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FALCOM
WIRELESS COMMUNICATIONS GMBH

TANGO55/i & 56/i

Hardware description

Version 1.03, 01/12/2005

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Version history:

Version number	Author	Changes
1.00	F. Beqiri	Initial version
1.01	F. Beqiri	The GSM LED description in chapter 4.2 updated. Chapter ” Possible external devices” removed.
1.02	F. Beqiri	In chapter 9, the paragraphs **"RF Exposure FCC:..."** and **"Health and Safety Information FCC:..."** removed.
1.03	F. Beqiri	Table 5 (chapter 2.5, page 18) – The RF Output Power updated with new values.

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Cautions

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

Please, read carefully the safety precautions.

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0 INTRODUCTION

TANGO55/i and TANGO56/i are designed for use on any GSM network in the world. TANGO55/i and TANGO56/i are Tri-Band GSM/GPRS engines that work on three frequencies GSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz or 850 MHz, DCS 1800 MHz, PCS 1900 MHz, respectively. These full type approved integrated modems constitute a self contained, fully integrated implementation of the GSM/GPRS. TANGO55/i and TANGO56/i feature GPRS class B, class 10 (making download at speeds up to 85 kbps) and support the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

TANGO55/i and TANGO56/i modems incorporate all you need to create high-performance GSM/GPRS solutions; base band processor, power supply ASIC, complete radio frequency circuit including a power amplifier, internal and external SIM interfaces and an antenna interface as well.

The physical interface to the cellular application is made through a RS-232 connector. It consists of 9-pin RS232 interface, required for controlling the unit and transferring data. They can be directly connected via RS232 interfaces to the serial port of a desktop or notebook computer. Interfaces for audio signals and applying power supply are also available.

The external dual band or triple band antenna can directly be connected to the integrated 50 Ω connector on the modem.

The TANGO55/56 are mobile stations for transmission of voice, data calls and FAX as well as short messages (SMS - **S**hort **M**essage **S**ervice) in GSM Network.

To control the GSM module there is an advanced set of AT commands according to GSM ETSI (**E**uropean **T**elecommunications **S**tandards **I**nstitute) 07.07 and 07.05 implemented.

About GPRS:

GPRS is standard for General Packet Radio Service that is an add-on to the GSM (Global System for Mobile Communications) cellular network - a type of network used to provide cellular phone service.

When in regions where GPRS is not available, user can still access their important information with GSM 14.4 kbps data connections.

Users are advised to quickly proceed to the "Security" chapter and read the hints carefully.

0.1 The differences between TANGO55/i & TANGO56/i modems

TANGO55 is a Tri-band GSM/GPRS device that operates on three frequencies GSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz, and is available to use in the European and Asian Networks.

TANGO55i is also a Tri-band GSM/GPRS device that operates on three frequencies GSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz, and is available to use in the European and Asia Networks. The TANGO55i modem provides a specific software and hardware (internal TCP/IP stack software with hardware extension) which has been internally implemented for using the embedded TCP/IP stack software.

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The integration of TCP/IP stack with hardware extension (*a TCP/IP-module added*) into the equipment converts it to a stand-alone client that can be connected to the internet via GPRS network. The modem can also send and receive data by GSM (set into Command-Mode) and GPRS network using TCP/IP stack. It supports SMS, DATA and FAX calls. The TANGO55i modem can be easily controlled by using TCP and AT commands. The "TCP Command Set" manual is also issued as separate document and is available on the distributed CD for the TANGO55i's users.

TANGO56 is a Tri-band GSM/GPRS device that operates on three frequencies GSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz, and is available to use in the European and Asia Networks.

TANGO56i is also a Tri-band GSM/GPRS device that operates on three frequencies GSM 850 MHz, DCS 1800 MHz and PCS 1900 MHz, and is available to use in the American Networks. However, the TANGO56i modem contains 1800 MHz GSM functions that is not operational (not allowed for use) 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 TANGO56i modem provides a specific soft- and hardware (internal TCP/IP stack software with hardware extension) which has been internally implemented for using the embedded TCP/IP stack software.

