

Draft (version 1.8)

Navigation Information Systems JSC

**ERA GLONASS Terminal
Mandatory Requirements**

Moscow, 2010

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1. PREFACE

The document defines mandatory requirements for ERA GLONASS terminal units. Functional requirements defined in Section 3. Standards compliance requirements defined in Section 4. Product package requirements defined in Section 5.

There are installation configurations discussed in the document:

- Aftermarket (retrofit) configuration – terminal installed at service centers or at dealer centers after vehicle assembled at OEM assembly line
- OEM pre installed configuration – terminal installed at OEM assembly line.

The document defines terminal connection, delivery package and documentation requirements for aftermarket configuration. Terminal connection, delivery package and documentation requirements for OEM pre installed configuration to be defined by vehicle OEM.

The document status is working draft. The document can be changed without prior notice.

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2. ABBREVIATIONS

| Abbreviation | Description |
|--------------|---|
| 3D | Three Dimensions |
| ADC | Analogue to Digital Converter |
| AEC | Acoustic Echo Cancellation |
| AGC | Automatic Gain Control |
| ASR | Automatic Speech Recognition |
| CLI | Caller Line Indication |
| CLID | Caller ID |
| CPU | Central Processing Unit |
| DOP | Dilution of Precision |
| DTC | Diagnostics Trouble Code |
| eCall | Emergency Call |
| ERA | Emergency Road Assistance |
| ETSI | European Telecommunications Standards Institute |
| GPRS | General Packet Radio Service |
| GPS | Global Positioning System |
| GLONASS | GLObal NAvigation Satellite System |
| GSM | Global System for Mobile communications |
| HF | Hands Free |
| HMI | Human Machine Interface |
| HW | Hardware |
| IMEI | International Mobile Equipment Identity |
| IO | Input Output |
| IP | Internet Protocol |
| IVS | In Vehicle System |
| LED | Light Emission Diode |

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| | |
|------|--|
| MSD | Minimal Set of Data |
| NAD | Network Access Device |
| NIS | Navigation Information Systems |
| OEM | Original Equipment Manufacturer |
| OTA | Over The Air |
| PSAP | Public Safety Answering Point |
| RAM | Random Access Memory |
| RTC | Real Time Clock |
| SIM | Subscriber Identity Module |
| SMS | Short Message System |
| SOS | Save Our Spirits |
| SRS | Supplemental Restraint System |
| SUV | Sport Utility Vehicle |
| SW | Software |
| TBD | To Be Determined |
| TBH | Total Harmonic Distortion |
| TCU | Telematics Communications Unit |
| TS | Technical Specification |
| UI | User Interface |
| UIM | User Interface Module |
| VDA | Verband der Automobilindustrie (in German) |
| VIN | Vehicle Identification Number |

3. FUNCTIONAL REQUIREMENTS

3.1 Data transfer mechanisms

Data transfer between the terminal and the back end should utilize GSM cellular networks. Data transfer mechanisms include in-band modem, SMS, and GPRS. In-band data transmission should be compliant with European eCall standards.

3.2 Basic requirements

Terminal will provide the following basic functionality: automatic (triggered by crash sensors provided with the terminal or external sensors which are part of OEM safety system) and manual (triggered by pushing Emergency Call button) transmission of the minimum set of data with consequent setup of a voice call to emergency response call center (PSAP).

Terminal should utilize GSM cellular networks for data and voice connection.

Data transfer mechanisms should include in-band modem (for emergency call data transfer). If in-band data transmission failed, then SMS shall be supported as back-up communication channel to transmit MND.

When emergency call is placed, Service category" element should be set according to event type (automatic/manual) as described in specification ETSI TS 124 008.

In-band modem should comply to the requirements of specifications ETSI TS 126 267, ETSI TS 126 268, ETSI TS 126 269, ETSI TS 126 969.

Minimum set of data, transmitted by the terminal, should be structured as described in the standard CEN TS 15722.

Terminal should provide handsfree voice communication to the cabin of the vehicle, with provision for muting external sound playback devices (such as in-dash radio) during emergency call.

Terminal should provide an indication of its status and mode of operation via light indicator or a corresponding icon/text message on the in-dash display.

3.3 Terminal architecture requirements

Main terminal module should provide functionality required for emergency assistance services.

3.4 Terminal modes of operation

3.4.1 Passive mode

Passive mode is intended for transportation and repairing/installation works. Network registration is done only in case the ignition is turned on and depends on network registration configuration setting. No active data transmission is initiated by the terminal. On ignition off all interfaces, GSM modem, and navigation receiver should be powered down.

