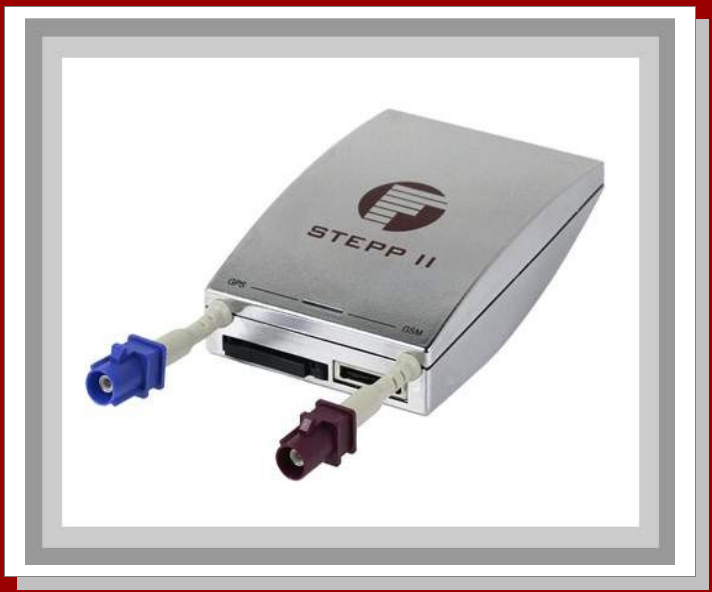
FALCOM
WIRELESS COMMUNICATIONS GMBH

STEPPII-55/56-LT

Hardware description



Version 1.01; Updated: Tue 29 May 2007

Table of contents

Version history:

Version number	Author	Changes	Change date
1.00	F. Beqiri	Initial release	23/02/2007
1.01	F. Beqiri	The operating voltage (V_{VC+} and GND) is protected from reverse pole connection as long no grounded antenna and/or an AMP connector is NOT connected to the STEPPII (see chapter 6.1).	29/05/2007

Cautions

Information furnished herein by FALCOM is accurate and reliable. However, no responsibility is assumed for its use.

Please, read carefully the safety precautions.

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1 INTRODUCTION

This product manual is only addressed to qualified personnel which is well skilled in electronical/electrical installation and not addressed to private consumers/end users. The installation, implementing or setting into operation of the product can only be performed by this qualified personnel.

1.1 General

This description is focused on the GSM/GPRS and GPS terminal STEPPII-55/56-LT from FALCOM GmbH. It contains information about purpose and use of the STEPPII-55/56-LT concept.

In order quickly to start and immediately and comprehensive to use all functions and to avoid any mistakes of STEPPII-55/56-LT terminal on your utilization, we recommend to read the following references and suggestions for using your new STEPPII-55/56-LT terminal.

The STEPPII-55/56-LT is a Plug-and-Play device, which provides powerful state-of-the art technologies (GSM, GPS, internet) and makes them available for quick and easy integration into a number of applications for the vertical and horizontal market. The new STEPPII-55/56-LT concept is a Full Type Approved combined GSM/GPRS/GPS Smart Terminal.

The compact design of the GSM/GPRS/GSM STEPPII-55/56-LT terminal integrates it in an all-in-one solution. This combination concept and internally embedded software (known as firmware) make it available to be used in a wild range of tracking solutions such as fleet management, vehicle tracking, navigation, emergency calling, location-based services and many others.

The STEPPII-55/56-LT is designed for use on any GSM850, GSM1800 and GSM1900 network. This single compact device is Tri-band GSM/GPRS engine that works on the three frequencies GSM 850MHz, GSM 1800 MHz and GSM 1900 MHz, it supports also state-of-art GPS technology for satellite navigation.

The embedded firmware based on the eCos operating system for the TCP/IP communication protocol (TCP/IP stack) converts data streams into data packets and makes GPRS traffic possible for industrial and automotive applications. No PDA or laptop is needed for establishing a GPRS connection. It has its own TCP/IP and PPP stack and will work as a stand-alone terminal. STEPPII-55/56-LT features GPRS Multislot class 10 and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. The STEPPII-55/56-LT terminal can send and receive data by GSM and GPRS networks. It supports SMS, data and voice calls as well as Internet and e-mail. The STEPPII-55/56-LT terminal can be easily controlled by using SMS and PRSF commands provided on the embedded software for all kinds of operations.

The internal advanced GPS system uses twelve parallel channels, providing highly accurate positional, speed, time and date information. Using satellite signals the embedded GPS module enables users to determine the position of device anywhere in the world. The STEPPII-55/56-LT module has an integrated TCXO that also improves the GPS system performance. Due to the temperature stabilizing its position is determined more precisely.

A compact "stacked FLASH/SRAM" device stores the STEPPII-55/56-LT software in the FLASH memory section of terminal, and a static RAM section provides the additional storage capacity required by GPRS connectivity.

The physical interfaces to the terminal application are made through integrated connectors. These are required for controlling the unit, receiving GPS location data, transferring data and audio signals and providing power supply lines. STEPPII-55/56-LT

provides a serial interface (2-wire and GND on the 16-pin AMP connector) giving you maximum flexibility for local use.

The internal backup Battery (LiIon- 850 mA/h) is available in case of external Power failure.

Figure 1 shows the front and backside of the STEPPII-55/56-LT.

a) front side b) back side

Figure 1: Front and back side of STEPPII-55/56-LT

1.2 Circuit concept

The STEPPII-55/56-LT architecture includes the following major functional components (*see figure 2*):

❖ ***Architecture integrates:***

- ✓ high-performance Tri Band GSM/GPRS core
- ✓ 12 parallel channel low-power GPS core
- ✓ ARM7TDMI processor that controls all functions of the system
- ✓ Power Control circuitry with 850 mAh Li-Ion, backup battery
- ✓ Audio amplifier
- ✓ Interface circuitry

❖ ***Physical interfaces:***

- ✓ 16-pin Molex connector (Type: Molex 43045-1609, and counterpart: Casing: 43025-1600 and Box type spring contact: 43031-0001) for power supply and I/O's
- ✓ 15-pin AMP connector (Type: AMP5-558556-1, and counterpart: 558666-1) for audio interfaces and software update
- ✓ SIM Card reader (Type: Molex-91228-0002 small SIM Card)
- ✓ GSM antenna interface (Type: Connector 50 Ω Fakra/Radiall SMB-male)
- ✓ GPS antenna interface (Type: Connector 50 Ω Fakra/Radiall SMB-male)

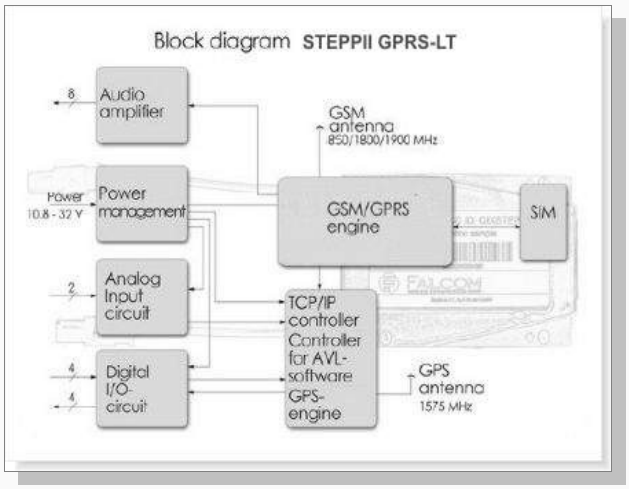


Figure 2: Architecture of the STEPPII-55/56-LT terminal

1.3 Scope of delivery

Check the contents of the package. In case of damaged or missing any item, please contact your dealer immediately.

Concerning the STEPPII-LT, there are four different terminals, which operate in the different frequencies:

- **STEPPII-55-LT** is a Tri-band device, which operates in the three frequencies GSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz, and is available to use in the European and Asian Networks.
- **STEPPII-56-LT** is a Tri-band device, which operates in the three frequencies GSM 850 MHz, DCS 1800 MHz and PCS 1900 MHz, and is available to use in the American Networks.

Regarding the electrical interfaces, mechanical specification (dimension, form etc.) and electrical specification are the same to all terminals.

Please, note that according to your requirements you can choose the desired STEPPII-LT device.

1.4 Used abbreviations

Abbreviation	Description
ASIC	Application Specific Integrated Circuit
DOP	Dilution of Precision
GPS	Global Positioning System
GSM	Global Standard for Mobile Communications
GGA	GPS Fixed Data
HDOP	Horizontal DOP
HW	Hardware
IMEI	International Mobile Equipment Identity
I/O	Input/Output
NMEA	National Marine Electronics Association
PRN	Pseudorandom Noise Number – The Identity of GPS satellites

RF	Radio Frequency
RTC	Real Time Clock
RXQUAL	Received Signal Quality
SIM	Subscriber Identification Module
SMS	Short Message Service
SRAM	Static Random Access Memory
TA	Terminal Adapter
TE	Terminal Equipment
TP	Transmit Protocol
TTFF	Time to First Fix
SA	Selective Availability
WAAS	Wide Area Augmentation System
MSK	Minimum Shift Keying

Table 1: Used abbreviations

1.5 Related documents

1. *ETSI GSM 07.05:"Use of Data Terminal Equipment–Data Circuit terminating Equipment interface for Short Message Service and Cell Broadcast Service"*
2. *ETSI GSM 07.07"AT command set for GSM Mobile Equipment"*
3. *ITU-T V.25ter "Serial asynchronous automatic dialing and control"*
4. *SiRF binary and NMEA protocol specification*
5. *steppII_getting_started.pdf*
6. *steppII_firmware_2.3.xx_manual.pdf (supporting GSM & GPRS services)*
7. *steppII_firmware_1.6.xx_manual.pdf (supporting GSM services, only)*
8. *falcom_eCos_SDK_user_guide.pdf*
9. *Application_notes_on_vehicle_mounting.pdf*
10. *AppNotes_connecting_a_bar_code_scanner_to a_STEPPII.pdf*

2 SECURITY

IMPORTANT FOR THE EFFICIENT AND SAFE OPERATION OF YOUR GSM-MODEM, READ THIS INFORMATION BEFORE USE!

Your cellular engine STEPPII-55/56-LT is one of the most exciting and innovative electronic products ever developed. With it you can stay in contact with your office, your home, emergency services and others, wherever service is provided.

This chapter contains important information for the safe and reliable use of the STEPPII-55/56-LT. Please read this chapter carefully before starting to use the cellular engine STEPPII-55/56-LT.

2.1 General information

Your STEPPII-55/56-LT device utilizes the GSM/GPRS/GPS standard for cellular technology. GSM/GPRS is a newer radio frequency („RF“) technology than the current FM technology that has been used for radio communications for decades. The GSM standard has been established for use in the European community and elsewhere. Your modem is actually a low power radio transmitter and receiver. It sends out and receives radio frequency energy. When you use your modem, the cellular system handling your calls controls both the radio frequency and the power level of your cellular modem.