The integration of TCP/IP stack with hardware extension (*a TCP/IP-module added*) into the equipment converts it to a stand-alone client that can be connected to the internet through any GSM 850/1800/1900 network. The modem can also send and receive data by GSM (set into the Command-Mode) and GPRS network using TCP/IP stack. It supports SMS, DATA and FAX calls. The TANGO56i modem can be easily controlled by using TCP and AT commands. The "TCP Command Set" manual is also issued as separate document and is available on the distributed CD for the TANGO56i's users.

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

Please note that, according to your requirement you can choose the desired device.

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0.2 Used abbreviations

Abbreviation	Description
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
AMP	Advanced Power Management
ANSI	American National Standards Institute
ARFCN	Absolute Radio Frequency Channel Number
ARP	Antenna Reference Point
B2B	Board-to-board connector
BER	Bit Error Rate
BTS	Base Transceiver Station
CB or CBM	Cell Broadcast Message
CE	Conformité Européene (European Conformity)
CHAP	Challenge Handshake Authentication Protocol
CPU	Central Processing Unit
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DAI	Digital Audio Interface
dBW	Decibel per Watt
dBm0	Digital level, 3.14 dBm0 corresponds to full scale, see ITU G.711, A-law
DCE	Data Communication Equipment (typically modems, e.g. XF55-AVL GSM engine)
DCS 1800	Digital Cellular System, also referred to as PCN
DGPS	Differential GPS
DOP	Dilution of Precision
DRX	Discontinuous Reception
DSP	Digital Signal Processor
DSR	Data Set Ready
DTE	Data Terminal Equipment (typically computer, terminal, printer or, for example, GSM application)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FCC	Federal Communications Commission (U.S.)
FDMA	Frequency Division Multiple Access
FR	Full Rate
GGA	GPS Fixed Data
GMSK	Gaussian Minimum Shift Keying
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global Standard for Mobile Communications
HiZ	High Impedance
HR	Half Rate
I/O	Input/Output
IC	Integrated Circuit
IMEI	International Mobile Equipment Identity
ISO	International Standards Organization
ITU	International Telecommunications Union
kbps	kbits per second

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Abbreviation	Description
LED	Light Emitting Diode
Mbps	Mbits per second
MMI	Man Machine Interface
MO	Mobile Originated
MS	Mobile Station (GSM engine), also referred to as TE
MSISDN	Mobile Station International ISDN number
MSK	Minimum Shift Key
MT	Mobile Terminated
NTC	Negative Temperature Coefficient
OEM	Original Equipment Manufacturer
PA	Power Amplifier
PAP	Password Authentication Protocol
PBCCH	Packet Switched Broadcast Control Channel
PCB	Printed Circuit Board
PCL	Power Control Level
PCM	Pulse Code Modulation
PCN	Personal Communications Network, also referred to as DCS 1800
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
PLL	Phase Locked Loop
PPP	Point-to-point protocol
PRN	Pseudo-Random Noise Number. The identity of GPS satellites
PSU	Power Supply Unit
R&TTE	Radio and Telecommunication Terminal Equipment
RAM	Random Access Memory
RF	Radio Frequency
RMS	Root Mean Square (value)
ROM	Read-only Memory
RP	Receive Protocol
RTC	Real Time Clock
RTCM	Radio Technical Commission for Maritime Services
Rx	Receive Direction
SA	Selective Availability
SAR	Specific Absorption Rate
SELV	Safety Extra Low Voltage
SIM	Subscriber Identification Module
SMS	Short Message Service
SRAM	Static Random Access Memory
TA	Terminal adapter (e.g. GSM engine)
TDMA	Time Division Multiple Access
TE	Terminal Equipment, also referred to as DTE
Tx	Transmit Direction
UART	Universal asynchronous receiver-transmitter
URC	Unsolicited Result Code
USSD	Unstructured Supplementary Service Data
VSWR	Voltage Standing Wave Ratio
WAAS	Wide Area Augmentation System
FD	SIM fix dialing phonebook
LD	SIM last dialing phonebook (list of numbers most recently dialed)
MC	Mobile Equipment list of unanswered MT calls (missed calls)
ME	Mobile Equipment phonebook
ON	Own numbers (MSISDNs) stored on SIM or ME
RC	Mobile Equipment list of received calls
SM	SIM phonebook

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0.3 Related documents

1. TANGO55/56 AT Command Set
2. gprs_startup_user_guide
3. TANGO55i/56i TCP Command Set
4. ETSI GSM 07.05: "Use of Data Terminal Equipment-Data Circuit terminating Equipment interface for Short Message Service and Cell Broadcast Service"
5. ETSI GSM 07.07 "AT command set for GSM Mobile Equipment"
6. ITU-T V.25ter "Serial asynchronous automatic dialling and control"

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1 SECURITY

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

Your GSM/GPRS modem 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.