3.4.2 Emergency Response mode

Emergency Response mode is intended for rendering emergency assistance services. On ignition on navigation receiver and automatic crash detection sensor are on, and eCall scenario can be started on crash detection or Emergency Call button press. Terminal registration scheme in GSM network defined by configuration settings.

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3.4.3 eCall mode

This is an emergency call mode. Voice connection to the emergency response call-center (PSAP) is established and MSD is transmitted. In case of unintentional call interruption the terminal will re-establish the call. Navigation receiver and all interfaces are powered on.

3.4.4 Test mode

Test mode is intended for testing the functionality of the IVS. The operation is identical to eCall mode, but voice calls are forwarded to a dedicated call center, and the mode identifier field in emergency data set is set to "test".

Provision should be made for automatic termination of testing mode when the vehicle moves with ignition on to the distance greater than predefined distance (configurable parameter) from the position where the testing mode was turned on.

3.4.5 Garage mode

Garage mode is intended for disabling terminal functional temporarily for the period of car service at a service station.

Provision should be made for automatic termination of garage mode when the vehicle moves with ignition on to the distance greater than predefined distance (configurable parameter) from the position where the garage mode was turned on.

3.4.6 OTA firmware download mode

OTA firmware download mode is intended for firmware upgrade over the air (via GPRS). In case the external power is present, the terminal is registered in GSM network, GPRS session and IP connection to the back end are established. Other aspects of operation are determined by the mode which was active prior to firmware loading mode.

Once firmware loading is complete, the terminal should restart and return to the mode which was active prior to firmware loading mode.

Firmware loading mode can be entered from any state, except for garage mode and Emergency Call mode. If garage mode or Emergency Call mode entered, the firmware loading mode shall be interrupted.

3.5 Current consumption requirements

Current consumption at 12 V (in absence of GSM transmission) should not exceed the following values:

- Standby mode (automatic crash detection sensor on, GLONASS/GPS receiver off, terminal registered in GSM network, but GPRS session not established) – 10 mA
- Deep sleep mode (automatic crash detection sensor, GLONASS/GPS receiver and GSM modem are off) – 1 mA.

3.6 Backup battery capacity requirements

Backup battery shall provide 1h voice call plus 8h standby mode operation at 20°C after 24h charging.

3.7 Air protocol requirements (data transfer between the terminal and the

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back end)

Data transfer should allow for the following groups of functions:

1. Telematics messages transfer from the terminal to the back end.
2. Commands transfer from the back end to the terminal (e.g. test mode on).
3. Transfer of configuration parameters from the back end to the terminal and from the terminal to the back end
4. OTA firmware download.

3.7.1 Content of telematics messages

Telematics messages from the terminal to the back end should contain the following data:

- Message serial number
- Terminal ID number
- Mode of operation
- External power voltage
- Backup battery voltage
- Transmission reason
- Date and time of the event
- Last location date and time
- Navigation module status
- Real time or last known navigation data (coordinates, speed, heading, number of satellites used in calculation, DOP parameters)
- Accelerometer reading.

3.7.2 List of terminal to back end message transmission reasons

- Periodic test message
- Reply to request
- Backup battery failure
- Navigation receiver disconnection or fault
- Accelerometer disconnection or fault
- Other failures.

Activation of message sending is determined for each transmission reason separately by setting corresponding configuration parameter.

3.7.3 Content of downlink commands

Commands sent from the back end to the terminal should contain the following data:

- Message serial number
- Terminal ID number
- Authentication code
- Command code and parameters

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3.7.4 Crash profile recording

In case that acceleration threshold is exceeded for a predefined time interval, the terminal shall record acceleration profile before and during the crash. Data array should contain lateral and transverse acceleration values stored in a cyclic buffer, covering the interval of at least 250 ms with resolution of at maximum 5 ms (1ms desirable) for the crash, plus 10 s with 100 ms resolution for the pre-crash history. Crash profile is transmitted as a separate block of data.

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3.8 Hardware requirements

- GLONASS or GLONASS/GPS navigation receiver with external antenna
- GSM/GPRS receiver
- Embedded SIM card
- In-band modem for eCall MSD transmission according to eCall standards listed in Section 3.2
- Vehicle ignition input
- Microphone input, stereo line audio output, stereo amplified audio out
- Radio mute output
- Optional backup battery to sustain voice operation without external power as required for emergency service delivery
- Automatic crash detection sensor
- UIM interface including Emergency Call button (for aftermarket configuration)
- Terminal status indicator
- Internal RTC with periodical wake-up
- Internal Flash and RAM memory
- CPU
- Power supply
- Nominal voltage 12 V and 24 V
- Operating temperature range -40 – +85°C.

