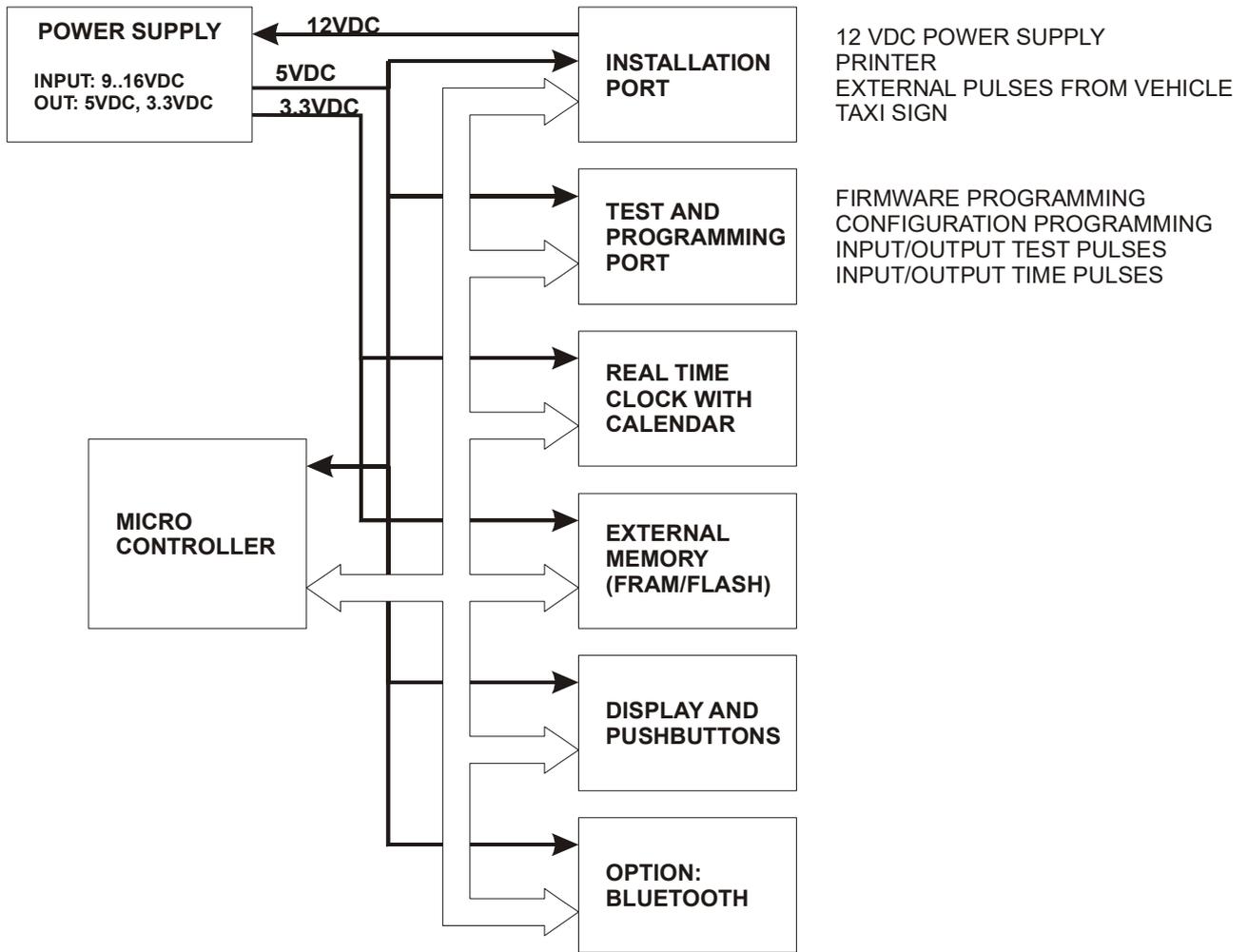


Figure 1: Block diagram of the taximeter

5. APPEARANCE OF THE TAXIMETER

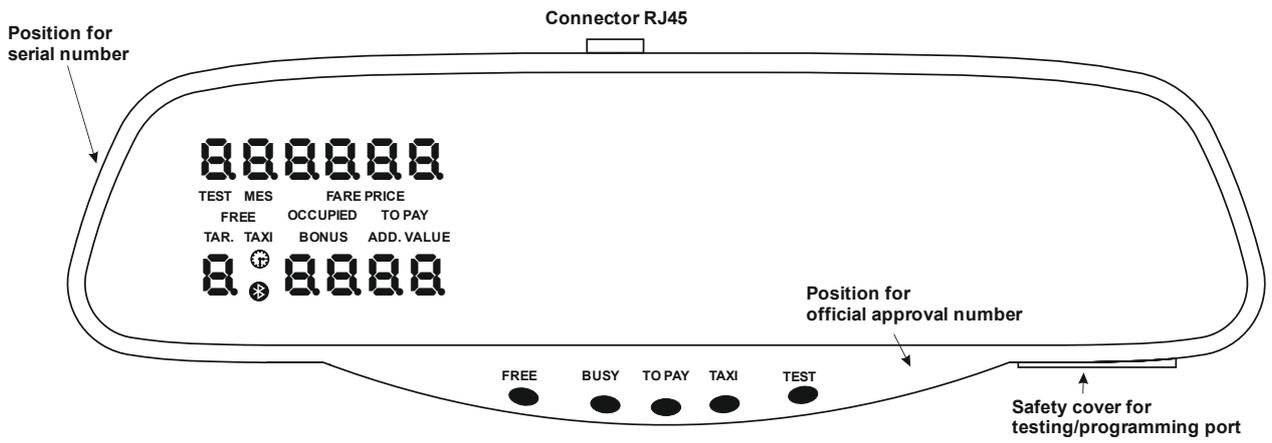


Figure 2: Taximeter front side



Figure 3: Taximeter front side

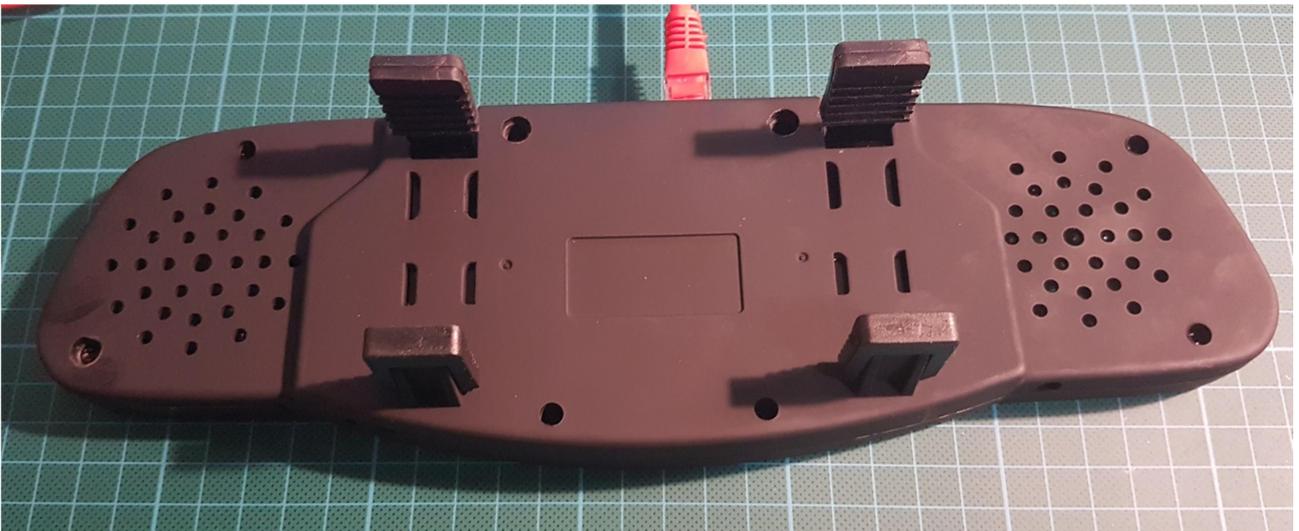