1.1.1 GENERAL

Your modem utilises the GSM standard for cellular technology. GSM 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.

1.1.2 EXPOSURE TO RF ENERGY

There has been some public concern about possible health effects of using GSM or GSM/GPRS 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 minimise 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 below guidelines.

1.1.3 EFFICIENT MODEM OPERATION

For Your modem to operate at the lowest power level, consistent with satisfactory call quality:

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.

1.1.4 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.

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

1.1.5 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: give 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 fulfil road-safety instructions of the current law!

1.1.6 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.

1.1.7 VEHICLE ELECTRONIC EQUIPMENT

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

1.1.8 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 modem **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.

1.1.9 AIRCRAFT

Turn Your modem **OFF** before boarding any aircraft.

Use it on the ground only with crew permission.

Do not use 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.

1.1.10 CHILDREN

Do not allow children to play with Your modem. 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.

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1.1.11 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.

1.1.12 POTENTIALLY EXPLOSIVE ATMOSPHERES

Turn Your modem **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.

1.1.13 NON-IONISING 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 be 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 50Ohm 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.

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1.2 Safety standards

THIS CELLULAR MODEM COMPLIES WITH ALL APPLICABLE RF SAFETY STANDARDS.

This cellular modem meets the standards and recommendations for the protection of public exposure to RF electromagnetic energy established by governmental bodies and other qualified organisations, such as the following :

Directives of the European Community, Directorate General V in Matters of Radio Frequency Electromagnetic Energy.

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2 TECHNICAL DATA

2.1 Technical specifications of GSM/GPRS engine

❖ ***Power supply:***

- **S**upply voltage 10.8 ... 31.2 V DC ±5 % (see chapter 2.2 for further details)

❖ ***Power saving (GSM):***

- **M**inimizes power consumption in SLEEP mode to 13 mA

❖ ***Temperature range:***

- **N**ormal operation: - 20 °C to + 55 °C (see chapter 2.3 for further details)

❖ ***Physical characteristics:***

- **S**ize: 115.0 ± 0.15 mm x 52.0 ± 0.15 mm x 26.6 ± 0.15 mm (for more details see chapter 6 "Housing")
- **W**eight: 82.6 ± 2 g (with SMB connector)
  88.0 g (with FME connector)

❖ ***Dimension of cradle:***

- **S**ize: 119.4mm x 66.7mm x 31.8mm**(**L x B x H)
- **W**eight: 21 gr
- through 2 screw holes on the cradle

❖ ***Mounting:***

- **T**hrough 2 screw holes on the cradle

❖ ***Frequency bands***:

- **T**ri-band *(TANGO55/i)*: EGSM 900, GSM 1800, GSM 1900
- **T**ri-band *(TANGO56/i)*: GSM 850, GSM 1800, GSM 1900
- **C**ompliant to GSM Phase 2/2+

❖ ***GSM class:***

- **S**mall MS

❖ ***Transmit power:***

- **C**lass 4 (2 W) at EGSM900 *(TANGO55/i) GSM 850 (TANGO56/i)*
- **C**lass 1 (1 W) at GSM 1800 and GSM 1900

❖ ***GPRS connectivity:***

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

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❖ ***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 3).
- **C**oding scheme: CS-1, CS-2, CS-3 and CS-4.
- **T**ANGO55/56 supports two protocols PAP (Password Authentication Protocol) and CHAP (Challenge Handshake Authentication Protocol) commonly used for PPP connections.
- **S**upport 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:***

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

❖ ***MMS:***

- **M**MS compliant

❖ ***FAX:***

- **G**roup 3: class 1, class 2

❖ ***SIM interface:***

- **S**upported SIM card: 3 V
- **I**ntegrated SIM card slot (for small SIM card, only)

❖ ***Casing:***

- **F**ully shield (Chromium-plate ABS)

❖ ***Temperature control and auto switch-off:***

- Constant temperature control prevents damage to TANGO55/i and TANGO56/i when the specified temperature is exceeded. When an emergency call is in progress the automatic temperature shutdown functionality is deactivated. (see chapter 2.3 for further details)

❖ ***External antenna:***

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- **S**ingle antenna interface SMB or FME antenna connector.