For the use of the acquired devices SIM cards are needed, which are not included in the scope of delivery of the device. The SIM cards can be acquired e.g. by specific providers. From the use of the SIM cards can result additional costs, which are to be borne by the purchaser (client) of the devices. The seller does not cover the extra costs for the use of the devices. The seller gives no recommendation for the use of specific SIM cards and does not liable also for the fact that the devices are usable with all available SIM cards. The seller also covers no other costs, that are needed for the application of the customer in connection with this device.

2.2 Exposure to RF energy

There has been some public concern about possible health effects of using a GSM modem. Although research on health effects from RF energy has focused for many years on the current RF technology, scientists have begun research regarding newer radio technologies, such as GSM. After existing research had been reviewed, and after compliance to all applicable safety standards had been tested, it has been concluded that the product is fit for use.

If you are concerned about exposure to RF energy there are things you can do to minimize exposure. Obviously, limiting the duration of your calls will reduce your exposure to RF energy. In addition, you can reduce RF exposure by operating your cellular modem efficiently by following the guidelines below.

2.3 Efficient modem operation

In order to operate your modem at the lowest power level, consistent with satisfactory call quality please take note of the following hints.

If your modem has an extendible antenna, extend it fully. Some models allow you to place a call with the antenna retracted. However, your modem operates more efficiently with the antenna fully extended.

Do not hold the antenna when the modem is „IN USE“. Holding the antenna affects call quality and may cause the modem to operate at a higher power level than needed.

2.4 Antenna care and replacement

Do not use the modem with a damaged antenna. If a damaged antenna comes into contact with the skin, a minor burn may result. Replace a damaged antenna immediately. Consult your manual to see if you may change the antenna yourself. If so, use only a manufacturer-approved antenna. Otherwise, have your antenna repaired by a qualified technician.

Use only the supplied or approved antenna. Unauthorized antennas, modifications or attachments could damage the modem and may contravene local RF emission regulations or invalidate type approval.

2.5 Driving

Check the laws and regulations on the use of cellular devices in the area where you drive. Always obey them. Also, when using your modem while driving, please pay full attention to driving, pull off the road and park before making or answering a call if driving conditions so require. When applications are prepared for mobile use they should fulfill road-safety instructions of the current law!

2.6 Electronic devices

Most electronic equipment, for example in hospitals and motor vehicles is shielded from RF energy. However, RF energy may affect some malfunctioning or improperly shielded electronic equipment.

2.7 Vehicle electronic equipment

Check your vehicle manufacturer’s representative to determine if any on board electronic equipment is adequately shielded from RF energy.

2.8 Medical electronic equipment

Consult the manufacturer of any personal medical devices (such as pacemakers, hearing aids, etc.) to determine if they are adequately shielded from external RF energy.

Turn your STEPPII-55/56-LT device OFF in health care facilities when any regulations posted in the area instruct you to do so. Hospitals or health care facilities may be using RF monitoring equipment.

2.9 Aircraft

Turn your STEPPII-55/56-LT OFF before boarding any aircraft.

Use it on the ground only with crew permission.

Do not use it in the air.

To prevent possible interference with aircraft systems, Federal Aviation Administration (FAA) regulations require you to have permission from a crew member to use your modem while the plane is on the ground. To prevent interference with cellular systems, local RF regulations prohibit using your modem whilst airborne.

2.10 Children

Do not allow children to play with your STEPPII-55/56-LT device. It is not a toy. Children could hurt themselves or others (by poking themselves or others in the eye with the antenna, for example). Children could damage the modem or make calls that increase your modem bills.

2.11 Blasting areas

To avoid interfering with blasting operations, turn your unit OFF when in a "blasting area" or in areas posted: „turn off two-way radio". Construction crew often use remote control RF devices to set off explosives.

2.12 Potentially explosive atmospheres

Turn your STEPPII-55/56-LT device **OFF** when in any area with a potentially explosive atmosphere. It is rare, but your modem or its accessories could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fuelling areas such as petrol stations; below decks on boats; fuel or chemical transfer or storage facilities; and areas where the air contains chemicals or particles, such as grain, dust or metal powders.

Do not transport or store flammable gas, liquid or explosives, in the compartment of your vehicle, which contains your modem or accessories.

Before using your modem in a vehicle powered by liquefied petroleum gas (such as propane or butane) ensure that the vehicle complies with the relevant fire and safety regulations of the country in which the vehicle is to be used.

2.13 Non-ionizing radiation

As with other mobile radio transmitting equipment users are advised that for satisfactory operation and for the safety of personnel, it is recommended that no part of the human body is allowed to come too close to the antenna during operation of the equipment.

The radio equipment shall be connected to the antenna via a non-radiating 50 Ohm coaxial cable.

The antenna shall be mounted in such a position that no part of the human body will normally rest close to any part of the antenna. It is also recommended to use the equipment not close to medical devices as for example hearing aids and pacemakers.

2.14 Battery safety

Mistreating the battery may cause the battery to get hot, crack, or inflame and cause serious injury. In order to avoid any damage and extend the life expectancy of battery, please follow the safety rules listed below before using the **STEPPII-55/56-LT** device:

- *Do not place the device (battery) on, in or near fires, apparatus that provide heat, or other high-temperature locations. Do not place the device (battery) in direct sunshine, or use or store the battery inside cars in hot weather. Doing so may cause the battery to generate heat, crack, or*

inflame. Using the battery in this manner may also result in a loss of performance.

- *Do not connect the pin 14 on the 16-pin MOLEX connector to any positive pole of supply voltage.*
- *Do not disassemble the unit and modify the battery.*
- *Immediately discontinue use of the battery if, while using, charging, or storing the battery, the battery emits an unusual smell, feels hot, or appears abnormal in any other way.*

3 SAFETY STANDARDS

This GSM/GPS modem complies with all applicable RF safety standards.

The embedded GSM/GPRS/GPS modem meets the safety standards for RF receivers and the standards and recommendations for the protection of public exposure to RF electromagnetic energy established by government bodies and professional organizations, such as directives of the European Community, Directorate General V in matters of radio frequency electromagnetic energy.

4 TECHNICAL DATA

4.1 General specifications of terminal STEPPII-55/56-LT

❖ ***Power supply:***

- Supply voltage from +10.8 V to +32.0 V (absolute maximum ratings) suitable for direct connection to an automotive +12V or +24V DC supply. Shoul be proteced against over-voltage and over-current.

❖ ***Internal battery:***

- **C**onsists of a rechargeable Lithium-Ion battery with +4.2 VDC input charging circuit and a capacity of 850 Ah built-in in side the unit. Charging is conrtrolled externally. Pin 14 on the 16-pin MOLEX connector servers to start and stop charging of the battery.
- **D**efault operating time is approx. 5 hours after full charged.

❖ ***Temperature:***

- **N**ormal operation (without connected battery): -0 °C to +55 °C (see chapter **4.1.2** for further details)

❖ ***Evaluation kit:***

- **T**he STEPPII-55/56-LT Eval-Board is designed to test, evaluate and make basis configuration to enable remote monitoring/configuration of the FALCOM STEPPII-55/56-LT. It provides a sample configuration for application.

❖ ***Physical characteristics:***

- **S**ize: 55.0 ± 0.15 mm x 80.0 ± 0.15 mm x 22.0 ± 0.15 mm
- **W**eight: ca. 120 g

❖ ***Audio:***

- **2** x Microphone, 2 x Speaker

❖ ***Firmware upgrade:***

- **O**ver serial interface

❖ ***Serial Interface Setting:***

- **F**ull duplex serial communication, CMOS level
- **2**-wire (RxA and TxA) serial communication
- **B**aud rate: 57600 bps on the serial port
- 8 data bits, no parity, 1 stop bit, no hardware

❖ ***Casing:***

- **F**ully shield

4.1.1 Power consumption

Test conditions:

All measurements have been performed at T_{amb}= 25 °C, V_{IN+} = 12 VDC and 24 VDC.

Average current at +12 V DC				
GPS/GSM on (Operating with firmware 1.6.2)	850	1800/1900	MHz	GSM band
	105	105	mA	in idle mode (base station sends at -85 dBm)
	197	153	mA	in transmit mode at power level 7/3
	219	178	mA	in transmit mode at power level 5/0 (maximum)
GPS/GPRS on (Operating with firmware 2.X.XX)	To be defined		mA	in receive mode at maximum power level 5 (3 x downstream +2 x upstream using Coding Scheme 4 (CS-4))

Table 2: Power supply and current consumption at 12 V DC

Average current at +24 V DC				
GPS/GSM on (Operating with firmware 1.6.2)	850	1800/1900	MHz	GSM band
	75	75	mA	in idle mode (base station sends at -85 dBm)
	111	93	mA	in transmit mode at power level 7/3
	119	103	mA	in transmit mode at power level 5/0 (maximum)
GPS/GPRS on (Operating with firmware 2.X.XX)	To be defined		mA	in receive mode at maximum power level 5 (3 x downstream +2 x upstream using Coding Scheme 4 (CS-4))

Table 3: Power supply and current consumption at 24 V DC.

4.1.2 Operating temperatures

Parameter	**Min**	**Typ**	**Max**	**Unit**
Ambient temperature (according to GSM 11.10)	0	25	+55	°C
Charging temperature	0	25	+40	°C
Discharging temperature	0	25	+55	°C

Table 4: Operating temperature

4.2 Battery Technical Data

❖ ***Electrical characteristics***

- ***N***ominal voltage (V) 3.70
- ***T***ypical capacity 20°C (mA/h) 850 mA/h @ 4.2 V

❖ ***Operating conditions***

- ***C***harging method Constant Current /Constant Voltage (CCCV)
- Charging voltage 4.20V
- Charging current 1C max
- Charging low current C/100
- Charging temperature range 0°C to + 40°C
- Discharge current 1C max. continuous
- Discharge temperature range 0°C to +55°C

4.3 Technical specifications of GSM/GPRS engine*

❖ ***Frequency bands:***

- **T**ri band: GSM 850, GSM 1800, GSM 1900
- **T**ri band: EGSM 900, GSM 1800, GSM 1900
- **C**ompliant to GSM Phase 2/2+

❖ ***GSM class:***

- **S**mall MS

❖ ***Transmit power:***

- **C**lass 4 (2 W) at GSM850 and GSM900
- **C**lass 1 (1 W) at GSM1800 and GSM 1900

❖ ***GPRS connectivity:***

- **G**PRS multi-slot class 10
- **G**PRS mobile station class B

❖ ***DATA:***

GPRS ⇒

- **G**PRS data downlink transfer: max. 85.6 kbps (see table 3).
- **G**PRS data uplink transfer: max. 42.8 kbps (see table 5).
- **C**oding scheme: CS-1, CS-2, CS-3 and CS-4. TCP/IP and PPP-stack.
- ***STEPPII-55/56-LT*** supports two protocols PAP (Password Authentication Protocol) and CHAP (Challenge Handshake Authentication Protocol) commonly used for PPP connections.
- **S**upports of Packet Switched Broadcast Control Channel (PBCCH) allows you to benefit from enhanced GPRS performance when offered by the network operators.

CSD ⇒

- **C**SD transmission rates: 2.4, 4.8, 9.6, 14.4 kbps, non-transparent, V.110.
- ***U***nstructured Supplementary Services Data (USSD) support.