3.9 Features requirements

3.9.1 eCall

3.9.1.1 eCall call functions shall be available only if eCall call service enabled with ECALL_ON configuration option.

3.9.1.2 Terminal shall support ECALL_BLACK_LIST. Terminal registration in ECALL_BLACK_LIST networks shall have the low priority comparing with networks not in ECALL_BLACK_LIST .

3.9.1.3 Emergency Call shall not be initiated if terminal is in network from ECALL_BLACK_LIST.

3.9.1.4 eCall automatic trigger source shall be configurable as one or two of the follows: internal accelerometer, external crash detection OEM input.

3.9.1.5 eCall shall be triggered automatically when acceleration exceeded CRASH_TRESHOLD (X, Y, Z, time) value when internal accelerometer used (configurable parameter).

3.9.1.6 eCall shall be triggered automatically per signal from an external crash detection OEM input when external crash detection OEM input used.

3.9.1.7 eCall shall be triggered automatically when ignition is off and Emergency Call button pressed within SOS_BUTTON_TIME time (configurable parameter) irrelevant of vehicle ignition line status.

3.9.1.8 ECALL_MODE_PIN should set active in eCall mode.

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- 3.9.1.9 eCall HF audio processing algorithm shall be compliant with section 3.9.2
- 3.9.1.10 eCall audio volume shall be set to maximum. Audio volume control shall be disabled in eCall mode.
- 3.9.1.11 Microphone mute function shall be not available in eCall mode.
- 3.9.1.12 eCall functions shall be compliant with eCall standards listed in section 3.2.
- 3.9.1.13 Bit6 and Bit7 shall be properly set in Service Category information element per TS 24.008.
- 3.9.1.14 When a call is 'ringing' TCU shall maintain the connection for at least ECALL_DIAL_DURATION to allow the PSAP system to answer the call.
- 3.9.1.15 The number of dial attempts in automatically triggered eCall shall be configurable as ECALL_AUTO_DIAL_ATTEMPTS. ECALL_AUTO_DIAL_ATTEMPTS set to 0 means the system dials until successfully connected.
- 3.9.1.16 The number of dial attempts in manually triggered eCall shall be configurable as ECALL_MANUAL_DIAL_ATTEMPTS. ECALL_MANUAL_DIAL_ATTEMPTS set to 0 means the system dials until successfully connected.
- 3.9.1.17 If eCall triggered automatically, PSAP connection not yet established and ECALL_AUTO_CAN_CANCEL configuration parameter set to TRUE, then eCall shall be cancelled if Service button pressed.
- 3.9.1.18 If eCall triggered manually, PSAP connection not yet established and ECALL_MANUAL_CAN_CANCEL configuration parameter set to TRUE, then eCall shall be cancelled if Service button pressed.
- 3.9.1.19 eCall shall be triggered with the defined activation flag if SMS in a special format arrived from back end.
- 3.9.1.20 If eCall happened, then terminal shall send additional telematics message to back end with eCall parameters if end user subscribed to Alarm, SVT or fleet management services.
- 3.9.1.21 If SMS with special format received from back end, then terminal shall send SMS with MND to configurable phone number ECALL_SMS_FALLBACK_NUMBER.

3.9.2 Handsfree audio

- 3.9.2.1 With vehicle specific tuning HF algorithm shall be VDA compliant and shall achieve Type I full-duplex operation under normal operating conditions in SUV vehicle on concrete surface at all volume levels.
- 3.9.2.2 HF algorithm shall provide programmable and fully automatic noise reduction up to 21 dB (15-20 dB typical).
- 3.9.2.3 HF algorithm shall accept common configuration parameter set providing leading market performance for full duplex communication pro install system.
- 3.9.2.4 The same parameter set should be used for 1 speaker configuration and for 2 speaker's configuration.
- 3.9.2.5 HF algorithm shall support vendor specific configuration parameter set for fine tuning for

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specific vehicle platforms.