Figure 4: Taximeter back side



Figure 5: Test/programming port cover



Figure 6: Securing access to test/programming port

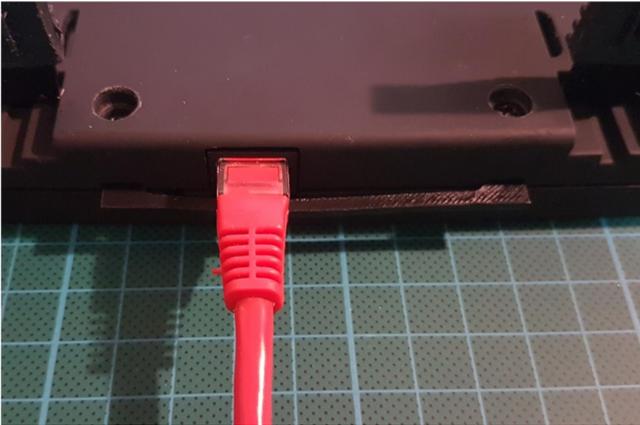


Figure 7: Main cable connection - power supply, pulse signal, printer

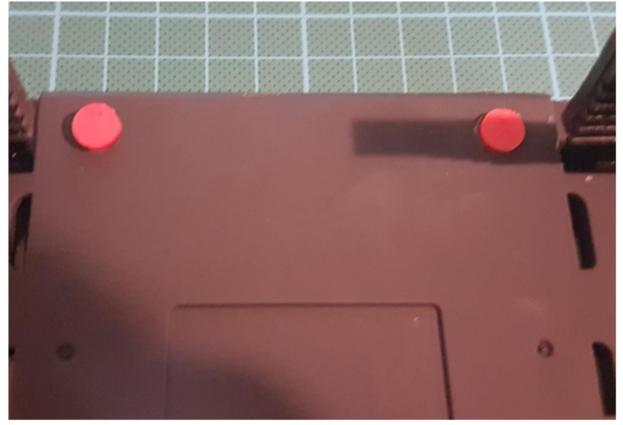


Figure 8: Securing main cable connection

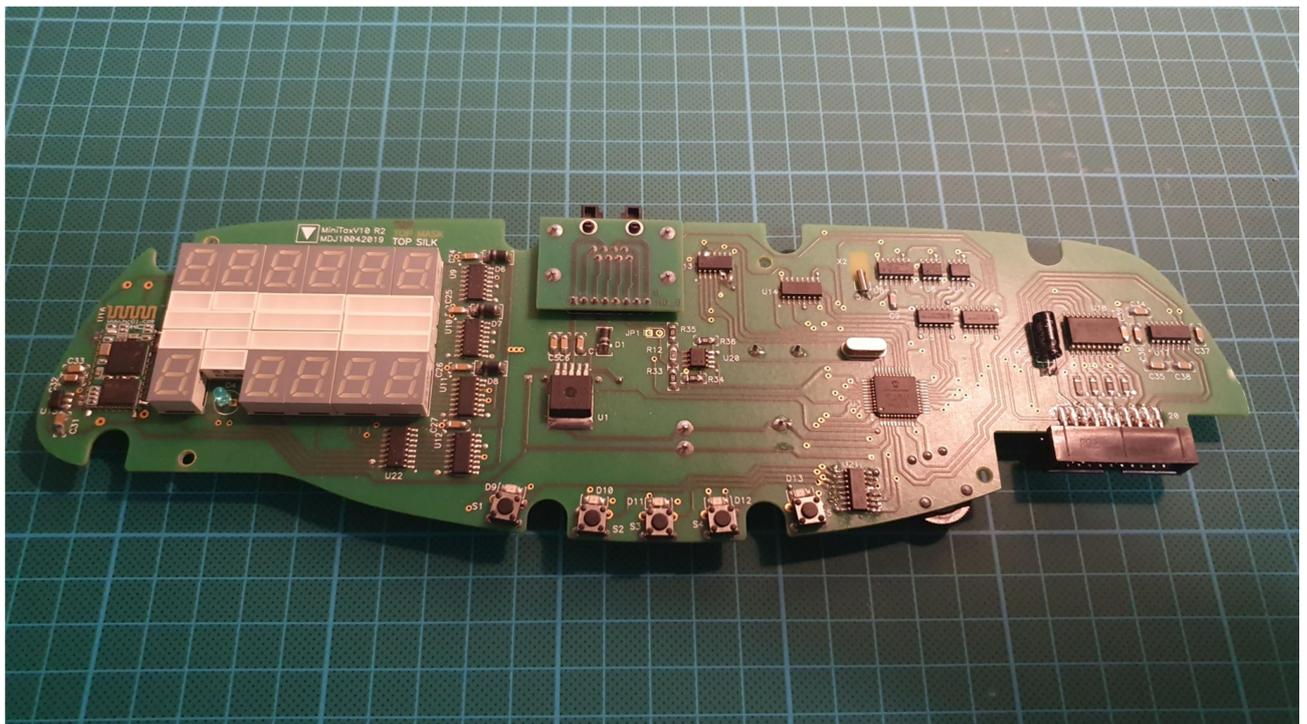


Figure 9: Circuit board - top side

5.1. Test connector board

Test connector board will enable several functions to the service technician:

- Entering operating position “**Measurement**”
- Entering operating position “**Programming**”
- Programming of the device firmware
- Connections for the verification authority, according to OIML R 21:

Inputs:

- o Distance pulses at a rate equivalent to a speed of up to 200 km/h
- o Time pulses at a rate equivalent of up to 10 times real time
- o Signal to block internal time counting

Outputs:

- o Distance pulses
- o Time pulses
- o A signal to indicate fare increments

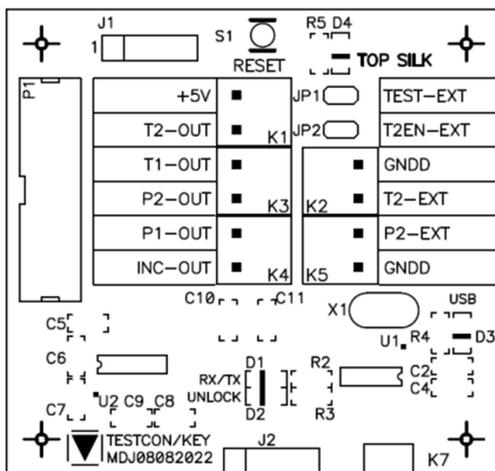


Figure 10a: Test connector board

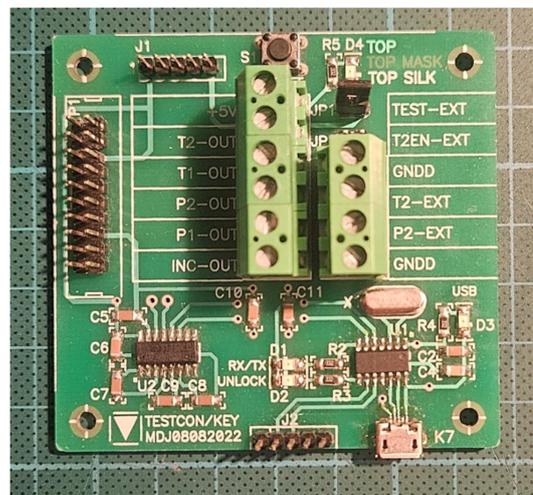


Figure 11: Test connector board

P1	connection to the taximeter	T2-OUT	external time pulses feedback
J1, J2	firmware programming port	T1-OUT	internal time pulses feedback
K7	USB connector, access with PC software for configuring the taximeter	P2-OUT	external distance pulses feedback
S1	system reset button	P1-OUT	internal distance pulses feedback
+5V, GNDD	system power supply	INC-OUT	signal to indicate fare increment (jump)
		TEST-EXT	test connector board is connected to system
		T2EN-EXT	disable internal, enable external time pulses
		T2-EXT	external time pulses
		P2-EXT	external distance pulses

TEST-EXT, T2-EXT, T2EN-EXT, P2-EXT inputs are active low. Nominal 0..5VDC, max 0..12VDC. TEST-EXT is sense input signal for the taximeter (test board is present). Provided jumper must be in position.

T2-EXT input for external time pulses, 1imp = 1sec.

T2EN-EXT input will disable calculation with internal time pulses and enable calculation with external time pulses. Provided jumper must be in position.

P2-EXT input for external distance pulses during testing. First external impulse will switch distance calculation to external pulses. First internal impulse (from transducer in the vehicle, connected to installation box) will change to calculation with pulses received on installation port.

T1-OUT, T2-OUT, P1-OUT, P2-OUT, INC-OUT are output signals with CMOS levels relative to GNDD.

T1-OUT feedback of internal time pulses, 1imp = 1sec, nominally 1Hz

T2-OUT feedback of external time pulses, 1imp = 1sec, up to 100Hz

INC-OUT for each jump in fare price, pulse of 1ms is created.