WAP ⇒

- ***W***AP compliant.

❖ ***SMS:***

- MT, MO, CB, Text and PDU mode
- SMS storage: SIM card plus 25 SMS locations in the mobile equipment
- Transmission of SMS alternatively over CSD or GPRS. Preferred mode can be user-defined.

❖ ***SIM interface:***

- **S**upport SIM card: 3 V

❖ ***External antenna:***

- **C**onnected via 50 Ohm antenna connector.

❖ ***Audio features:***

Speech codec modes:

- ***H***alf Rate (ETS 06.20)
- ***F***ull Rate (ETS 06.10)
- ***E***nhanced Full Rate (ETS 06.50/06.60/06.80)
- ***A***daptive Multi Rate (AMR)

Handsfree operation

- ***E***cho cancellation
- ***N***oise reduction

❖ ***Phonebook management:***

- Supported phonebook types: SM, FD, LD, MC, RC, ON, ME

❖ ***Ringing tones:***

- ***O***ffers a choice of 7 different ringing tones/melodies, easily selectable with AT command

❖ ***Real time clock:***

- ***I***mplemented

❖ ***Timer function:***

- ***P***rogrammable via SMS or $PSRF commands

Coding scheme	1 Timeslot	2 Timeslots	4 Timeslots
CS-1:	9.05 kbps	18.1 kbps	36.2 kbps
CS-2:	13.4 kbps	26.8 kbps	53.6 kbps
CS-3:	15.6 kbps	31.2 kbps	62.4 kbps
CS-4:	21.4 kbps	42.8 kbps	85.6 kbps

Table 5: Coding schemes and maximum net data rates over air interface

Please note that the values listed above are the maximum ratings which, in practice, are influenced by a great variety of factors, primarily, for example, traffic variations and network coverage.

* Please note that not all features given above (in this chapter) are utilized in our firmware.

4.3.1 Air interface of the STEPPII-55/56-LT GSM/GPRS part

Test conditions:

All measurements have been performed at T_{amb}= 25 °C, V_{IN+} nom = 12 V.

Parameter		Min	Typ	Max	Unit
Frequency range Uplink (MS → BTS)	GSM 850	824		849	MHz
	GSM 1800	1710		1785	MHz
Frequency range Downlink (BTS → MS)	GSM 1900	1850		1910	MHz
	GSM 850	869		894	MHz
	GSM 1800	1805		1880	MHz
	GSM 1900	1930		1990	MHz

RF power @ ARP with 50 Ω load	GSM 850	31	33	35	dBm
	GSM 1800	28	30	32	dBm
	GSM 1900	28	30	32	dBm
	GSM 850		124		
	GSM 1800		374		
	GSM 1900		299		dBm
Duplex spacing	GSM 850		45		MHz
	GSM 1800		95		MHz
	GSM 1900		80		MHz
Carrier spacing			200		kHz
Multiplex, Duplex		TDMA/FTDMA, FDD			
Time slots per TDMA frame			8		
Frame duration			4.615		ms
Time slot duration			577		µs
Modulation		GMSK			
Receiver input sensitivity @ ARP BER Class II < 2.4 %	GSM 850	-102	-107		dBm
	GSM 1800	-102	-106		dBm
	GSM 1900	-102	-105.5		dBm

Table 6: Air Interface

4.4 Technical specifications of GPS receiver

❖ ***GPS features:***

- **O**EM single board 12 channel GPS receiver, L1 1575.42 MHz, C/A code 1,023 MHz chip rate.
- **G**PS receiver with SiRFstarIIe/LP chip set
- **P**rocessor type ARM7/TDMI
- **S**iRF GSW2, version 2.20 (adapted for tracking solutions).

❖ ***Accuracy:***

- **P**osition 10 meters CEP without SA.
- **V**elocity 0.1 meters/second, without SA
- **T**ime 1 microsecond synchronized to GPS time

❖ ***DGPS Accuracy:***

- **P**osition 1 to 5 meters, typical
- **V**elocity 0.05 meters/second, typical

❖ ***Datum:***

- **W**GS-84.

❖ ***Acquisition Rate:***

- **H**ot start <8 sec, average
- **W**arm start <38 sec, average
- **C**old start <45 sec, average

❖ ***Dynamic Conditions:***

- **A**ltitude 18,000 meters (60,000 feet) max.
- **V**elocity <515 meters/second (1000 knots) max.
- **A**cceleration 4 g, max.
- **J**erk 20 meters/second³, max.

❖ ***Casing:***

- Fully shield

❖ ***Time – 1 PPS Pulse:***

- **L**evel CMOS.
- **P**ulse duration 100 ms
- **T**ime reference At the pulse positive edge
- **M**easurements Aligned to GPS second, ± µs

❖ ***Supported protocols:***

- **N**MEA Msg.: GLL, GGA, RMC, VTG, GSV, GSA

❖ ***External antenna:***

- **S**eparate GPS antenna connector. See figure 37 for details

❖ ***Memory:***

- **C**ombo-Memory (2 MB Flash–512 KB SRAM)

4.5 NMEA data message

The STEPPII-55/56-LT device delivers data in the NMEA-0183 format.

Table 7 lists each of the NMEA output messages supported by the STEPPII-55/56-LT evaluation receiver and a brief description. For further description about NMEA see Related documents[4].

Option	Description
GGA	Time, position and fix type data.
GLL	Latitude, longitude, UTC time of position fix and status.
GSA	GPS receiver operating mode, satellites used in the position solution and DOP values.
VTG	The number of GPS satellites in view satellite ID numbers, elevation, azimuth and SNR values.
GSV	The number of GPS satellites in view satellite ID numbers, elevation, azimuth and SNR values.
RMC	Time, date, position, course and speed data.

Table 7: NMEA Output Messages

5 FUNCTIONAL DESCRIPTION

5.1 How does it work

It can be powered from +10.8 to +32.0 VDC. It integrates a charging management, which allows attachment to a Li-Ion backup battery. If the battery voltage is going low, to charge it just supply the terminal (via VC+ and GND pins) with aforementioned power source (e.g. car battery). The user external connected battery is internally monitored. A circuit example is shown in the chapter 7.1.2.4. Attached battery allows operation of terminal for some hours (it depends on the capacity of user chosen battery pack) in case of operating voltage (i.e. car battery) failure.

A general-purpose terminal providing multiple digital/analogue inputs and outputs for a different variety of uses.

The STEPPII-55/56-LT provides 2 analogue inputs that are very convenient to monitor a tachometer generator, a temperature sensor as well fuel level etc. Circuit examples for digital inputs are attached on the chapter 7.1.2.1. It also provides 4 digital inputs that can be used to trigger alarm SMS (i.e. they can be connected to the car alarm, to a door switch or customer specific requirements (e.g.: Panic button)). Circuit examples for digital inputs are attached in chapter 7.1.2.2. 4 digital outputs are provided to switch on/off external devices. Circuit examples for digital outputs are attached in chapter 7.1.2.3.

Three other inputs are pre-defined by the manufacturer:

- 1 x Power Supply line → which has to be connected to the vehicle battery (clamp 30) or another power source.
- 2 x Ignition lines → which can be connected to the vehicle starter lock (clamp 15).

To use the STEPPII-55/56-LT you need to insert a SIM card (available for SMS, data and voice calls. The different services, i.e. Voice, Data and SMS depend on your application) and to install the terminal indoor at the supposed location (e.g. vehicle, boat etc.). STEPPII-55/56-LT comes with a combined GSM/GPS antenna. To achieve an accurate geographical location of STEPPII-55/56-LT, it is important to place the GPS antenna so that it has a clear view to the sky (no obstacle). The STEPPII-55/56-LT terminal is not water resistant, please; give careful consideration to the installation location of terminal. The configuration of the terminal can be done by using a serial interface connection (locally) or over GSM network (remotely) using SMS commands. *Note that*, in order to configure the STEPPII-55/56-LT remotely the basis configuration has to be executed locally. Once the basis configuration of the STEPPII-55/56-LT terminal is locally set and stored (using STEPPII-55/56-LT Eval-Board und Configuration software) then by means of provided SMS and PFAL input messages it can be remotely configured or the present configuration can be changed. You can then control it from a remote mobile phone via SMS. The GPS position or current configuration can be received by means of any GSM phone or PC connected to a GSM modem (able to send/receive SMS, data and voice calls). Thus, you will be able remotely to monitor the position of trucks, cars and boats (with a GSM/GPRS coverage) and to receive an alarm if the device has moved from a marked position (e.g. if your truck, car or boat has been stolen), deviates off a route or to detect if a car leaves a country.

The FALCOM STEPPII-55/56-LT comprises also two audio interfaces available on the provided connectors:

- Two analog audio interfaces, each with a balanced analog microphone input and a balanced analog earpiece output. Both analog interfaces provide supply circuits to feed active microphones.

This means you can connect up to two audio devices in any combination. An audio interface allows the direct connection of a headset. An example of a possible installation is shown in the Appendix of this manual. The voice channel of STEPPII-55/56-LT allows you to conduct a normal telephone conversation. For this, STEPPII-55/56-LT operates in free-speech mode. Requirements are to connect a loud speaker (pins 13 and 15) and a free-speech microphone (pins 14 and 16) on the 16-pin connector interface of the STEPPII-55/56-LT.

After that the terminal is connected to the aforementioned power supply, its actual status is displayed by two LED's on the front side of terminal.

STEPPII-55/56-LT device provides the following LED indicators		
Name	**LED mode**	**Function**
GSM (Green LED)	Off	Terminal is off or runs in SLEEP mode.
	600 ms On/600 ms Off	No SIM card inserted or no PIN entered, or network search in progress, or ongoing user authentication, or network login in progress.
	75 ms On/3 s Off	Logged to network (monitoring control channels and user interactions). No call in progress.
	75 ms On/75 ms Off/ 75 ms On/3 ms Off	One or more GPRS contexts activated.
	Flashing	Flashing Indicates GPRS data transfer: When a GPRS transfer is in progress, the LED goes on within 1 second after data packets were exchanged. Flash duration is approximately 0.5 s.
	On	On Depending on type of call: *Voice call:* Connected to remote party. *Data call:* Connected to remote party or exchange of parameters while setting up or disconnecting a call.
GPS (Yellow LED)	ON	Terminal is searching for satellites. Terminal receives invalid GPS position, no GPS fix obtained.
	Flashing (4 sec. interval)	Start-up GSM error (i.e. no SIM card inserted or incorrect PIN configuration or is not ready for operation).
	Continually flashing	Valid GPS data are being received, terminal has obtained a GPS fix and ready for use.

Table 8: Modes of the LED's and associated functions

5.2 FALCOM STEPPII-55/56-LT typical applications

The STEPPII-55/56-LT is a plug and play device that can be used as mobile client in a different variety of system solutions:

❖ **TRACKING**

The vehicle to be tracked is fitted with a STEPPII-55/56-LT and an antenna. GPS satellites are continuously transmitting information, including when the data is being sent, which satellite sent it and the current reliability of the system. The STEPPII-55/56-LT fitted in the vehicle, receives this

information from at least 4 satellites and carries out the necessary calculations to determine its current position.

