

Wireless self-service terminal "Signal" for petrol stations



TECHNICAL GUIDE

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CONTENT

REVISION HISTORY	3
PURPOSE OF THE DOCUMENT	4
LIST OF TERMS AND ABBREVIATIONS USED IN TEXT	5
APPOINTMENT	6
TECHNICAL SPECIFICATIONS	7
Main technical characteristics of terminal "Signal-1"	7
Main technical characteristics of terminal "Signal-1"	8
STRUCTURE AND OPERATION	9
Construction of terminal "Signal-1"	9
Input-output means of terminal "Signal-1"	9
Indication elements of terminal "Signal-1"	10
Provision of terminal "Signal-1" intrinsic safety	10
Means of indication and control over RH-hub "Signal-K"	11

REVISION HISTORY

REV	DATE	BY	SECTION	DESCRIPTION
1.01	2013.01.11	EV	All	First release

PURPOSE OF THE DOCUMENT

This Technical Guide is intended for studying of wireless self-service terminal "Signal" for petrol stations. It contains basic information regarding the "Signal" terminal and RF-Hub devices, their principles of operation, structure, configuration and adjustments, maintenance by service personnel, connection to NaftaPOS software. Admission to work with device is allowed only to qualified specialists, who have read and understood current Technical Guide.

Due to a reason that terminal "Signal" is constantly being developed in direction of improvements of its possibilities, changes are possible in its final version, which are not described in given Technical Guide.

During the system development process given Technical Guide will be also expanded and updated and new chapters will be added. Latest version of this Technical Guide can be downloaded from the wireless self-service terminal "Signal" web-page: <http://technotrade.ua/signal-self-service-terminal.htm>.

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In case if you find any mistakes, omissions in this document or have any suggestions on improvements to this document, please feel free to e-mail them to our support mailbox: support_1a@technotrade.ua. We will be grateful to you for this valuable information.

All technical questions regarding the wireless self-service terminal "Signal" for petrol stations are welcome to be asked on support mailbox: support_1a@technotrade.ua. Our support team will be glad to help you.

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LIST OF TERMS AND ABBREVIATIONS USED IN TEXT

AES - Advanced Encryption Standard
EPROM - Erasable Programmable Read Only Memory
GOST - State Standardization System
LED - Light-Emitting Diode
LQI - Level Quality Indicator
NVRAM - Non-Volatile Random-Access Memory
PC - Personal Computer
POS - Point Of Sale
RFID - Radio Frequency Identification
SHA-1 - Secure Hash Algorithm 1
TFT - Thin-Film-Transistor
USB - Universal Serial Bus

APPOINTMENT

Terminal "Signal-1" – is self-service terminal intended for provision of self-service at petrol stations. It has wireless communication and is equipped with a built-in display, keyboard, RFID-reader and iButton-tags reader, which allows it to be used for following purposes:

- preset of order to be dispensed from fuel dispensers
- application of fuel cards (identification of customers, displaying of current card's balance and limits, operations with cards and accounts)
- identification of fuel attendants
- self-service at petrol station

Terminal "Signal-1" has explosion-proof case with 1ExibIIBT4 marking and can be mounted on fuel dispenser (pump). Terminal "Signal-1" works in a structure of NaftaPOS system of petrol stations and also can be integrated with NaftaCards fuel cards system. Terminal "Signal-1" communicates to NaftaPOS software through a radio-frequency hub "Signal-K".

The terminal gives the following advantages compared to "traditional" way of petrol station operation, equipped only with POS system:

- decreasing of time on customer service due to remote identification and automated processing of requests on fuel dispensing
- simplification of settlements between petrol station and corporate customers using fuel cards
- reinforcement of fuel consumption control by corporate customers, exclusion of misuse possibilities

One Terminal can be configured to service all fuel dispensers or any particular fuel dispenser (if installed on the fuel dispenser side). Sequence of customer servicing by Terminal (operation algorithm) can be further developed upon request.

Terminal "Signal-1" can have a unique address in range from 1 to 15, which can be set using a DIP-switch. "Signal-1" responses to requests, which sent only to its address. Data exchange between terminal "Signal-1" and RF- hub "Signal-K" is done using wireless interface in non-licensed frequency range on 868 MHz in accordance with standard IEEE Std 802.15.4™-2006. Power of separate transceiver is not more than 10 W, which in most cases allows to apply the terminal without necessity to get any licenses. Data from RF-hub "Signal-K" to any terminal "Signal-1" is transferred to distance up to 100 meters. Transferred data at transmission is protected from unauthorized access using AES-128 encryption-decryption method.

Besides petrol station the terminal "Signal-1" can be applied for provision of wireless identification of fuel attendants or corporate customers on other industrial, trade or transport sights.