- 3.9.2.6 HF algorithm shall have vendor specific tuning interface.
- 3.9.2.7 HF algorithm shall support 1 microphone configuration.
- 3.9.2.8 If 2 microphone configuration used, then delta of NR shall be >6 dB without speech quality impact so acceptable for ASR.
- 3.9.2.9 AEC by the adaptive filter shall be ≥ 40 dB.
- 3.9.2.10 Overall echo cancellation (AEC + NLP) shall be ≥ 55 dB.
- 3.9.2.11 Echo tail length shall be ≥ 32 ms.
- 3.9.2.12 HF algorithm convergence time shall be ≤ 1 second.
- 3.9.2.13 Attenuation in dB inserted by NLP during single talk shall be <15 dB on uplink and 0 dB on downlink.
- 3.9.2.14 Switching time needed to remove attenuation by NLP shall be <50ms.
- 3.9.2.15 Attenuation in dB inserted by NLP during double talk shall be ≤ 3 dB on uplink and ≤ 3 dB on downlink.
- 3.9.2.16 Overall echo loss provided during double talk shall be >36 dB.
- 3.9.2.17 The acceptance level of non-linear distortions (TBH) in the echo path shall be 10%.
- 3.9.2.18 HF algorithm shall have a configurable equalizer to tune AC frequency response.
- 3.9.2.19 HF algorithm shall provide Automatic Gain Control (AGC).
- 3.9.2.20 HF algorithm shall provide noise-dependent volume control.
- 3.9.2.21 Optionally - HF algorithm shall provide mixing of signals from several audio sources (e.g. to remove navigation prompts from uplink audio).
- 3.9.2.22 HF algorithm shall provide a feedback eliminator (shall prevent howling).
- 3.9.2.23 HF algorithm shall provide a Shock eliminator in line with AS/ACIF S004:2004 standard and ACIF G616:2004 recommendation

3.9.3 Status indication

3.9.3.1 Below ECU operating modes should be indicated with ECU status indicator:

- system ready
- system failure
- eCall active
- test mode

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- garage mode.

3.9.4 Internal integrity monitoring

- 3.9.4.1 Terminal shall perform internal integrity monitoring and transmit status messages every SELFTEST_INTERVAL and in case of failure detection.
- 3.9.4.2 This shall be possible to initiate internal integrity check from back end and from wired diagnostics interface.
- 3.9.4.3 Terminal shall set Diagnostics Trouble Code (DTC) in the internal memory if a failure detected.
- 3.9.4.4 Terminal DTC codes shall be restored after ignition off / ignition in cycle.
- 3.9.4.5 Terminal DTC codes shall be readable from back end and through wired diagnostics interface.
- 3.9.4.6 Terminal DTC codes shall be clearable from back end and through wired diagnostics interface.
- 3.9.4.7 Below integrity checks shall be performed if technically possible. Corresponding DTC's shall be set if a failure detected
- Main SW image integrity
 - Additional SW images integrity (if additional SW images present)
 - GSM modem HW interface
 - GLONASS/GPS receiver
 - Backup battery voltage level OK
 - Automatic crash detection sensor
 - Internal RTC
 - UIM works OK (aftermarket configuration)
 - Microphone works OK.

3.9.5 Test mode

- 3.9.5.1 This shall be possible to turn test mode on and off from back end, from wired diagnostics interface or per user input.
- 3.9.5.2 User shall be able to turn test mode on and off using UIM w/o additional equipment.
- 3.9.5.3 One test session shall supported at given point of time so if a test session started from back end, then subsequent request to start test session from a wired diagnostics shall be discarded and error reported.
- 3.9.5.4 System in the test mode shall execute system test commands issued from back end or from wired diagnostics interface.
- 3.9.5.5 Each test command shall run until completed. If a test command is running and a new test command arrived, then the new test command shall be discarded and an interface error shall be reported.

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- 3.9.5.6 Watchdog timer shall be set in the test mode for TEST_MODE_WATCHDOG time.
- 3.9.5.7 System shall reset if the watchdog timer expired, but currently running test command not ended. Test mode should be still on after the system reset, but hanging test command shall not be restarted.
- 3.9.5.8 System reset event in the test mode shall be reported to back end or through wired diagnostics interface.
- 3.9.5.9 Test mode shall be ended by special command. System shall reset and enter normal operating mode.
- 3.9.5.10 Test mode shall end automatically if the vehicle moves for more than TEST_END_DISTANCE from the location when the test mode was started.
- 3.9.5.11 This shall be possible to run tests listed in section 3.9.4.7 in the test mode.
- 3.9.5.12 Visual indication in the test mode shall include the following: no GSM coverage; GSM coverage OK, but cannot setup GPRS connection; no GLONASS/GPS signals; accelerometer problem; other problems.
- 3.9.5.13 Test sequence in the test mode shall be defined by back end. Test results saved at back end.
- 3.9.5.14 Additional tests shall be implemented in the test mode:
 - eCall to test server using ECALL_TEST_NUMBER with “test call” flag set triggered by Emergency Call button press
 - Microphone connection test. For example, ask the user to say predefined phrase and recognize the speech with ASR.
 - Speaker (speakers) connection test. For example: play tone or voice prompt to Left / Right speakers and ask the tester to confirm the tone or voice prompt sounded OK in Left / Right speakers
 - Ignition off / ignition on test
 - Extended UIM test. For example, play voice prompts asking the tester to press specific buttons (button combinations) and check pressed OK. Also may ask the tester to confirm light indicator lit / blank OK by button press
 - Backup battery test
 - Internal accelerometer test.