- **AVL**

  The embedded GPS receiver into the STEPPII-55/56-LT determines its current location, speed and heading. This data can be stored or can be directly transmitted to a control centre. The terminal reports its position to the ***base station*** over GSM or GPRS (Internet) communications network. Current position can also be displayed on digital maps installed on PC/PDA.

- **SECURITY**

  Such as Telephone, Position, Speed/Course, Temperature, Remote reading, Alarm, Movement, Fire, Gas, Water level and many others.

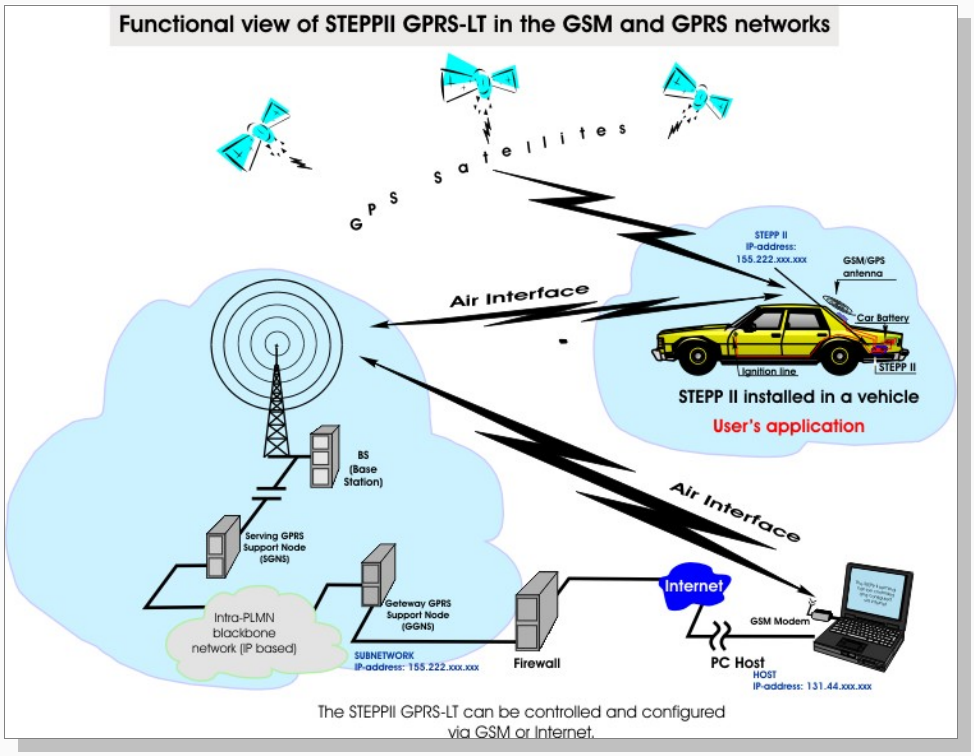
- **SETTING ALARM INPUTS**

  For each input several telephone numbers (destination numbers) can be configured. Beside the destination number, alarm text as SMS with the desired GPS protocol (max. 2 protocols) can be configured.

  The alarm type could also be voice, and data connection.

- **REMOTE MONITORING**

- **.....**



Normally the GPS antenna must be placed in a position where it can see the sky.. To get a valid position, the STEPPII-55/56-LT should get information from at least 3 satellites.

The STEPPII-55/56-LT supports two different kinds ofsoftware (known as "**firmware**").

- Depending on the configuration, the device exchanges data with a server application (e.g. Mapping-Software, etc.). STEPPII-55/56-LT can be configured by the user via local RS232-interface or remotely over the GSM (air link see diagram marked ❶). This configuration is based on the STEPPII-55/56-LT operating with firmware version 1.6.2. Please, refer to the issued manual "stepp_II_software_1.6.2_manual.pdf".
- STEPPII-55/56-LT terminal supports also a firmware that uses TCP/IP stack and PPP protocol. It is an independent-customized software that provides even greater performance and flexibility for its users and system integrators to develop high-performance applications. The concept of the device is based on a simple implementation for a wide range of applications with low costs and high flexibility. The software enables you to implement applications, to track, control and monitor STEPPII-55/56-LT devices, as well as to set and poll the configuration remotely via SMS, data call or over Internet form a remote server. The software comprises a set of word-like commands termed "**PFAL**". Each of these causes the terminal STEPPII-55/56-LT either to take a particular action or to read, set a particular configuration. The software provides the basic configuration settings needed when the system starts up and used as starting points for the creation of user applications. The development of user applications is based on the advanced event-handling features provided by the operating software. Events may be individually configured to be sent back GPS position data or any other information. The exact point at which you configure the STEPPII-55/56-LT depends on the application you want to develope. Events are triggered automatically at system run-time and manually when an input changes. For more information, please refer to the manual "stepp_II_software_2.4.xx_manual.pdf".

6 STEPPII-55/56-LT APPLICATION INTERFACE

6.1 Power supply

The power supply for the STEPPII-55/56-LT terminal has to be a single voltage source of V_{VC+} = +10.8 V...+32.0 VDC. It must be able to provide sufficient current in a transmit GSM burst which typically rises to 1.6 A. The operating voltage (V_{VC+} and GND) is protected from reverse pole connection as long no ground antenna and/or an AMP connector is NOT connected to the STEPPII-55/56-LT.

All the key functions for supplying power to the device are handled by an ASIC power supply. The ASIC provides the following features:

- Stabilizes the supply voltages for the GSM base band using low drop linear voltage regulators.
- Controls the module power up and power down procedures.
- A watchdog logic implemented in the base band processor periodically sends signals to the ASIC, allowing it to maintain the supply voltage for all digital components of STEPPII-55/56-LT GSM/GPRS core. Whenever the watchdog pulses fail to arrive constantly, the terminal is turned off.
- Provides power to the SIM interface, digital outputs and handsfree set.

Keep in mind that, operating voltage (VVC+) has to be permanently applied to the terminal, because of several STEPPII-55/56-LT components such as digital outputs and handsfree-set do not operate only from the external battery. These components are operational as long as the main power (VVC+) is applied to the STEPPII-55/56-LT terminal.

6.1.1 Power up/down scenarios

In general, be sure not to turn on the STEPPII-55/56-LT terminal module while it is out of the operating range of voltage and temperature stated in Table 11 and Table 4. The STEPPII-55/56-LT terminal would immediately switch off after having started and detected these inappropriate conditions.

6.1.2 Power supply pins (14, 15 and 16) on the 16-pin connector

One VC+ pin of the 16-pin connector is dedicated to connect the supply voltage, 3 GND pins are recommended for grounding.

The BAT ON/OFF pin serves for charging the internal Li-Ion battery.

Signal name	I/O	Parameter	Description
VC+	I	+10.8 V...+32.0 VDC, I_{typ} ≤ 1.6 during transmit burst. The minimum operating voltage must not fall below +10.0 VDC, not even in case of voltage drop.	Positive operating voltage.
GND	-	0 V	Ground
BAT ON/OFF	I	Pull to ground (GND) to charge the internal Li-Ion battery. Leave it open to stop charging.	Except ground planes, newer connect this line to any power supply voltage.

6.1.3 Automatic shutdown

Automatic shutdown takes effect if:

- the STEPPII-55/56-LT board is exceeding the critical limits of over or under temperature.

- the battery is exceeding the critical limits of over or under temperature.
- under voltage is detected.

The automatic shutdown procedure is equivalent to the power-down initiated, i.e. STEPPII-55/56-LT logs off from the network and the software enters a secure state avoiding loss of data.

6.1.3.1 Over voltage shutdown

For over voltage conditions, no hardware and software controlled shutdown is implemented. If the supply voltage exceeds the maximum value specified in Table 11, loss of data and even unrecoverable hardware damage can occur.

6.1.4 Charging & Discharging process of the battery

When the battery voltage reaches 4.2 volts per cell, the charging current is decreased to maintain a constant terminal voltage of 4.2 volts per cell. Charging will be terminated after the battery reaches full capacity, which approximately takes 5-7 hours. During this time the unit can also be used, but note that, the battery's capacity must be higher then 3.8 V.

Keep in mind, the extreme temperatures have an unfavourable influence on the rechargeable batteries. The capacity and life cycle of the batteries are reduced if they are kept at cold or warm places, e.g. in a closed car at summer or winter conditions. Try always to keep the included battery at normal temperatures between 10°C and 25°C. Outside this range, a decrease in battery performance may result. The terminals STEPPII-55/56-LT with a too cold or too warm battery does not temporarily operate sometimes, even if the battery is completely charged. Especially, the achievement of battery is strongly reduced at temperatures under the freezing point.

6.2 Automatic GPRS Multislot Class change

Temperature control is also effective for operation in GPRS Multislot class 10. If the board temperature exceeds the specified limit (*see 4.1.2 for temperature limits known as restricted operation*) while data are transmitted over GPRS, the module automatically reverts from GPRS Multislot class 10 (3 RX x 2 TX) to class 8 (4 RX x 1 TX). This reduces the power consumption and, consequently, causes the temperature of board to decrease. Once the temperature drops to a value of 5 degrees below the limit of restricted operation, STEPPII-55/56-LT returns to the higher Multislot class 10. If the temperature stays at the critical level or even continues to rise, STEPPII-55/56-LT will not switch back to the higher class. After a transition from Multislot class 10 to Multislot class 8 a possible switchback to Multislot class 10 is blocked for one minute. Please, note that there is no one single cause of switching over to a lower GPRS Multislot class. Rather it is the result of an interaction of several factors, such as the board temperature that depends largely on the ambient temperature, the operating mode and the transmit power. Furthermore, take into account that there is a delay until the network proceeds to a lower or, accordingly, higher Multislot class. The delay time is network dependent. In extreme cases, if it takes too much time for the network and the temperature cannot drop due to this delay, the terminal may even switch off.

6.3 Determining the External Equipment Type

Before you connect the serial port pins on the aforementioned terminals (DCE units) to external equipment, you need to determine if the external hardware serial ports are configured as DTE or DCE.

The FALCOM STEPPII-55/56-LT is designed for use as a DCE. Based on the aforementioned conventions for DCE-DTE connections it communicates with the customer application (DTE) using the following signals:

STEPPII-55/56-LT Terminal (DCE)	to	Application (DTE)
RxA	<----------	TXD
TxA	---------->	RXD

Table 9: The signalling definitions between DTE and DCE.