P1-OUT feedback signal for distance pulses received via installation box (from the vehicle)

P2-OUT feedback signal for distance pulses received via test connector board (from the testing equipment)

Distance pulses:	
- low/high transition:	~3.11 V
- high/low transition:	~1.27 V
- maximum input frequency:	~2200 Hz
Time pulses	
- low/high transition:	~3.11 V
- high/low transition:	~1.27 V
- minimum input frequency:	1 Hz
- maximum input frequency:	100 Hz

Figure 12: Input signals voltage levels

Distance pulses:	
- low/high transition:	~4.4 V
- high/low transition:	~0.26 V
Time pulses	
- low/high transition:	~4.4 V
- high/low transition:	~0.26 V
- internal clock frequency:	1 Hz
Fare increment signal	
- low/high transition:	~4.4 V
- high/low transition:	~0.26 V

Figure 13: Output signals voltage levels

Connection between Test board and Taximeter is via 2x10 pin flat cables. To access test port of the taximeter, service technician must remove the seal and the safety cover. Connecting flat cable has IDC 2x10 connectors on both ends. IDC connector has polarizing rib. Both taximeter and connector board have 2x10 box headers with polarizing slot, thus ensuring that cable connectors can be correctly inserted.

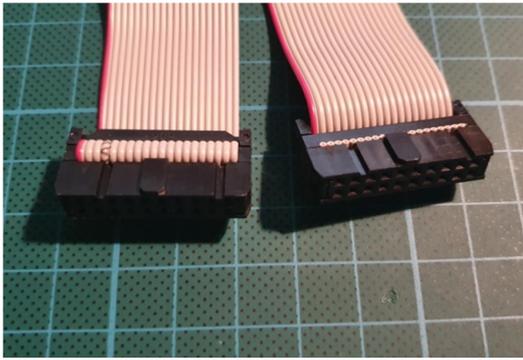


Figure 14: 2x10 IDC connector

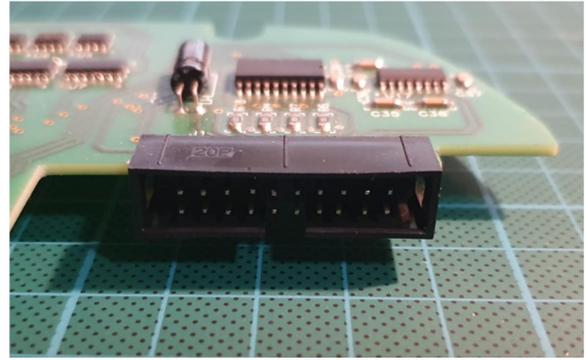


Figure 15: 2x10 Box Header (MiniTax)

5.2. Installation box

Installation box is used to connect distance measurement device (transducer), fare invoice printer, vehicle battery power supply and TAXI sign to the taximeter. It is also containing safety fuses for powering printer (3A), taxi sign (5A) and taximeter (1A) and power relay for switching of the TAXI sign. Installation box is connected to the taximeter with one cable with RJ45 connector. Cable is protected with safety seal on both ends.

Power supply cable is connected to constant +12VDC (or +24VDC) vehicle supply (to battery).

Printer port is used for connection of fare invoice printer. This port also provides power supply for the printer. Communication to printer is RS232 with TTL voltage levels, with dedicated pin-out. Therefore the port can't be used for connection of other devices with standard RS232 port. Port is unidirectional: from taximeter to printer, using TX pin. RX pin is used only to detect when printer is connected (pull-down, no communication of any kind).

Taximeter port with RJ45 connector is used to provide power supply, distance pulses and communication to printer for the taximeter device.

Pin-out:

- 1- TX
- 2- +12VDC (+24VDC) power supply
- 3- GND
- 4- FIRM, activation of output relay for TAXI sign
- 5- (not used)
- 6- RX
- 7- (not used)
- 8- Distance pulses

Distance pulses connector is used to connect the taximeter to the source of pulses used for calculation.