3.9.6 Accident acceleration profile collection

- 3.9.6.1 Accident acceleration profile data shall be stored in circular buffer and provide data for PAYD_CRASH_RECORD_TIME period of time with PAYD_CRASH_RECORD_RESOLUTION resolution after crash event detected and for PAYD_CRASH_PRE_RECORD_TIME period of time with PAYD_CRASH_PRE_RECORD_RESOLUTION resolution before crash event detected.
- 3.9.6.2 Acceleration profile resolution (PAYD_CRASH_RECORD_RESOLUTION) shall be ≤ 5 ms (recommended resolution is 1 ms).
- 3.9.6.3 Acceleration shall be reassured with accuracy 10% and resolution equal or better then:
 - Lateral acceleration: -5 G to +5 G (resolution 0.1 G)

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- Longitudinal acceleration: -24 G to +24 G (resolution 0.1 G in -10 G to +10 G and 0.5 G outside of -10 G to +10 G)
- Normal acceleration: -5 G to +5 G (resolution 0.1 G).

3.9.6.4 Accident acceleration profile data shall be automatically transmitted to back end if acceleration exceeds PAYD_CRASH_ACCEL_TRESHOLD (X, Y, Z, time) configuration parameter.

3.9.6.5 Below data shall be transmitted along with the acceleration profile:

- the number of ignition on / ignition off cycles since last crash event
- the number of ignition on / ignition off cycles since last transmission of the acceleration profile data.

3.9.7 Automatic crash detection sensor and automatic crash detection sensor test requirements

3.9.7.1 If automatic crash detection sensor not embedded to the terminal unit, then automatic crash detection sensor shall be supplied with accelerometer mount mechanism which guarantees correct data collection with acceleration up to 50G and guarantees sensor mounting with acceleration up to 60G.

3.9.7.2 If automatic crash detection sensor embedded to the terminal unit, then terminal unit shall be supplied with terminal unit mount mechanism which guarantees correct data collection with acceleration up to 50G and guarantees terminal unit mounting with acceleration up to 60G.

3.9.7.3 Automatic crash detection sensor installation test procedure shall be developed by the terminal vendor. If necessary, then terminal vendor shall provide mechanism (mechanisms) to be used to test correct installation.

3.9.7.4 Terminal shall constantly monitor correct automatic crash detection sensor functioning and report automatic crash detection sensor failure if detected.

3.10 UIM requirements

3.10.1 UIM shall include Emergency Call button.

3.10.2 UIM shall include system status indicator.

3.10.3 Protection mechanism shall be implemented for SOS button to minimize event of wrong eCall activation.

3.11 Unit configuration

3.11.1.1 Below mandatory unit configuration parameters shall be supported.

| Parameter name | Parameter type | Description |
|---|----------------|--|
| Radio mute configuration (for aftermarket configuration only) | | |
| RADIO_MUTE_DELAY | INT | Delay between assertion of the radio mute signal and the start of audio playback |
| RADIO_UNMUTE_DELAY | INT | Delay between release of the radio mute signal and the end of audio playback |
| General configuration settings | | |
| ECALL_BLACK_LIST | TBD | The list of networks where eCall service blocked |
| AUTOMATIC_REGISTRATION | BOOLEAN | Flag which enables automatic SIM registration in the limited active mode |