❖ ***Audio interfaces:***

- **A**n analogue audio interface

❖ ***Audio features:***

- RJ45 serial link (microphone and speaker)

Speech code 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

❖ ***One serial interface (RS-232C):***

- **2**.65V level, bi-directional bus for AT commands and data
- **S**erial link↔full-featured 8-wire serial interface. Supports RTS0/CTS0 hardware handshake and software XON/XOFF flow control. Multiplex ability according to GSM 07.10 Multiplexer Protocol.
- **B**aud rate: 300 bps ... 230 kbps on ASC0
- **A**utobauding detects 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 bps

❖ ***Phonebook management:***

- **S**upported 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 AT command

❖ ***Support of TTY/CTM:***

- **T**o benefit from TTY communication via GSM, CTM equipment can be connected to the audio interface.

❖ ***Software for TANGO55i/56i, only:***

- **T**CP/IP stack (Internet protocols stack which handles the Internet's link, network, transport and application layers). The embedded software

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interface that runs on TANGO55i/56i modems for establishing internet connectivity using IP commands. TCP/IP software description is also available, see related documents [3].

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 2: 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.

2.2 Power consumption for TANGO55, only

POWER CONSUMPTION						
	Min	**Typ.**	**Max**	**Unit**	**Description**	
GSM/GPRS engine						
Supply voltage	10.8	12	31.2	V	Voltage must stay within the min/max values, including voltage drop, ripple and spikes.	
Average supply current						
		60		µA	POWER DOWN mode	
GSM		9		mA	SLEEP mode @ DRX = 6	
					MODE	**BAND (TANGO55/i, only)**
		15		mA	IDLE mode	EGSM 900
		15		mA	IDLE mode	GSM 1800/1900
		250		mA	TALK mode	EGSM 900*)
		170		mA	TALK mode	GSM 1800/1900**)
GPRS		15		mA	IDLE GPRS	EGSM 900
		15		mA	IDLE GPRS	GSM 1800/1900
		290		mA	DATA mode GPRS, (4 Rx, 1 Tx)	EGSM 900*)
		220		mA	DATA mode GPRS, (4 Rx, 1 Tx)	GSM 1800/1900**)
		440		mA	DATA mode GPRS, (3 Rx, 2 Tx)	EGSM 900*)
		310		mA	DATA mode GPRS, (3 Rx, 2 Tx)	GSM 1800/1900**)
Peak supply current.		1,6		A	Power control level*) During transmission slot every 4.6 ms.	

Table 3: Power supply

*) Power Control Level (PCL 5).

**) Power Control Level (PCL 0).

2.3 Operating temperatures

Parameter	Min	Typ.	Max	Unit
Ambient temperature (according to GSM 11.10)	-20	25	50	°C
Restricted operation *)	-25 to -20		55 to 70	°C
Automatic shutdown TANGO55/i and TANGO56/i board temperature	-29 °C		>70 °C	°C

Table 4: Operating temperature

*) TANGO55/i and TANGO56/i work, but deviations from the GSM specification may occur.

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2.4 Air interface of the TANGO55 GSM/GPRS engine, only

Test conditions:

All measurements have been performed at T_{amb} = 25 °C, V_{VIN} typ. = 12 V DC.

Parameter		Min	Typ.	Max	Unit
Frequency range Uplink (MS → BTS)	GSM 900	880		915	MHz
	GSM 1800	1710		1785	MHz
	GSM 1900	1850		1910	MHz
Frequency range Downlink (BTS → MS)	GSM 900	925		960	MHz
	GSM 1800	1805		1880	MHz
	GSM 1900	1930		1990	MHz
RF power @ ARP with 50 Ω load	GSM 900	31	33	35	dBm
	GSM 1800	28	30	32	dBm
	GSM 1900	28	30	32	dBm
Number of carriers	GSM 900		174		
	GSM 1800		374		
	GSM 1900		299		dBm
Duplex spacing	GSM 900		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 900	-102	-107		dBm
	GSM 1800	-102	-106		dBm
	GSM 1900	-102	-105.5		dBm

Table 5: Air Interface

2.5 Air interface of the TANGO56 GSM/GPRS engine, only

Test conditions:

All measurements have been performed at T_{amb} = 25 °C, V_{VIN} typ. = 12 V DC.