- GND
- Pulse input
- +12VDC

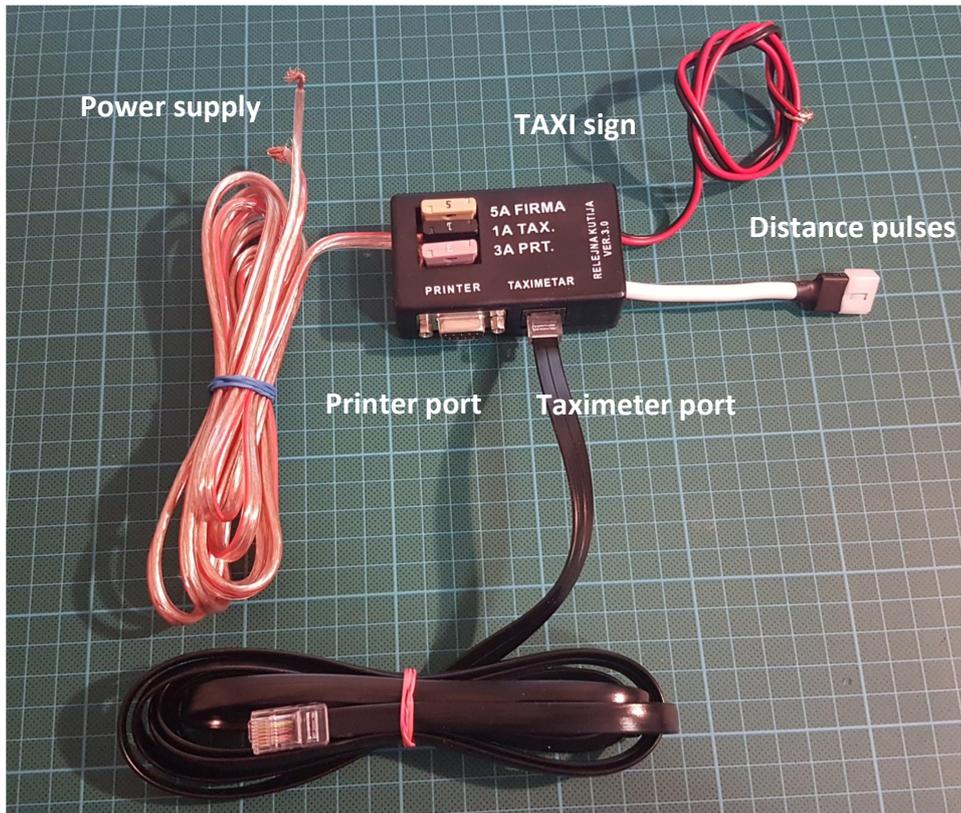


Figure 16: Installation box with cables

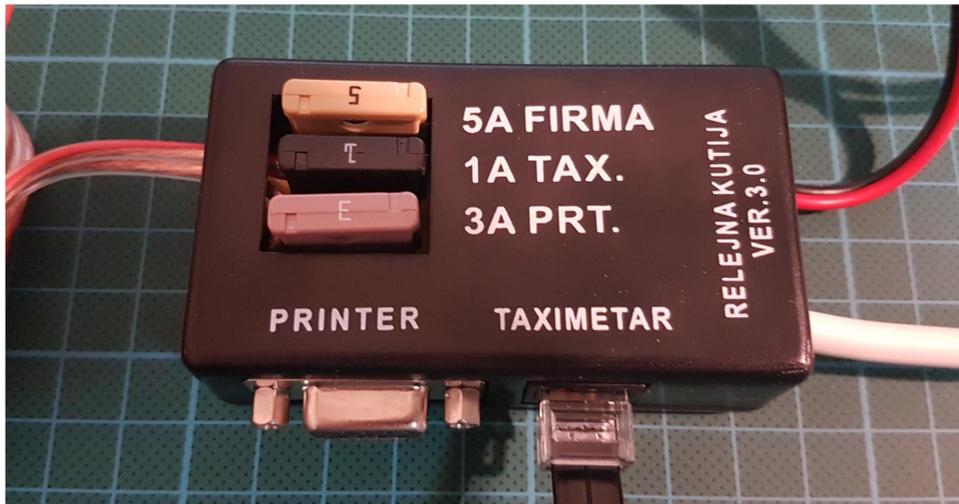


Figure 17: Installation box with safety fuses

Labels and markings:

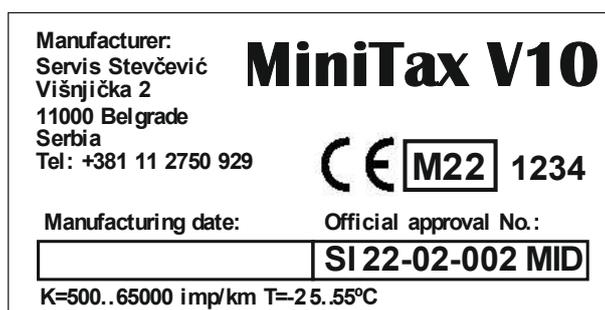


Figure 18: Example of a sticker

- | | |
|-----------------------------------|--------------------------|
| - manufacturer's mark and name: | Stevčević Servis |
| - type of meter: | MiniTax V10 |
| - serial number of the taximeter: | SN: 000001 (example) |
| - official approval number: | SI 22-02-002 MID |
| - the value of the constant: | K = (500 - 65000) imp/km |
| - operational temperature range: | T= - 25°C to 55 °C |
| - date of production: | xx.xx.xx |