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| SELFTEST_INTERVAL | INT | Self-test interval |
| TEST_END_DISTANCE | INT | Distance when test mode and garage mode should turn off automatically |
| ECALL_TEST_NUMBER | STRING | Phone number to be used for eCall test calls |
| GARAGE_MODE_PIN | ENUM {NONE, PIN_1 .. PIN_8} | Garage mode indication NONE- no indication PIN_X – PIN_X active when garage mode turned on |
| TEST_MODE_WATCHDOG | INT | Test mode watchdog timer |
| Service level configuration | | |
| eCall service configuration parameters | | |
| ECALL_SERVICE_ON | BOOLEAN | ECALL service enabled or disabled |
| CRASH_SIGNAL_INTERNAL | BOOLEAN | Internal accelerometer used to detect crash event |
| CRASH_SIGNAL_EXTERNAL | BOOLEAN | External signal used to detect crash event |
| SOS_BUTTON_TIME | INT | SOS button press detection time |
| ECALL_MODE_PIN | ENUM {NONE, PIN_1 .. PIN_8} | eCall mode indication NONE- no indication PIN_X – PIN_X active when eCall active |
| CCFT | INT | Call clear down timer per eCall spec (should be set to 60 minutes) |
| INVITATION_SIGNAL_DURATION | INT | INVITATION signal duration per eCall spec (should be set to 2 seconds) |
| SEND_MSG_PERIOD | INT | SEND MSG period per eCall spec (should be set to 2 seconds) |
| AL_ACK_PERIOD | INT | AL-ACK period per eCall spec (should be set to 2 seconds) |
| MSD_MAX_TRANSMISSION_TIME | INT | MSD max transmission time per eCall spec (should be set to 20 seconds) |
| NAD_MIN_REGISTRATION_PERIOD | INT | Following call clear-down by PSAP NAD shall remain registered to receive calls from PSAP (should be set to TBD value) |
| ECALL_DIAL_TIME | INT | Total dial time in eCall initiation phase |
| ECALL_DIAL_DURATION | INT | Dial duration in eCall initiation phase |
| NAD_DEREGISTRATION_TIMER | INT | De-register from the network after the timer expired (should be set to 12 hours) |
| ECALL_AUTO_DIAL_ATTEMPTS | INT | The number of dial attempts in automatically generated eCall |
| ECALL_MANUAL_DIAL_ATTEMPTS | INT | The number of dial attempts in manually generated eCall |
| ECALL_AUTO_CAN_CANCEL | BOOLEAN | TRUE – automatically triggered eCall shall be cancelled if Service button pressed |
| ECALL_SMS_FALLBACK_NUMBER | STRING | If SMS in special format received from back end, then send SMS with MND to ECALL_SMS_FALLBACK_NUMBER |
| ECALL_MANUAL_CAN_CANCEL | BOOLEAN | TRUE – manually triggered eCall shall be cancelled if Service button pressed |
| Acceleration profile collection | | |

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|---------------------------------|--------------|---|
| PAYD_CRASH_RECORD_TIME | INT | Accident acceleration profile record time |
| PAYD_CRASH_RECORD_RESOLUTION | INT | Accident acceleration profile resolution |
| PAYD_CRASH_PRE_RECORD_TIME | INT | Pre-accident acceleration profile record time |
| PAYD_CRASH_RECORD_RESOLUTION | INT | Pre-accident acceleration profile resolution |
| PAYD_ACCEL_TRESHOLD | ACCEL_CONFIG | Accident detection acceleration threshold value |
| Vehicle data | | |
| VIN | STRING | VIN number according ISO 3779 |
| VEHICLE_TYPE | INT | Bit 4-0: 00001 – passenger vehicle (Class M1) 00010 = buses and coaches (Class M2) 00011 = buses and coaches (Class M3) 00100 = light commercial vehicles (Class N1) 00101 = heavy duty vehicles (Class N2) 00110 = heavy duty vehicles (Class N3) 00111 = motorcycles (Class L1e) 01000 = motorcycles (Class L2e) 01001 = motorcycles (Class L3e) 01010 = motorcycles (Class L4e) 01011 = motorcycles (Class L5e) 01100 = motorcycles (Class L6e) 01101 = motorcycles (Class L7e) |
| VEHICLE_PROPULSION_STORAGE_TYPE | INT | This byte identifies the type of vehicle energy storage(s) present. All bits set to zero indicates an unknown type of energy storage Bit 7: unused Bit 6: unused Bit 5: 1 = hydrogen storage Bit 4: 1 = electric energy storage (with more than 42 v and 100 Ah) Bit 3: 1 = liquid propane gas (LPG) Bit 2: 1 = compressed natural gas (CNG) Bit 1: 1 = diesel tank present Bit 0: 1 = gasoline tank present |
| Unit data | | |
| SERIAL_NUMBER | STRING | TCU unit serial number |
| HW_VERSION | STRING | TCU unit HW version |
| SW_VERSION | STRING | TCU unit SW version |
| VENDOR_ID | INT | TCU unit vendor ID |
| UNIT_ID | INT | Unique unit ID assigned by NIS the first time the unit activated |
| LANGUAGE_ID | INT | Proffered language for voice communication per ISO 639 0x5F – Russian |
| IMEI | STRING | SIM IMEI number |