7 HARDWARE INTERFACES

This chapter describes the hardware interfaces:

- pinout on the 16-pin (Molex) connector
- pinout on the 15-pin (AMP) connector
- RF interfaces
- SIM interface
- LED's indicator

Interface specifications	
Interface A	16-pin Molex 43045-1609
Interface B	SIM card reader for small SIM cards (3V)
Interface C	GPS RF Connector 50 Ω Fakra/Radiall (SMB-Male)
Interface D	GSM RF Connector 50 Ω Fakra/Radiall (SMB-Male)
Interface E	15-pin AMP 5-558556-1
Interface F	Optical LEDs, GSM/GPS operating state

Table 10: Interface specifications

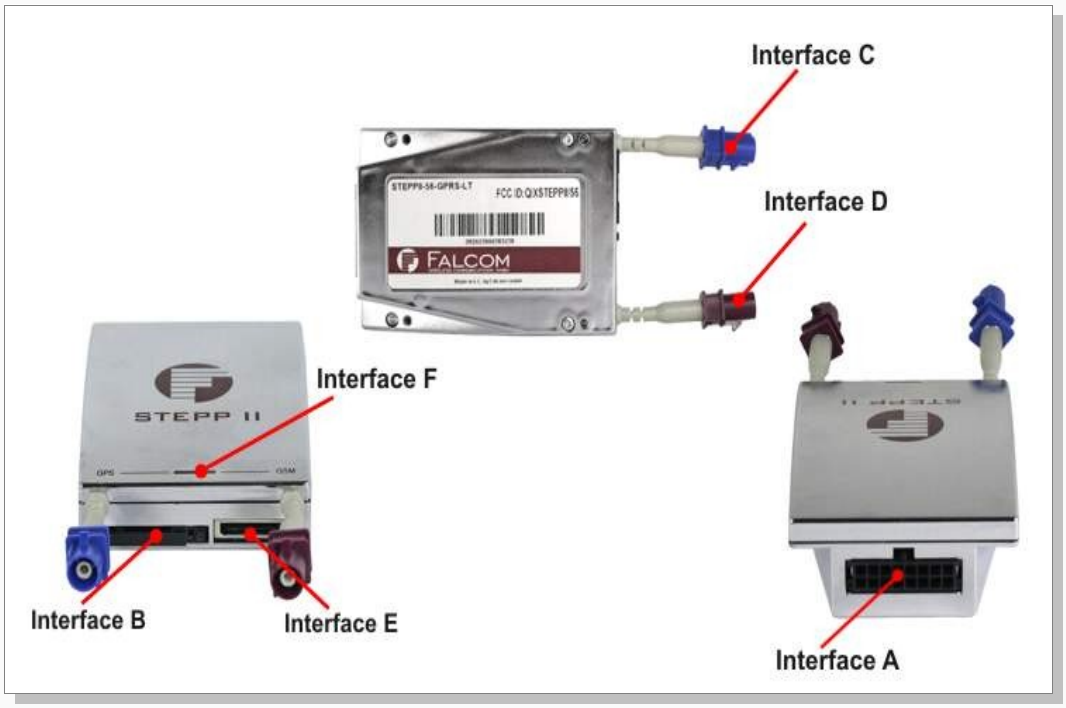


Figure 3: Interface specifications

7.1 Interface A (16-pin Molex 43045-1609)

Figure 4: View of the 16-pin Molex 43045-1609 connector pin assignments

7.1.1 Description of the 16-pin connector

PIN	NAME	I/O	DISCRIPTION	LEVEL
1	MIC N1	I(-)	Balanced microphone input. Can be used to directly feed an active microphone. If not used leave it open.	R_I ≈ 50 kΩ differential V_{Imax} = 20 mVpp
3	MIC P1	I(+)		
2	Analog Input 2	I	General propose analog inputs.	up to 32 V DC/8 bit resolution
4	Analog Input 1	I		
5	Out_2	O	Open collector outputs.	300 mA max. at +10.8 .. +32V DC
7	Out_1	O		
9	Out_3	O		
11	Out_4	O		
6	Inp_4	I	General propose inputs.	HIGH ≥+10.8 .. +32 V DC LOW = 0V
8	Inp_3	I		
10	Inp_2	I		10.8 .. 32 V DC
12	Inp_1	I		
13	IGN	I		
14	BAT ON/OFF	I/O	Charging control pin which has to be pulled to ground when the internal battery should be charged, otherwise left it open. **Never onnect this pin to power supply (V+).**	When pulled to GND the device starts charging the battery, otherwise if its is left open the device stops charging the battery.
15	VC+	I	Power supply input (Input 7). The power supply must be able to meet the requirements of current consumption in a Tx burst (up to 2 A). Sending with two timeslots doubles the duration of current pulses to 1154 µs (every 4.616 ms)!	V_I = +10.8 ... +32.0 V ±5 % I_{max} ≤ 2 A (during Tx burst) 1 x Tx, peak current 577 µs every 4.616 ms 2 x Tx, peak current 1154 µs every 4.616 ms
16	GND	-	Negative operating voltage (ground).	0 V

Table 11: Pin description of 16pin Molex connector

7.1.2 Special pin description

7.1.2.1 Analog inputs (pin 2, 4)

Analog voltages up to 32 V with 8 bit resolution can be processed and remotely evaluated by a server application. Pull-up resistor to a constant input voltage allows for resistive transducers to ground, e.g. fuel sensor or thermistors.

↓ CONNECTION EXAMPLE FOR ANALOG INPUT 2:

Thus, pin 2 (analog input 2) can be connected to a temperature sensor (a NTC resistor for instance). It is possible to set a low temperature alarm and a high temperature alarm (upper and lower values), passed to required temperature. Passage through these thresholds will trigger an alarm. We recommend to use SMS as alarm type with the protocol GPIOP (SMS including voltage values and text. It depends on the user configuration). The SMS can be received on a mobile phone, modem or any GSM device, see illustrated example in figure below:

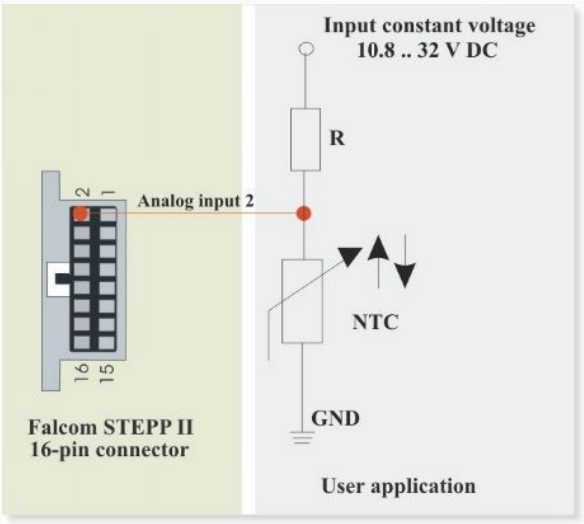


Figure 5: Connection example for analog input 2

↓ CONNECTION EXAMPLE FOR ANALOG INPUT 1:

Likewise, on pin 4 (analog input 1) you can install a tachometer generator. Its functionality is just like pin 2 (analog input 2). The maximum output voltage of the tachometer is +32 V (see illustrated example in figure below).

- Both circuit examples (the NTC (above) and the Tachometer) are only illustrations to show the aim of the analog inputs.

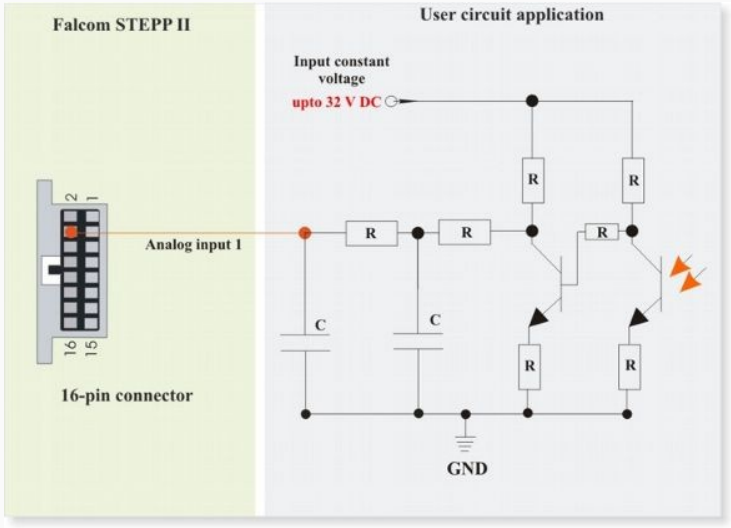


Figure 6: Connection example for analog input 1

7.1.2.2 *Inputs (pin 6, 8, 10, 12)*

The inputs (pin 6, 8, 10, 12) on the 16-pin connector are high active so they can be connected to +10.8 ... 32 V DC. The figure below illustrates how to connect these inputs. If one of the connected pins (inputs) is activated (for at least 1 sec), STEPPII-55/56-LT will release an alarm (SMS, Voice or data connection). The alarm type and the alarm text (alarm type SMS) depend on the configuration done by the user. The inputs can be configured by using the configuration software (Configurator_2.2). All inputs reserved for customer specific applications can be connected as shown below:

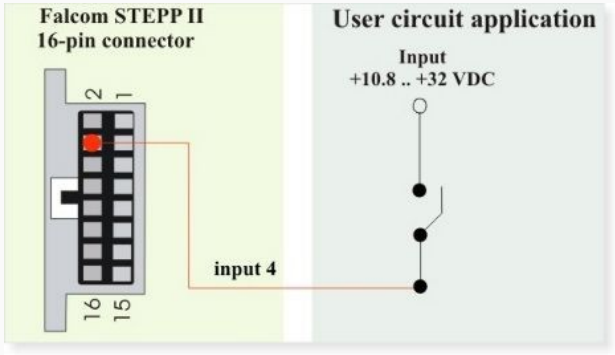


Figure 7: Connection example for input 4

A completed circuit example for all inputs is attached in section 11.1.1.

7.1.2.3 Outputs (pin 5, 7, 9, 11)

The STEPPII-55/56-LT supports four outputs. These can be set remotely by the server application. The figures below show the schematic of possible output connections.

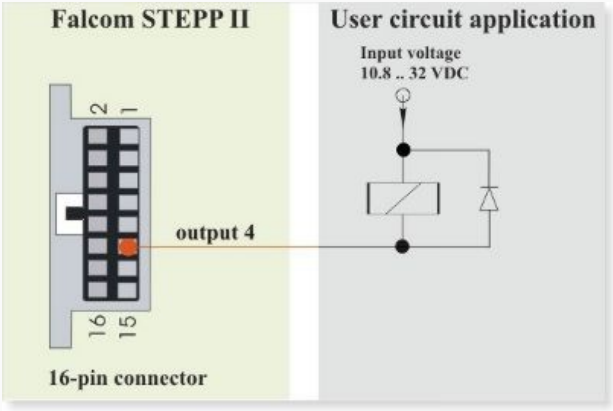


Figure 8: Connection example 1 for output 4 (Relay)

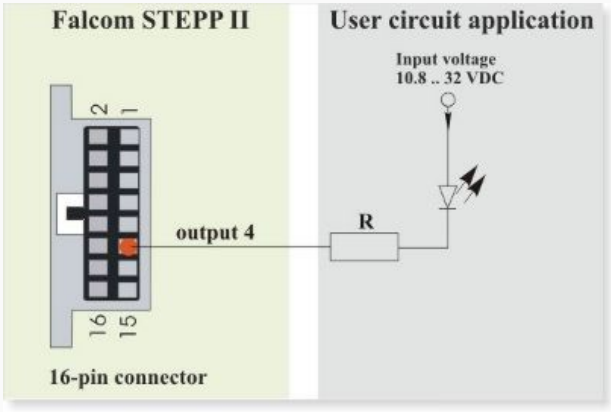


Figure 9: Connection example 2 for output 4 (LED)

A completed circuit example for all outputs is attached in section 11.1.1.