Parameter		Frequency Channel	Min	Typ.	Max	Unit
Frequency range Uplink (MS → BTS)	GSM 850		824		849	MHz
	GSM 1800		1710		1785	MHz
	GSM 1900		1850		1910	MHz
Frequency range Downlink (BTS → MS)	GSM 850		869		894	MHz
	GSM 1800		1805		1880	MHz
	GSM 1900		1930		1990	MHz
RF power @ ARP with 50 Ω load	GSM 850	128	-	-	31.51	dBm
		188	-	-	31.69	dBm
		251	-	-	31.82	dBm
	GSM 1800	-	-	-	-	-
	PCS 1900	512	-	-	27.43	dBm
		661	-	-	27.57	dBm
		810	-	-	28.16	dBm
Number of carriers	GSM 850			124		
	GSM 1800			374		
	PCS 1900			299		dBm
Duplex spacing	GSM 850			45		MHz
	GSM 1800			95		MHz
	PCS 1900			80		MHz
Carrier spacing				200		kHz

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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	GSM 850	-102	-107		dBm
BER Class II < 2.4 %	GSM 1800	-102	-106		dBm
	PCS 1900	-102	-105.5		dBm

Table 6: Air Interface

2.6 Determining the External Equipment Type

Before you connect the DB9 serial port connectors 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 terms DTE (Data Terminal Equipment) and DCE (Data Communications Equipment) are typically used to describe serial ports on devices. Computers (PCs) generally use DTE connectors and communication devices such as modems and DSU/CSU devices generally use DCE connectors. As a general rule, DTE ports connect to DCE ports via straight through pinned cables. In other words, a DTE port never connects directly to another DTE port. Similarly, a DCE port never connects directly to another DCE port. The signalling definitions were written from the perspective of the DTE device; therefore, a Receive Data signal becomes an input to DTE but an output from DCE.

TANGO55/i and TANGO56/i are designed for use as a DCE unit. Based on the aforementioned conventions for DCE-DTE connections it communicates with the customer application (DTE) using the following signals:

TANGO55/i and TANGO56/i Terminal (DCE)	to	Application (DTE)
TxD	◄----------	TXD
RxD	----------►	RXD
RTS	◄----------	RTS
CTS	----------►	CTS
DTR	◄----------	DTR
DSR	----------►	DSR
DCD	----------►	DCD
RING	----------►	RING

Table 7: The signaling definitions between DTE and DCE.

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3 GSM/GPRS APPLICATION INTERFACE

3.1 Description of operating modes

The chapter below briefly summarizes the various operating modes referred to the following chapters.

Definition of the GPRS class B mode of operation:

The definition of GPRS class B mode is, that the MS can be attached to both GPRS and other GSM services, but the MS can only operate one set of services at a time. Class B enables making or receiving a voice call, or sending/receiving a SMS during a GPRS connection. During voice calls or SMS, the GPRS services will be suspended and then resumed automatically after the call or SMS session has been ended.

3.1.1 Normal mode operation

3.1.1.1 GSM/GPRS SLEEP

Various power save modes set with `AT+CFUN` command. Software is active to minimum extent. If the module was registered to the GSM network in IDLE mode, it is registered and paging with the BTS in SLEEP mode, too. Power saving can be chosen at different levels: The NON-CYCLIC SLEEP mode (`AT+CFUN=0`) disables the AT interface. The CYCLIC SLEEP modes `AT+CFUN=5,6,7,8` and `9` alternatively activate and deactivate the AT interfaces to allow permanent access to all AT commands.

3.1.1.2 GSM IDLE

Software is active. Once registered to the GSM network, paging with BTS is carried out. The module is ready to send and receive.

3.1.1.3 GSM TALK

Connection between two subscribers is in progress. Power consumption depends on network coverage individual settings, such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.

3.1.1.4 GPRS IDLE

Module is ready for GPRS data transfer, but no data is currently sent or received. Power consumption depends on network settings and GPRS configuration (e.g. multislot settings).

3.1.1.5 GPRS DATA

GPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink/downlink data rates and GPRS configuration (e.g. used multislot settings).