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3.12 Terminal connection

3.12.1 Aftermarket configuration

3.12.1.1 Terminal connection in aftermarket configuration defined in Figure 1.

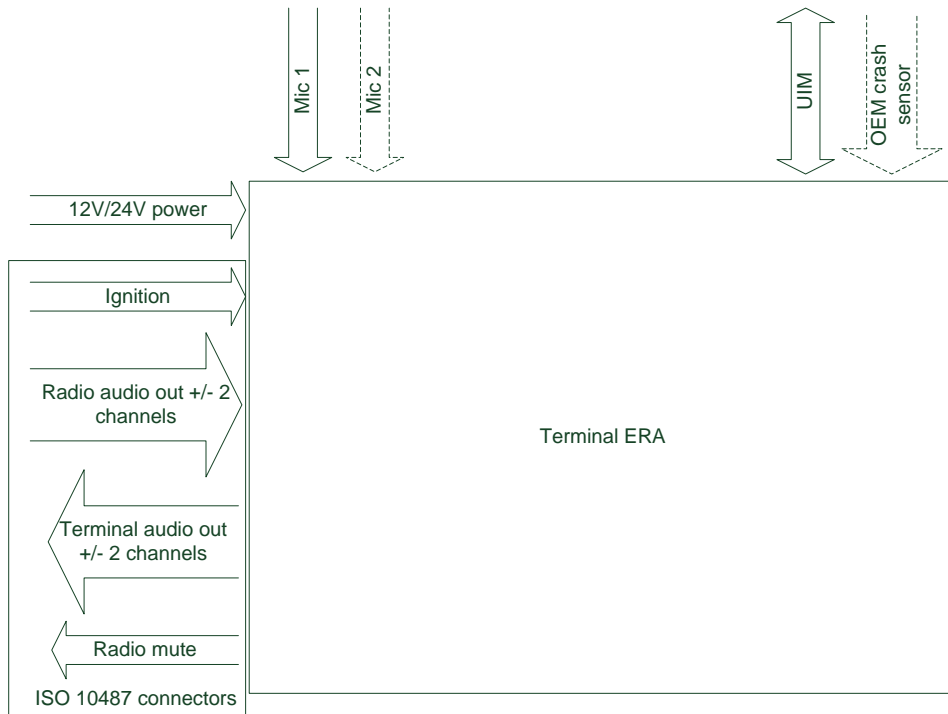


Figure 1: Terminal connection

3.12.1.2 Terminal audio out (2 front speakers) shall be connected to vehicle audio system through ISO 10487 connectors.

3.12.1.3 If vehicle radio installed, then vehicle audio out (2 front speakers) shall be connected to terminal through ISO 10487 connectors for audio commutation inside terminal.

3.12.1.4 Mute line shall be connected to vehicle radio through ISO 10487 connector.

3.12.1.5 Below interfaces are optional:

- Mic 2 in
- OEM crash sensor.

3.12.1.6 Below terminal connection schemes can be used in aftermarket configuration:

- A: Vehicle with radio, stereo audio in, speakers and access to radio / speakers ISO connector: connect radio front L/R out to terminal though ISO connector, terminal to speakers though ISO connector.
- B: Vehicle with radio, stereo audio in, speakers and w/o access to radio / speakers ISO connector: the main path to cut wires between radio and front L/R speakers and install as discussed in the case A. If this is not possible to cut wires for specific vehicle, then install as discussed in the case D.
- C: Vehicle with radio w/o stereo audio in with access to radio / speakers ISO connector: the same connection as A.

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- D: Vehicle with radio w/o stereo audio in and w/o access to radio / speakers ISO connector: connect mute line to the radio, install additional speaker and connect the speaker to L or R channel of the terminal amplified stereo audio out.
- E: Vehicle w/o radio and with audio system with ISO connector: connect terminal to speakers though ISO connector.
- F: Vehicle w/o radio and w/o audio system with ISO connector: install additional speaker and connect the speaker to L or R channel of terminal amplified stereo audio out.

3.12.2 OEM pre installed configuration

3.12.2.1 Terminal connection in OEM pre installed configuration to be defined by vehicle OEM.

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4. STANDARDS COMPLIANCE REQUIREMENTS

4.1 Radio electronic safety

4.1.1 Terminal shall satisfy below standards:

- GOST 28751-90 – in the area of conduction noise in board systems;
- GOST 28751-90 – ECU shall tolerate overvoltage in board system including reversed connection of vehicle battery;
- GOST 29157-91 – in the area of resistance to noise in control and signaling board circuits from capacitor and inductive connections;
- GOST R 50607-93 – in the area of resistance to noise from electrostatic pulse - per GOST R 50607-93;
- GOST R 41.10-99 – in the area of radio noise from devices installed in vehicle;
- GOST 28279-89 – in the area of electromagnetic compliance of vehicle pre installed devices and vehicle customer radio electronic devices.