7.1.2.4 BATT ON/OFF (pin 14)

The charging algorithm is optimized for the built-in Li-Ion battery pack. The Li-Ion battery integrated into your STEPPII-55/56-LT unit contains following specifications.

- Li-Ion battery pack specifies a maximum charging voltage of 4.2 V and a capacity of 850 mAh.
- The charging current is limited to 450 mA.
- The battery incorporates a protection circuit capable of detecting over voltage (protection against overcharging), under voltage (protection against deep discharging) and over current.
- The internal resistance of the battery is smaller then 150 mΩ. The battery cell is insensitive to rupture, fire and gassing under extreme conditions of temperature and charging (voltage, current).
- The battery pack is approved to satisfy the requirements of CE conformity.

If the STEPPII-55/56-LT is not in use for a long time (e.g. warehouse) the BATT ON/OFF - pin should be left open.

CAUTION: 1) PLEASE, KEEP IN MIND THAT THE PIN (BATT ON/OFF) HAS IN NO CASE TO BE CONNECTED NEITHER TO THE OPERATING VOLTAGE (V_{VC+}) PIN NOR TO ANY EXTERNAL POWER SOURCE.

2) CHARGING PROCESS CAN ONLY BE ACCOMPLISHED IN A TEMPERATURE RANGE FROM 0 °C TO +40 °C, TYPICALLY 15 TO 25 °C.

THE EXTREME TEMPERATURES HAVE AN UNFAVOURABLE INFLUENCE ON THE RECHARGEABLE BATTERIES. THE CAPACITY AND LIFE CYCLE OF THE BATTERIES ARE REDUCED IF THEY ARE KEPT AT COLD OR WARM PLACES, E.G. IN A CLOSED CAR AT SUMMER OR WINTER CONDITIONS. TRY ALWAYS TO KEEP THE CONNECTED BATTERY (STEPPII-55/56-LT) AT NORMAL TEMPERATURES BETWEEN 15 °C AND 25 °C.

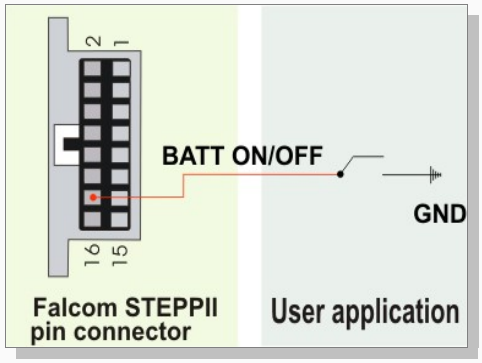


Figure 10: BATT ON/OFF pin connection example.

7.1.2.5 Ignition (pin 13)

STEPPII-55/56-LT provides two Ignition pins (pin 13) on the Molex and AMP connectors. Their functionality is the same. The vehicle ignition line (starter lock clamp 15) can be connected to one of the IGN pins of terminals (Pin 13). Thus, it is possible to send an alarm SMS (by starting the car engine), prerequisite, the input IGN of the STEPPII-55/56-LT should be configured for this purpose. Both pins 13 on the Molex connector and AMP connector are internally connected with each other, so they can be alternatively used. For more information see the corresponding figure in chapter 11.1.1.

Note that the STEPPII-55/56-LT's IGN pins are not assumed to switch on the STEPPII-55/56-LT terminal, they are only input pins, which can be used for specific customer requirements.

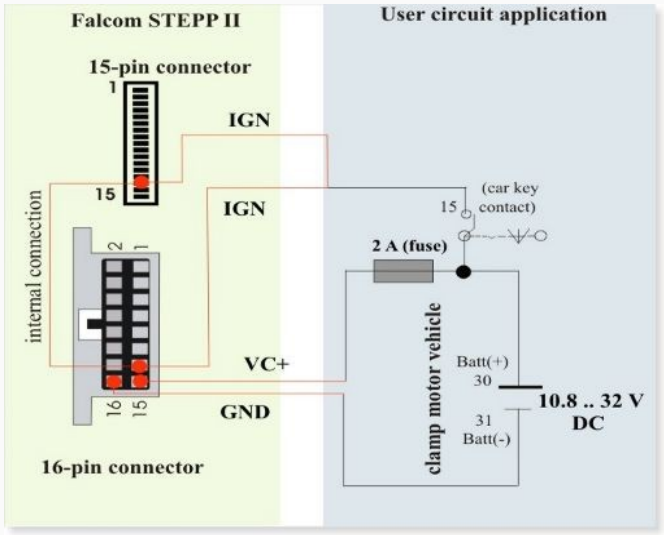


Figure 11: Ignition connection example

7.2 Interface B (SIM card interface Molex-91228-0002)

The figure below shows the SIM card reader interface of the STEPPII-55/56-LT.

Figure 12: View of the SIM card interface

The SIM interface controls an internal small 3 V SIM card. This interface is fully compliant with GSM 11.11 recommendations concerning SIM functions.

Note: *The SIM should not be removed, while the module is powered on. The SIM must only be removed when the STEPPII-55/56-LT is shut down. To remove the SIM card press the Eject button (see figure 12) then pull out the SIM card holder.*

Note: *The unit is not designed for use of single 5 V SIM cards. These cards will generate an error which cannot be distinguished from a faulty SIM card.*

7.3 Interfaces C and D

The STEPPII-55/56-LT is fitted with two male SMB FAKRA connectors that accept a wide variety of GSM/GPS antenna styles. One of them (right) (see figure below), is provided for GSM RF connection. The GSM RF connector has an impedance of 50 Ω. A GSM antenna can be directly connected to this connector.

The other left-one is provided for GPS RF connection. The GPS RF connector (see figure below) has an impedance of 50 Ω. Active antennas have an integrated low-noise amplifier. They can be directly connected to this connector. The integrated low-noise amplifier of the antenna is internally supplied with the specified voltage.

FALCOM GmbH provides a combined GSM/GPS antenna, especially, for the STEPP devices, the GSM antenna operates on four frequencies: GSM 850 MHz and DCS 1800/1900 MHz. The GPS antenna operates on 1575.42 MHz frequency. This antenna is suitable for mounting, covertly if required, in various locations.

The order name of combined GSM/GPS antenna is: **FAL-ANT-5**

☝ **In order to operate properly the GPS part, it is recommended the GPS active antenna should not exceed 25 mA. The antenna voltage is supplied internally. The GPS antenna is protected from reverse pole connection.**

The figure below shows the position of GSM/GPS connectors.

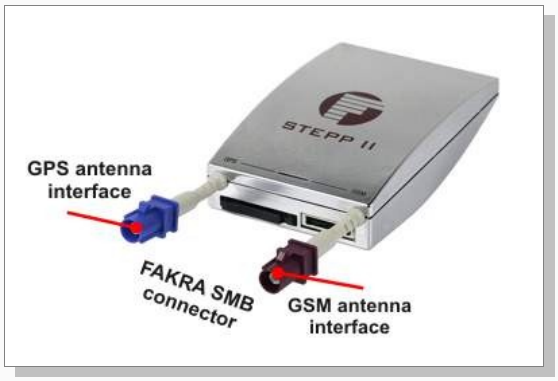


Figure 13: View of the GSM/GPS antenna cable.

Both GSM/GPS antenna cables with their FAKRA connectors are connected to STEPPII-55/56-LT. Both GSM and GPS antenna cables have the same length.

7.4 Interface E (AMP 558556-1 Connector)

Figure 14: View of the 15-pin AMP5-558556-1 connector pin assignments

CAUTION INSERT THE 15-PIN AMP ADAPTER KINDLY INTO THE AMP SLOT OF TERMINAL. FORCING THE ADAPTER MAY DAMAGE THE CONNECTOR PINS. IF YOU FEEL ANY RESISTANCE WHILE INSERTING THE ADAPTER INTO THE AMP SLOT OF TERMINAL, REMOVE IT IMMEDIATELY AND CHECK FOR ANY DAMAGE OF ITS CONNECTOR OR BEND PINS.

7.4.1 The 15- pin connector description

PIN	NAME	I/O	DISCRIPTION	LEVEL
1	GND	-	Negative operating voltage (grounds).	0 V
2	GND	-		0 V
3	SPK N1	O(-)	Analogue audio interface. Balanced audio output. Can be used to operate directly an earpiece. This audio interface is without amplifier. If not used leave it open.	V_{Omax} = 1.3 Vpp
4	SPK P1	O(+)		
5	VC 5	O	Power supply output. Can be used to supply external equipment which requires the same voltage level.	100 mA at 5 V ± 5% VDC
6	VB		Battery controller	

7	MIC N2	I(-)	Balanced microphone input. Can be used to feed directly an active microphone. If not used leave it open.	R_I ≈ 50 kΩ differential V_{Imax} = 20 mVpp
8	MIC P2	I(+)		
9	SPK N2 with amplifier	O	Analogue audio interface. Balanced audio output. Can be used to operate directly an earpiece. If not used leave it open.	8 Ω/1 W
10	SPK P2 with amplifier	O		
11	Boot select	I	STEPPII-55/56-LT boots in debug mode if this pin is set to low. Connect it to GND in case of firmware update. For normal operation leave it open.	0 V (ground)
12	NC	-	Not connected	-
13	IGN2	I	Input 8	+10.8 ... +32 V
14	RxA RS232	O	Serial interface for direct connection to the host PC (configuration, evaluation, receiving data and others) or to the STEPPII-55/56-LT Eval-Board. If not used leave open.	V24, ±12 V
15	TxA RS232	I		

Table 12: Pins description of 15-pin AMP connector

7.4.2 Special pin description

7.4.2.1 VC 5

This output can be used to power some external functions. VC 5 has to be used as a power supply for external user applications which require 100 mA at 5 V ± 5% VDC. This power supply is available when the terminal is switched on. To use this pin see chapter 11.1.2.

7.4.2.2 Boot select

To update a new STEPPII-55/56-LT firmware, this pin should be switched to GND (ground). Leave it open for a normal STEPPII-55/56-LT operation (tracking, call, etc.).

7.4.2.3 Serial communication signals (RxA, TxA)

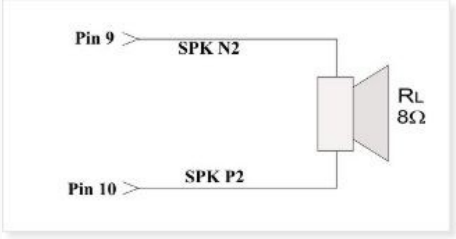
The board supports a full duplex serial channel. The serial connection is at V24, ±12 V level. You do not need to use any level shifter. The signals on these pins are obtained to RS232 compatible signal levels. All supported variable baud rates can be controlled from any terminal software. You can directly communicate with a PC serial port. It is recommended to use the STEPPII-55/56-LT Eval-Board in order to communicate with theterminal.

RxA — This is the main receiving channel and is used to receive software commands to the board from any terminal software (e.g. HyperTerminal) or from user written software.