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3.1.2 Power down

Normal shutdown after sending the AT^SMSO command. The Power Supply ASIC (PSU-ASIC) disconnects the supply voltage from the base band part of the circuit. Only a voltage regulator in the PSU-ASIC is active for powering the RTC. Software is not active. The serial interfaces are not accessible. Operating voltage remains applied.

3.1.3 Alarm mode

Alarm mode restricted operation launched by RTC alert function while the module is in POWER DOWN mode. Module will not be registered to GSM network. Limited number of AT commands is accessible.

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4 HARDWARE INTERFACES

4.1 Interfaces on the TANGO55/i & TANGO56/i

Interface specifications	
Interface A	4-pin Micro-Fit™ 3.0 Molex Part number: 43045-0406 (Female)
Interface B	Standard RS232 serial interface
Interface C	Audio 8-pin RJ45, RS232 (Rx, Tx) serial interface
Interface D	GSM antenna interface with SMB or FME antenna connector.
Interface E	SIM card reader for small SIM cards (3V)
Interface F	LED's for status indication

Table 8: Interface specifications of the modems

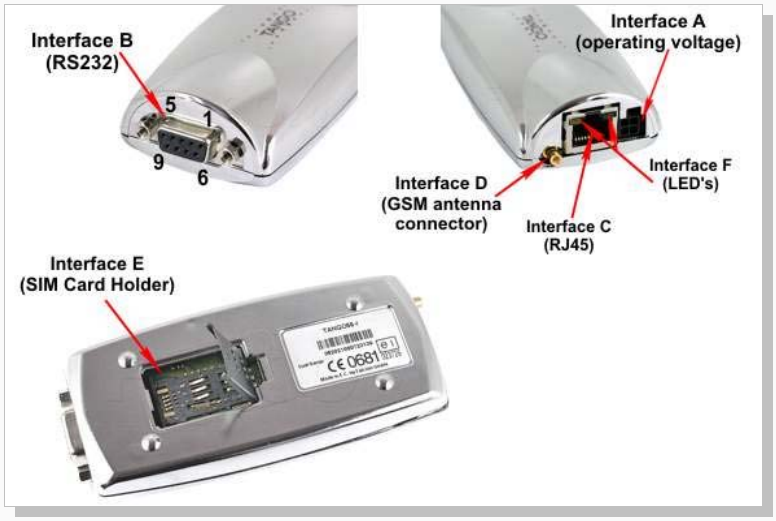

Figure 1: view of modem interfaces.

4.1.1 Interface A (4-pin connector, power supply)

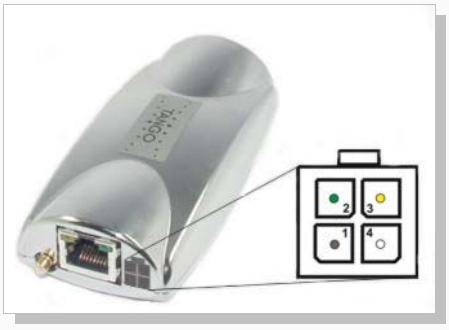

Figure 2: Pin out of 4-pin power supply connector (interface A)

Power input: 10,8....31,2 V DC			
Pin number	**Name**	**Wire-Colour**	**Functions**
1	GND	Brown	DC power negative input
2	Mute	Green	Do not connect
3	IGN	Yellow	Ignition (connected to positive DC power)
4	POWER (+Vin)	White	DC power positive input

Table 9: Description of modem power connector

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A cable, included in the package shall be used for power supply connection.
For more details see Appendix chapters 7.1 and 7.1.1.

4.1.2 Interface B (9-pin D-SUB connector)

Interface B has the highest priority connection to control the TANGO55/56 modem.s This one has a standard D-SUB-male serial connector.

RS232	9 pin D-Sub to DIN 41652
+/-12V	RX, TX, RTS, CTS, DTR, DSR, DCD, RI
300...115200	Baud rates for serial link (2400...19200 with auto-bauding)

Interface B (DB9 connector) has the following layout.