TECHNICAL SPECIFICATIONS

Main technical characteristics of terminal "Signal-1"

Technical characteristics	
Nominal voltage of power supply for keyboard, RFID-reader and iButton driver, Volts	+5,0
Nominal voltage of terminal board power supply, Volts	+3,3
Allowed deviation of power supply from nominal, %	± 10
Presence of protection from reversal of input voltage	present
Presence of protection from input voltage exceeding	Present
Consumed power, not more than, W	2,5

Parameters of wireless interface	
Frequency, MHz	868
Modulation type	GFSK
Number of channel	0
Channel width, kHz	200
Deviation, kHz	19,6
Baud rate, baud/sec	38400
Radiated power level, dB	+10
Device address in network*	1 ... 15

* Notice! Address of device is set using a DIP-switch on the board of terminal "Signal-1"

Input electrical values of intrinsically safe circuits	
Open-circuit voltage of first channel, not more than, V	+3,9
Open-circuit voltage of second channel, not more than, V	+5,6
Current consumption of first and second channel, not more than, mA	500
Internal inductance, not more then, uH	50
Internal electrical capacity, not more then, uF	100

Characteristics of case	
Level of protection	IP60
Overall dimensions. mm	230 x 270 x 50
Weight, not more than, kg	3

Terms of application	
Environment temperature	from -20 till +60°C
Upper limit of relative humidity	95% at 35°C*
Atmospheric pressure	from 84 till 107 kPa (from 630 till 800 mm Hg)

* Notice! And more low temperatures without condensation

Main technical characteristics of RF-hub "Signal-K"

Technical characteristics	
Nominal voltage of power supply, Volts	+5,0
Allowed deviation of power supply from nominal, %	± 10
Consumed power, not more than, W	0,5

Parameters of communication with PC	
Baud rate, baud/sec	115200
Number of data bits	8
Number of stop bits	1
Parity control	no

Parameters of wireless interface	
Frequency, MHz	868
Modulation type	GFSK
Number of channel	0
Channel width, kHz	200
Deviation, kHz	19,6
Baud rate, baud/sec	38400
Radiated power level, dB	+10

Characteristics of case	
Level of protection	IP54
Overall dimensions. mm	110 x 56 x 25
Weight, not more than, kg	0,1

Terms of application	
Environment temperature	from +5 till +40°C
Upper limit of relative humidity	95% at 30°C*
Atmospheric pressure	from 84 till 107 kPa (from 630 till 800 mm Hg)

* Notice! And more low temperatures without condensation

STRUCTURE AND OPERATION

Construction of terminal "Signal-1"



Terminal "Signal-1" is performed in metal casing with vandal-proof execution. Due to square construction of casing it is possible to mount device to dispenser pumphead from any side using a bracket (16) with screw mounting, situated on side surface of casing chassis. Connection of power supply cable of terminal with voltages +3,3 V and +5 V is performed through a hermetic input situated on side of mounting bracket. Metal casing is painted in black color using powder painting technology. Coating ensures 100% protection from moisture, corrosion, exposure by sunlight and household chemicals. All metal parts have protective covering. Transmission and reception of data by terminal on wireless interface is performed using RF antenna (5) situated behind the glass (17) inside the shell of the terminal. Antenna is a piece of single core insulated wire with length of 8.6 cm. All means for indication, identification and user input are situated on the front panel of the terminal and protected by 5 mm thick glass (17).

Input-output means of terminal "Signal-1"

Output of text information is performed using a graphical display (1) with 4,3" diagonal size and resolution 480 x 272 pixels. Brightness and saturation of display provide well reading of display at direct sunlight.

Input of user data is performed using:

- capacitive touch keyboard (7) with the 16 buttons 16 (4 x 4)
- RFID-reader (11) of contactless cards
- contact iButton reader (12)

Touch input using keyboard is provided by touching the buttons fields with bare fingers of subscriber or through winter mittens with thickness not exceeding 5 mm.

RFID-reader module provides reliable reading and writing of contactless cards of ISO / IEC 14443A standard at distance of up to 5 cm. Currently supported cards are MIFARE 1K Classic, MIFARE 4K Classic, MIFARE Ultralight, MIFARE Plus (SL1). Maximum data transfer rate between the card and RFID-reader is up to 848 kbit/s in both directions. In future versions of the software support for cards DESFire, Mifare PLUS mode SL3, and Mifare UltralightC will be implemented. In addition to the above it is possible to read and write cards of ISO / IEC 14443V standard(mode 2 and 3), support for P2P mode in the passive mode of initiator in accordance with ISO / IEC18092, as well as support of the protocol according to ISO / IEC15693, EPC UID and ISO / IEC 18000-3, mode 3.

iButton reader is resistant to climatic influences and vandal actions because it is formed by two stainless steel contacts. iButton – is a family of microelectronic devices, developed by company Dallas Semiconductor, USA (currently manufactured by Maxim). Each iButton device is enclosed in a sealed steel cylindrical body and has a unique number (ID), recorded during manufacture.