TxA — This is the main transmitting channel and is used to output navigation and measurement data to any terminal software (e.g. HyperTerminal) or user written software.

7.4.2.4 Speaker outputs characteristics

A speaker can be connected directly to the pin 9 and pin 10. The standard level is 8 Ω/1 Watt.



PIN	NAME	DESCRIPTION	LEVEL
9	SPK N2 with amplifier	Speaker 2 negative output	8 Ω/1 W
10	SPK P2 with amplifier	Speaker 2 positive output	8 Ω/1 W

Table 13: Description of recommended speaker characteristics.

7.5 Interface F (LED's description)

The actual state of the STEPPII-55/56-LT is displayed by two LED's on the interface D of the terminal.

The following description shows the function of these LED's.

Figure 15: View of the GSM/GPS LED's

Two LEDs show the actual state of the STEPPII-55/56-LT terminal:

- **Red** (Battery): Battery status and ambient temperature (about its functionality see Table 8).
- **Green** (GSM): GSM network status (about its functionality see Table 8).
- **Yellow** (GPS): GPS status (about its functionality see Table 8).

7.6 Interface E (Mounting holes)

The STEPPII-55/56-LT compact terminal provides 4 holes for attaching it to the suitable cradle. As a reference for mounting holes use figure 16 below in this section. The cradle is available in the sales package.

In order to avoid any damage during mounting of the terminal is required to use (choose if the screws are damaged) properly the screws delivered with STEPPII-55/56-LT. Fasteners are 22 x 6 mm screws plus suitable washers, or customized screws.

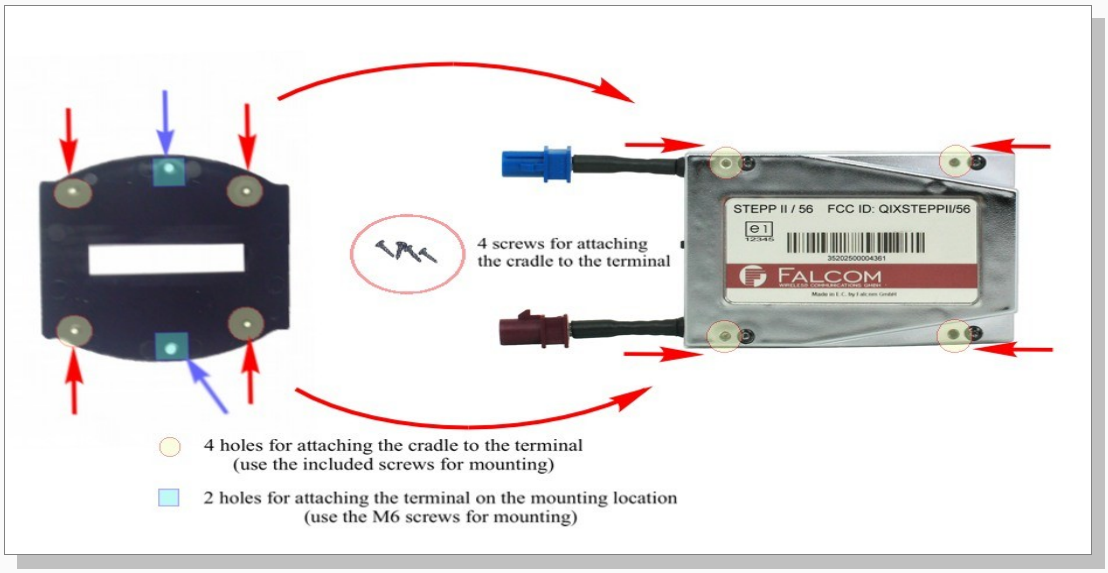


Figure 16: View of the mounting holes

7.6.1.1 Mounting the cradle to the terminal

Figure 17: Attached cradle to the terminal.

In order to avoid any damage during mounting, place the terminal (if needed) on the cradle and push it up/down until you see both terminal and cradle holes are facing each other. Screws must be inserted with the screw head on the bottom of cradle through to the provided holes on the bottom of the STEPPII-55/56-LT. Use a suitable screwdriver to perform the rotation. Screw up kindly the appropriate screws. To avoid short circuits ensure that the customized screws (screws with different length) do not come into contact with the STEPPII-55/56-LT PCB since there are a

number of test points. Make sure that the STEPPII-55/56-LT does not move up and down inside the cradle.

After you have secured up the cradle to the terminal, choose the mounting location (see next section). The terminal can be mounted in different locations on a wall or vehicle, metal or non-metal sheets. It depends on the user's application. As a reference for mounting holes use figure 16 (blue colour).

7.6.1.2 Placing the terminal

CAUTION: IN ORDER TO COMPLY WITH RF EXPOSURE REQUIREMENTS, INSTALL THE TERMINAL SO THAT A MINIMUM DISTANCE OF 20 CM CAN BE MAINTAINED BETWEEN THE ANTENNA AND PERSONS. IF YOU USE AN EXTERNAL ANTENNA, INSTALL THE ANTENNA SO THAT A MINIMUM DISTANCE OF 20 CM CAN BE MAINTAINED BETWEEN THE ANTENNA AND PERSONS, WITH ANTENNA GAIN NOT EXCEEDING 3 DBI.

1. Place mounted terminal in a proper location:
2. The mounting location must be chosen far enough from electronic devices so that no interference takes place. Please, contact your vehicle supplier for more information.
3. Make sure the screws are suitable for mounting plate.
4. Drill appropriate screws (M6) the two indentations on the cradle.
5. Secure the cradle and terminal and firmly fixed on the selected mounting place.

   ☝ All radio-transmitting devices send signals, which may cause interference in different electronic devices (PC, television or electronic devices etc). To avoid interference, place the terminal far enough from other electronic devices.

8 HOUSING

The housing material: Galvano-ABS, gloss-chromium-plated.

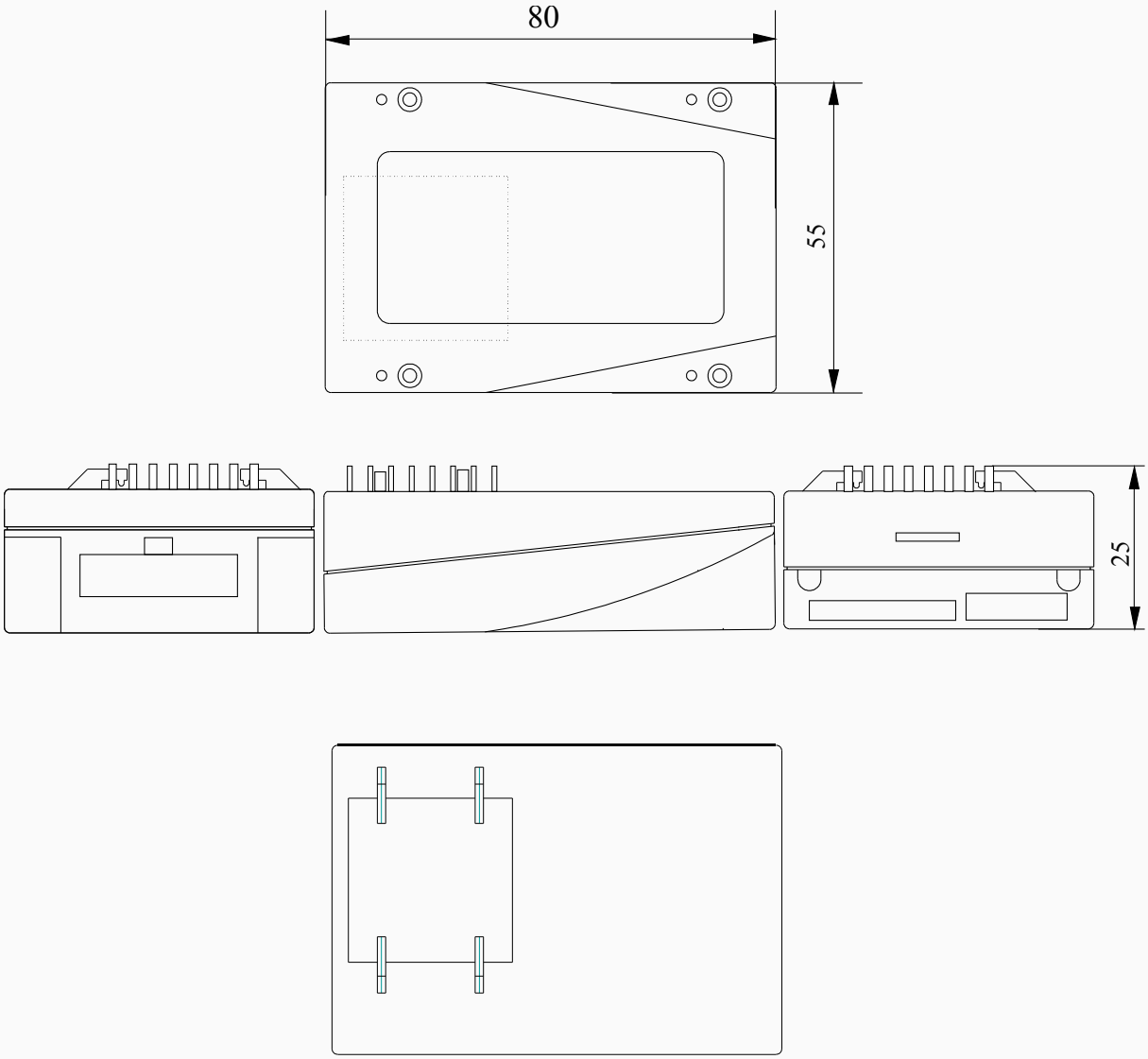


Figure 18: Housing of the STEPPII-55/56-LT.