Figure 3: RS232 pin-out (interface B)

Pin	Description	Direction
1	DCD ↔ Data Carrier Detect	OUT
2	RxD ↔ Received Data	OUT
3	TxD ↔ Transmitted Data	IN
4	DTR ↔ Data Terminal Ready	IN
5	GND ↔ Signal Ground	-
6	DSR ↔ Data Set Ready	OUT
7	RTS ↔ Request To Send	IN
8	CTS ↔ Clear To Send	OUT
9	RI ↔ Ring Indicator	OUT

Table 10: Pin assignment of the standard RS232 connector

4.1.3 Interface C (8-pin RJ45 connector)

The TANGO55/56 modems provide this interface (RJ45) for serial and audio connection.

You can use a RJ45 serial cable to connect the modem's RJ45 connector (Interface C) to external controller/computer (without HW handshake). If TANGO55/56 modems have been connected through interface B, interface C is automatically deactivated (Rx, Tx). In this case, only 4 pins are available (MIC[+,-] and SPK[+,-]). So a headset can be connected (see Appendix chapter 7.3 headset's characteristic).

This interface supports also a connection to an external device such as active headset.

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Figure 4: Audio interface pin-out (interface C)

Pin	Description	Direction
1	Power output 10V ± 5% 150mA	OUT
2	TxD ↔ Transmitted Data	IN
3	RxD ↔ Received Data	OUT
4	Ground	-
5	SPK+	OUT
6	SPK-	OUT
7	MIC+	IN
8	MIC-	IN

Table 11: Pin assignment of RJ45

4.1.4 Interface D (antenna interface)

There are two TANGO55/56 versions as far as the antenna interface is concerned. The specifications and functions of the modems are the same. The difference between both equipments can be recognised by looking at the GSM antenna on the left side of the modems: the first one provides an antenna with SMB connector interface (Figure 5.a); the second one provides an antenna with FME connector interface (Figure 5.b). The length of antenna cable integrated on the TANGO55/i and TANGO56/i is 23.3 cm.

Figure 5.a: TANGO55/56 modem with SMB antenna connector

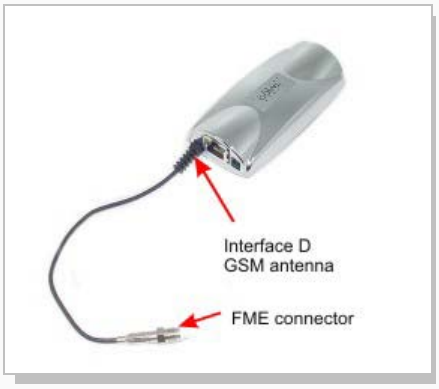

Figure 5.b: TANGO55/56 modem with FME antenna connector

4.1.5 Interface E (SIM interface)

The SIM interface controls a 3V SIM Card. This interface is fully compliant with GSM 11.11 recommendations concerning SIM functions.

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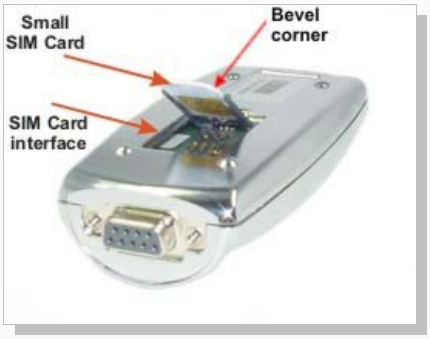

Figure 6: SIM interface (interface E)

4.1.6 Interface F (Optical indicator interface)

The actual state of the TANGO55/i and TANGO56/i is displayed by two LED's on interface F of the unit (for more details see chapter 4.2 Functional description).

Figure 7: Status indicator of modem

4.2 Functional description

The GSM/GPRS modem TANGO55/i and TANGO56/i are mobile stations for the transmission of voice, data and fax calls as well as SMS in GSM/GPRS networks.

The GSM/GPRS modems TANGO55/i and TANGO56/i consist of the following components:

- GSM/GPRS transceiver
- Power supply unit
- Serial link (V.24) for data transmission and control
- GPRS Class B, Class 2 or Class 10.

If the GSM/GPRS modem is registered in the network, it acts just like a regular fax/data modem. To control the GSM modem there is an advanced set of AT-commands according to GSM ETSI 07.07 and 07.05 implemented. The two LED's on the top of Interface C are showing the state of TANGO55/i and TANGO56/i. The yellow LED signals the actual connection of the modem (interface B or C) and the green LED signals power connection, GSM/GPRS network, a "RESET" function and "SOFT-ON " procedure.