POS-terminal "Signal 1" supports two types of electronic keys iButton:

- DS1961S - 1 KB secure EPROM and 512-bit SHA-1 processor.
- DS1963S - secure non-volatile RAM with integrated calculator of 160-bit keys using the algorithm SHA-1. RAM size - 4096 bits.

Data exchange with iButton is done via 1-Wire interface, which is also a proprietary development of Dallas Semiconductor. Information is transmitted on a single conductor, i.e. data bus is a single wire. iButton obtains power from the same conductor, by charging internal capacitor in the moments when there is no data exchange on the bus. Baud rate is sufficient for provision of data transfer at the moment of touching the contact device.

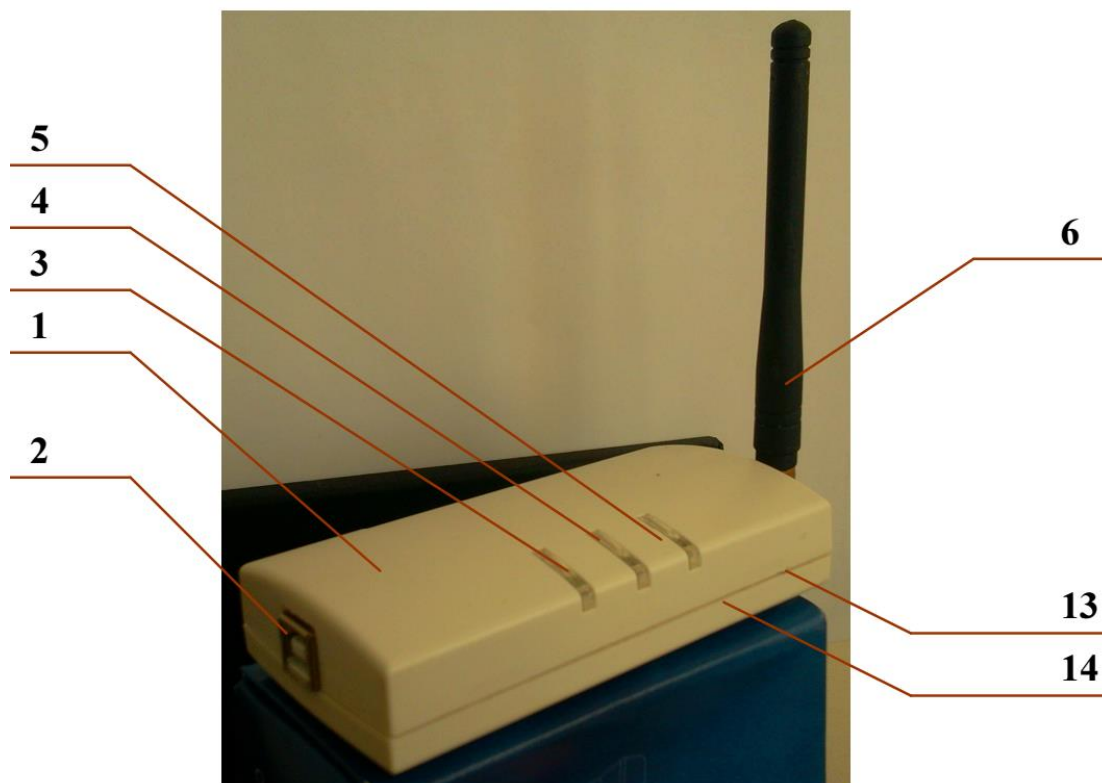
Indication elements of terminal "Signal-1"

- Two red LEDs "+ 5V" (9) and "+3,3 V" (10) indicate presence of power supply of terminal "Signal 1".
- Red LED "Status" (2) indicates mode of terminal operation. In operating mode this LED blinks once per 3 seconds ("heartbeat" is OK). In emergency mode this LED blinks with frequency of 100 Hz. Emergency mode occurs at following conditions: failure of one of the peripheral devices (graphic display, touch screen keyboard, RFID-reader or iButton driver) and/or short circuit in iButton reader (14). At corruption of microcontroller's flash-memory this LED constantly lights.
- Blue LED "Tx" (3) indicates data transfer from the POS-terminal to RF-hub wirelessly.
- Green LED "Rx" (4) indicates that the data reception from RF-hub wirelessly.
- LED backlit of graphic display (1), touch pad (7), RFID-reader (11) and iButton reader (14) is always turned on.
- Touching to capacitive button of keyboard (7) in active mode is followed by audio and light signaling (blue LED (6) in the upper right corner of the button).
- If RFID-reader is in active mode, reading of UID of contactless RFID-tags at bringing to RFID-reader (not far than 5 cm) is followed by a short beep and switching on the green LED (11) for 0.5 second.
- In active mode reading of ID by iButton reader at touching using a key to contact of iButton reader (14) is followed by activation of LED indicator (15) and a short beep. Operation on reading and writing is performed almost instantly at contact.