4.2 Resistance to external influences

4.2.1 Terminal shall satisfy below standards:

- GOST R 52230 2004 – in the area of low atmospheric pressure for trucks working in elevation up to 4650 meters above sea level, for atmospheric pressure as low as 57 kPa (427,5 millimeters of mercury column);
- GOST R 52230-2004 – moisture-proofness for devices of “XL” type, which corresponds to the damp thermal environment during 4 days with temperature $(40\pm 2)^{\circ}\text{C}$ and relative moistness of $(95\pm 3)\%$;
- GOST 14254-96 – degree of protection of electronic devices from penetration of foreign matters, dust and water shall be in-line with IP52 code. IP52 code defines the following protection characteristics:
 - The device is protected from dust (not full dust protection, but the duct shall not be in quantity preventing device from regular work and scarifying safety);
 - Wire cannot access dangerous parts of the device (test probe with diameter 1,0 millimeter cannot go inside the case);
 - Protected from vertically falling drops of water when case rotated up to 15° from vertical position (vertically falling drops of water shall not alert device functions when case rotated from version position to any side up to 15° inclusive);

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- In addition, device shall be steady to washing liquids, gas, oil, salt and their steams.

4.3 Reliability requirements

4.3.1 Terminal shall satisfy GOST R 50905- 96 reliability requirements. Reliability shall be characterized by:

- Average time between failures;
- Gamma percentage resource;
- Average life cycle;
- Period of storage.

Note: the above parameters will be defined in the next document version.

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4.4 Navigation performance requirements

- 4.4.1 Navigation module shall receive and process autonomously (jointly) GLONASS signal (GLONASS and GPS signals) to calculate position and speed information.
- 4.4.2 Navigation data received from GLONASS system shall have higher priority comparing with navigation data received from GPS system if this is impossible to receive trustable location and speed information using GLONASS and GPS signals jointly.
- 4.4.3 In normal operating mode navigation module shall ensure location and speed accuracy not worse than 30 meters and 0.1 meter per second per GOST R 52456-2005.

4.5 Ergonomic and industrial art requirements

- 4.5.1 Terminal and other units mechanical design and color scheme shall satisfy esthetical and ergonomical requirements defined for vehicle cabin devices defined in GOST 12.2.049-80.

4.6 Constructional requirements

- 4.6.1 The same parts of terminal equipment shall be interchangeable. If a part changed, then tuning and calibration shall not be required.
- 4.6.2 Mechanical design and size/installation factors shall be negotiated with OEM's.
- 4.6.3 The case shall carry below information:
 - ECU name;
 - ECU serial number per ECU manufacturer guidelines;
 - Year of manufacturing;
 - Label of acceptance for equipment type;
 - Identification mark of connectors.

4.7 Safety and ecological requirements

- 4.7.1 Terminal shall be safe in storage, transportation and usage and follow sanitary andhygienic regulations.
- 4.7.2 If user input sequence is out of order, then terminal shall not generate emergency situation.
- 4.7.3 In terminal usage the driver shall be protected from electrical shock per defense class III in line with GOST 12.2.007.0-75.
- 4.7.4 In terminal manufacturing inflammable and allocating harmful substances at burning materials shall not be used per requirements of fire-prevention safety in line with GOST

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12.1.044-89.

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5. PRODUCT PACKAGE REQUIREMENTS

5.1 Product package

5.1.1 Product package in aftermarket configuration shall include the following:

- TCU and TCU mounting materials
- UIM and UIM mounting materials
- Harness between TCU and UIM
- Accelerometer with cable and accelerometer mounting materials (if accelerometer not embedded to the main unit)
- Microphone (microphone array) with cable and microphone (microphone array) mounting materials
- Harness between TCU and vehicle electronics (vehicle adaptation kit)
- Backup battery (preinstalled to TCU case)
- Optional HF speaker with cable and HF speaker mounting materials
- Owners user manual
- Owner's product brief brochure.

5.1.2 Product package in OEM pre installed configuration to be defined by OEM.

5.2 Additional documentation requirements

5.2.1 Installation manual shall be provided (only for aftermarket configuration).

5.2.2 Configuration and diagnostics / test manual shall be provided (only for aftermarket configuration).

5.3 Branding requirements

5.3.1 UIM shall carry small ERA GLONASS logo. Small ERA GLONASS logo will be provided by NIS.

5.3.2 TCU shall carry extended ERA GLONASS logo. Extended ERA GLONASS logo will be provided by NIS.

5.3.3 Owner's user manual and product brief brochure shall carry small ERA GLONASS logo.

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