Figure 19: Display mask - Serbian

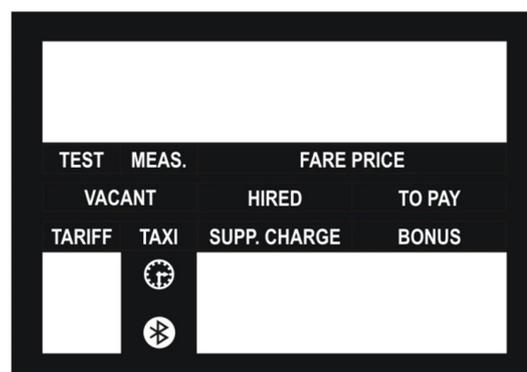


Figure 20: Display mask - English

APPENDIX A - Data Transfer

Bluetooth module

All values that are usually printed on the mechanical printer can be also sent to other devices connected via the Bluetooth module (mobile phone, tablet,...). A shortened format for printing information is used (compared to a printer). The format for sending data is defined by the requirements of the software used by a particular taxi company.

The message is sent in ASCII format.

Each message starts with a specific prefix, contains data separated by ';', and ends with CR-LF (carriage return, line feed) control characters.

Several types of messages are used, which differ in prefix. Also, different prefixes are used depending on whether the taxi company uses the Serbian or English version of the software (hereinafter referred to as [SRP/ENG]):

S;X [CRLF]	Sent every 10 seconds in "Free" mode, X is the tariff number
F;1 [CRLF] F;0 [CRLF]	Company sign on/off
T [CRLF]	Printed in the configured data review mode, each time a new data type is selected for review
Z;X;CV [CRLF]	In "Busy" mode, the message is sent every 10 seconds, where X is the tariff number, and CV is the fare price
P;X;CV [CRLF]	In "Payment" mode, the current value of the fare is sent, where X is the tariff number, and CV is the fare price
R	Sending invoice for the completed trip
U	Sending total counter
D	Sending trip counter

When sending an invoice for the completed trip (message with prefix R), the following data is sent, necessary for creating the invoice:

- Number invoice
- Number of kilometers traveled during the trip, with a resolution of 0.1 km
- Price of the trip, with a resolution of 0.01 CU
- Surcharge, with a resolution of 0.01 CU
- Price of the trip with the surcharge included, with a resolution of 0.01 CU
- Bonus if any, with a resolution of 0.01 CU
- Final value for payment, with a resolution of 0.01 CU

R;1;10,5;785,00;0,00;0,00;0,00;785,00 [CRLF] - example message

When sending the total and trip counter (prefixes U and D), the following data is sent:

- Total charged, with a resolution of 0.01 CU
- Total km traveled since the moment of installation of the taximeter, with a resolution of 0.1 km
- Total km traveled in the "Busy" mode, with a resolution of 0.1 km
- Total number of fares

U;175324,00;22354,3;20034,1;353 [CRLF] - example message

Fiscal cash register

If the taximeter is connected to the fiscal cash register, the data is packaged and transmitted in a format that suits the specific device, in accordance with local regulations (time, date, serial number, driving results, etc.) The fiscal cash register can be connected via a standard RS232 port or via a Bluetooth module. The connection parameters depend on the connected device.

Verification of sent data

Depending on the protocol on the receiving side (i.e. the requirements of the connected device or program), a checksum is used to check the correctness of the sent data, and the device reports whether the data is correct or not. The checksum is calculated using the CRC16 algorithm (cyclic redundancy check). CRC is used to detect random changes in digital data, as a result of interference or noise during data transmission. Basically, a block of data that is being sent is accompanied by a short checksum that is the result of a certain calculation on the data to be sent. The receiving device performs the same calculation on the received data and compares the result with the received checksum. If the result does not match the checksum, the receiving device takes some corrective action (the most common and simplest is to request a retransmission of the data). If the reception is correct, the device may or may not send an acknowledgement.

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