9 STEPPII-55/56-LT-MOUNTING CRADLE

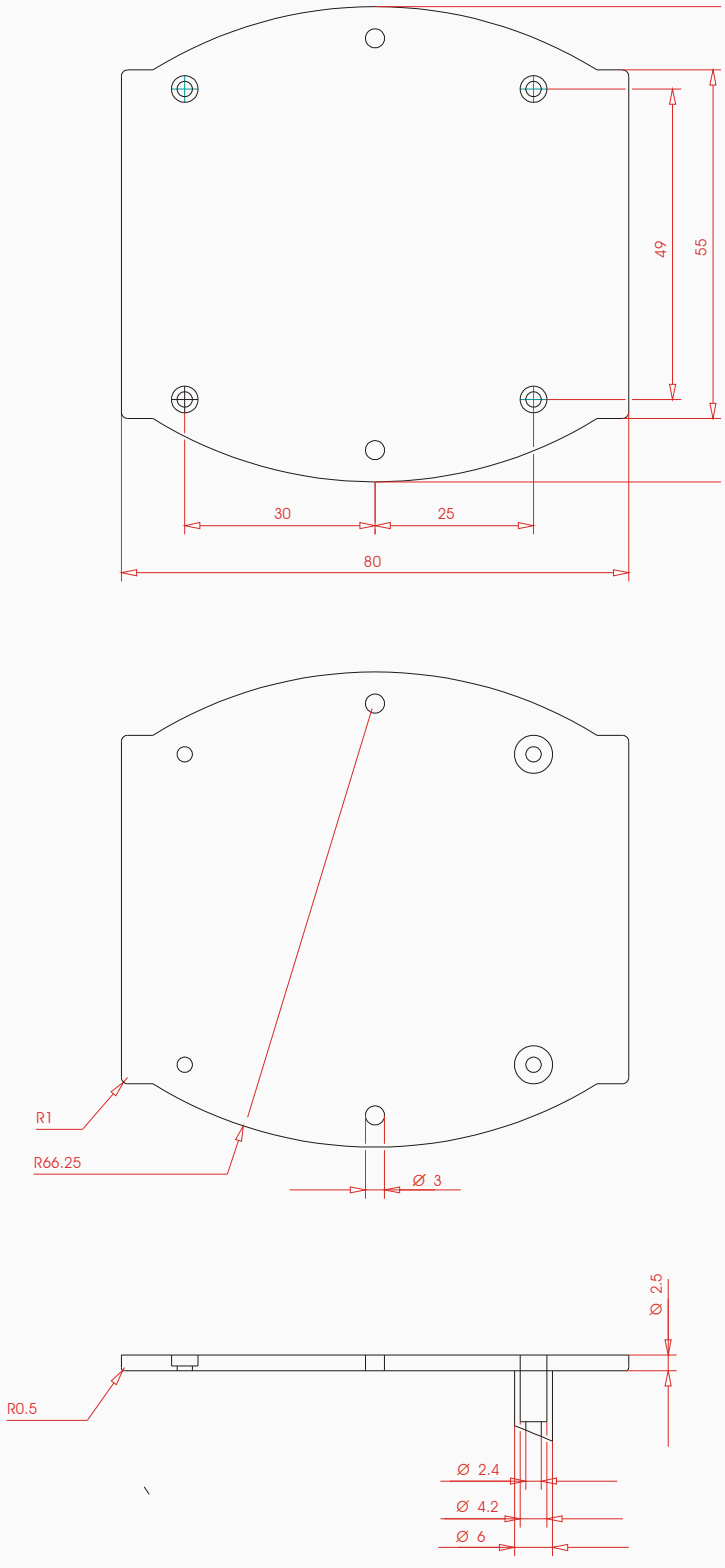


Figure 19: Mounting cradle of the STEPPII-55/56-LT

10 RF EXPOSURES

This device contains 850/1800/1900 MHz GSM/GPRS functions that are operational in these frequencies respectively.

The following statements according to the FCCs are applied for the STEPPII-55/56-LT. However, the STEPPII-55/56-LT terminal contains 1800 MHz GSM functions that are not operational (must not be used) in U.S. Territories. This filing is only applicable for 850MHz GSM/1900 MHz PCS operations, whereby only these frequencies (850MHz GSM/1900 MHz PCS) are possible to be used in U.S. Territories.

The external antennas used for this mobile transmitter must provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Statement according to FCC part 15.19:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

Statement according to FCC part 15.21:

Modifications not expressly approved by this company could void the user's authority to operate the equipment.

Statement according to FCC part 15.105:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help

11 APPENDIX

11.1 Schematics

The figures below illustrate the recommended schematics for the connection of the 16-pin Molex and 15-pin AMP connectors.

11.1.1 Installation guidance for 16-pin Molex connector

On the top of the schematic the corresponding pin out of the 16-pin Molex connector can be found.

A general purpose terminal providing multiple digital and analogue inputs as well as outputs for a variety of uses.

The STEPPII-55/56-LT comprises 7 inputs, 4 outputs and 2 analog inputs.

Of the 7 inputs, 4 inputs are free available for the user application. Three of the inputs are predefined by the manufacturer as below:

- **1 x Power supply** → which has to be connected to the vehicle battery (clamp 30).
- **2 x Ignition lines** → one from them can be connected to the vehicle starter lock (clamp 15). It can be used to trigger an alarm SMS when clamp 15 (ignition contact) of the vehicle is closed (engine of vehicle started). These pins are not provided to switch ON/OFF the STEPPII-55/56-LT terminal.

4 digital inputs can be used to trigger any alarm type (SMS, voice or data), i.e. they can be connected to the car alarms or to a door switch, etc.

4 digital outputs are useful to switch remotely ON/OFF an external device. A schematic below in this section shows how digital inputs/outputs can be used.

Note that all provided outputs have to be used on the same level to the operating voltage (V_{VC+}).

4 digital outputs are useful to switch remotely ON/OFF an external device. A schematic below in this section shows how digital inputs/outputs can be used.

Note that, the outputs of the STEPPII-LT and VC+ must be on the same voltage level when they operate.

STEPPII-LT device is not protected against over-voltage and over-current. The operating voltage range must never be exceeded. The positive wire of the STEPPII-LT (input power supply) must always be protected manually with a 2A fuse at +10.8 … +32 VDC. See circuit diagram below.

Please note that, all ground pins of the STEPPII-LT unit should be isolated from the vehicle body to avoid ground loops.

CAUTION IF YOU USE A GROUND-MOUNTED ANTENNA, TO AVOID ANY FAULT CURRENT ENSURE THAT ANTENNA GROUND DOES NOT COME INTO CONTACT WITH VEHICLE BODY. PLEASE, DOUBLE-CHECK ALL GROUNDS AND OTHER USED LINES WHETHER THEY ARE ISOLATED FROM VEHICLE GROUND.

A microphone can be connected to pin 1 and pin 3 of the 16-pin Molex connector. The figure 20 shows an example for the installation of the STEPPII-I/O's in a motor vehicle.

A microphone can be connected to pin 1 and pin 3 of the 16-pin Molex connector. The figure 20 shows an example for the installation of the STEPPII-55/56-LT-I/O's in a motor vehicle.

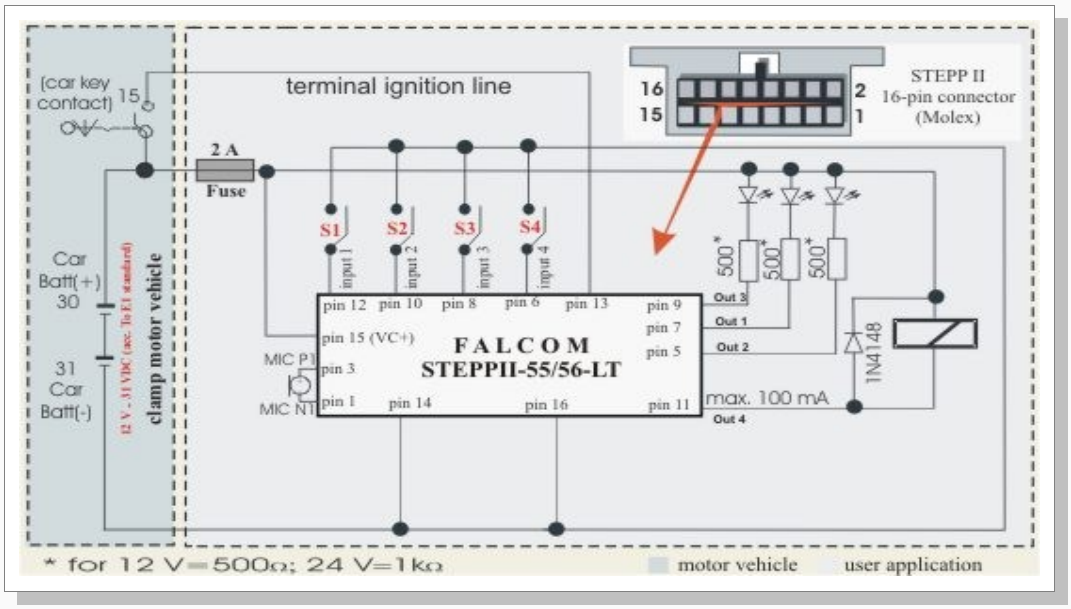


Figure 20: Schematic example of installation guidance

11.1.2 Installation guidance for 15-pin AMP connector

Figure 21 shows an example of an installation that enables voice communication. STEPPII-55/56-LT supports two differential microphone inputs and two differential speaker outputs. The integrated amplifier allows direct connection of a Hands-Free-set to Pin 9 and Pin 10.

Please, note that the integrated audio interfaces are predefined on the embedded internal firmware as voice and alarm channels, where by pins (7, 8, 9 and 10) provided on the 15-pin AMP connector support voice channel and pins (1 and 3) provided on the 16-pin Molex connector support alarm channel.

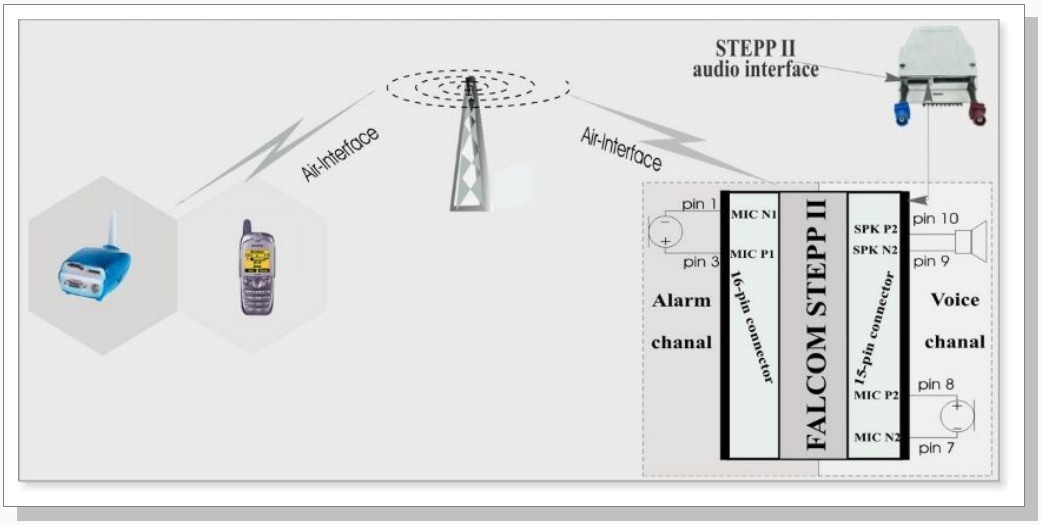


Figure 21: Possible installation for enabling voice connection.

Voice channel

The voice channel allows you to conduct a normal telephone conversation with the FALCOM STEPPII-55/56-LT. For this, FALCOM STEPPII-55/56-LT operates in Hands-Free mode. Requirements are to connect a loud speaker to the pins 9 and 10 and a Hands-Free microphone to the pins 7 and 8 of the FALCOM STEPPII-55/56-LT 15-pin connector. FALCOM STEPPII-55/56-LT will automatically answer an incoming call after the second or third ring.

Alarm channel

The alarm channel allows you to establish a voice call (listen-in mode) to the FALCOM STEPPII-55/56-LT, without activating the loudspeaker interface on the FALCOM STEPPII-55/56-LT. In this case, connect a Hands-Free microphone to pins 1 and 3 of the FALCOM STEPPII-55/56-LT 16-pin connector.