Provision of terminal "Signal-1" intrinsic safety

Intrinsic safety of input electrical circuits of "Signal-1" terminal is provided by limitation the internal equivalent inductance and capacitance of its electrical circuits to safe values and application of intrinsically safe power supply.

Construction of RH-hub "Signal-K"



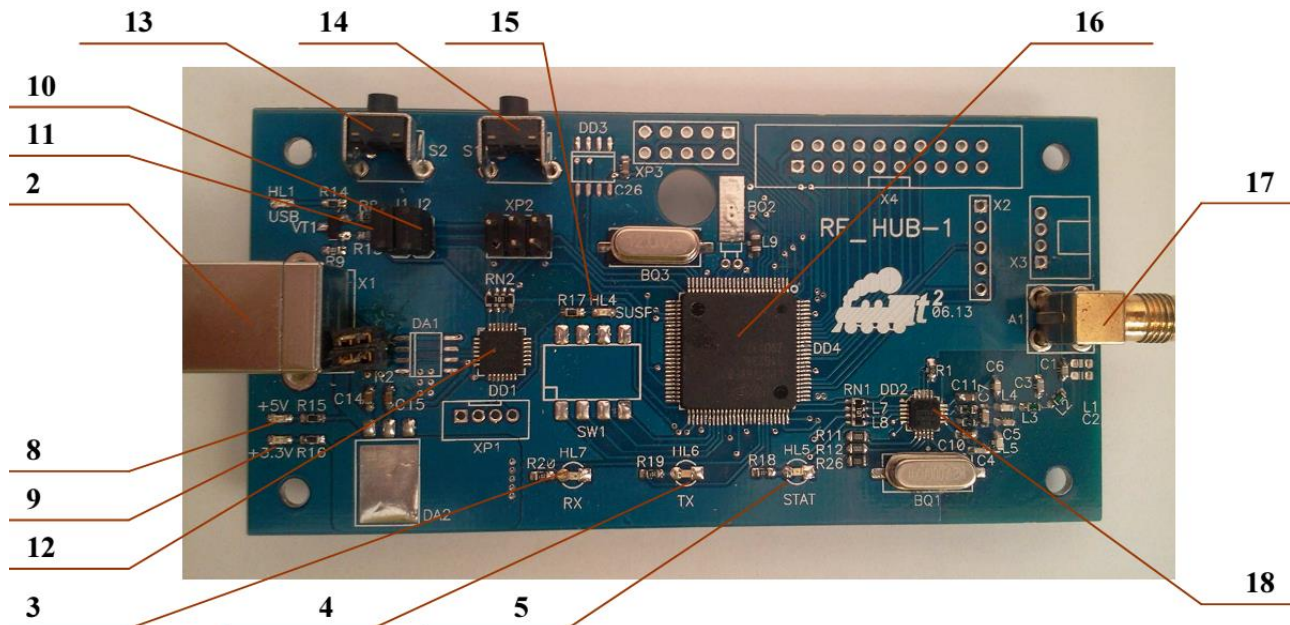
RF-hub is performed in a plastic case (1) of white color. Power supply is made through the USB-connector (2). Transfer and reception of data to RF-hub through a wireless interface is performed through HF-antenna (6) connected through SMA-jack (17). Means of indications are located on front surface of case – red LED "Status" (5), blue LED "Tx" (4) and green LED "Rx" (3). Holes for buttons "Reset" (13) and "Loading" (14) and located on side surface of case.

Top cap of RF-hub is mounted using a single screw (7) located on back side of case. For access to the board it is necessary to make the following actions:

- unscrew HF-antenna (6)
- unscrew mounting screw (7)
- disconnect top cap (1)



Means of indication and control over RH-hub "Signal-K"



- Two red LEDs «+5B» (8) and «+3,3B» (9) signal about presence of RH-hub power supply
- Red LED «SUSP» (15) signals about activation of USB-driver CP2102;
- Red LED «Status» (5) shows mode of RF-hub operation. In working more this LED blinks once per 3 seconds ("heartbeat" is OK). At damage of microcontroller flash-memory this LED "Status" is constantly shining
- Blue LED "Tx" (4) signals about data transfer from RF-hub to "Signal-1" terminal over wireless interface
- Green LED "Rx" (3) signals about data reception from "Signal-1" terminal over wireless interface
- Button "Reset" (13) makes reset of the RF-hub
- Button "Boot" (14) makes transfer of RF-hub into program mode. In working mode pressing and holding this button for more than 10 seconds leads to reset of AES-key in default state
- Jumpers J1 (11), J2 (10) should be inserted for reprogramming of the RF-hub using «Flash Magic» utility