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The actual state of modems is displayed by two LED's at the connector on the top of interface C of the unit.

Green LED (GSM)	Off	Modem is off or run 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.
Yellow LED	Off	Power off or interface C in use.
	On	Power on, interface B in use or both interfaces (B & C) are not connected.

4.2.1 Ignition line

The Ignition Line on Interface A uses an internal processor to control the timing of the "TURN-ON" procedure of the internal GSM modem.

To switch the modem ON the Ignition Line has to be connected to a high voltage level of (10,8V ... 31,2V). The green LED on interface C shows the progress of the "TURN-ON" procedure (green indicator light). Enter PIN number of the inserted SIM card (if required). After a few seconds it will go flashing slowly (that means the registration into the network is successfully). To switch the modem off the commands AT+CPOF or AT+CFUN=0 (see AT commands manual) has to be issued. To switch the modem on again see above.

4.2.2 Serial handling

The GSM/GPRS modem TANGO55/56 allows control of the GSM/GPRS modem over the interface B or Interface C. The interface B is a implementation of a serial interface corresponding to EIA-RS232-C.

See table below for details:

CCITT V24	Pin	Description	Direction
102	5	Signal Ground (GND)	
103	3	Transmitted Data (TxD). The DTE uses the TxD line to send data to the interface for transmission over the Modem.	IN
104	2	Received Data (RxD). The interface uses the RxD to send data received from the Modem to the DTE.	OUT
105	7	Request To Send (RTS)	IN
106	8	Clear To Send (CTS)	OUT
107	6	Data Set Ready (DSR)	OUT
108	4	Data Terminal Ready (DTR)	IN
109	1	Data Carrier Detect (DCD)	OUT
125	9	Ring Indicator (RI)	OUT

Table 12: R232 9-pin description

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Both interface B and C are not independent usable. The interface B has the highest priority. If you don't want to use the interface B you must deactivate the signals RTS (or remove connection). With the interface C you have the audio and control functionality on one interface.

See table for connections:

Pin	Description	Direction
1	Power output 10V ± 5% 150mA	OUT
2	Received Data (RxD)	IN
3	Transmitted Data (TxD)	OUT
4	Ground	
5	SPK+	OUT
6	SPK-	OUT
7	MIC+	IN
8	MIC-	IN

Table 13: Pin description fo RJ45

4.2.3 Reset configuration

In case of malfunction the GSM/GPRS modem offers various RESET possibilities.

For a RESET of the GSM/GPRS modem please use the following way:

a) Operating voltage remains applied, the Ignition line of the modem remains connected to the operating voltage or any other external power source (10,8V ... 31,2V).

b) Then, send for at least 100ms a LOW signal level to the Transmit Data [TxD] pin of the serial interface B or C (means: send a "BREAK" signal to the used Transmit Data [TxD] line from a terminal software). The "BREAK" signal forces the modem to perform a reset by driving the TxD pin of modem to the ground.

c) Once the system detects an incomming signal through TxD pin (e.g. type AT <enter> on the terminal screen) the modem set itself into the command mode. (Via IGN line is also posible, by disconnecting the Ignition line (IGN) and connecting it again, the modem set itself also into the command mode).

If the GSM software is still running, while the user feels the need to reset the modem, AT+CFUN=1,1 could be used. This will de-register the modem from the network and bring it into the state before the PIN has been entered.

4.2.4 Firmware update

The download procedure is documented in chapter 8.

4.2.5 Turn off GSM/GPRS engine of the TANGO55/56 modems using AT command

The best and safest approach to powering down the GSM/GPRS engine is to issue the `AT^SMSO` command. This procedure lets GSM engine log off from the network and allows the software to enter into a secure state and safe data before disconnecting the power supply. The mode is referred to as POWER DOWN mode. In this mode, only the RTC stays active.

Before switching off the device sends the following response:

```
^SMSO: MS OFF

OK
```

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```
^SHUTDOWN
```

After sending `AT^SMSO` do not enter any other AT commands. There are two ways to verify when the modems turn off:

- Wait for the URC "SHUTDOWN". It indicates that data have been stored non-volatile and the modems turn off in less than 1 second.

Be sure not to disconnect the operating voltage V_{Vin+} before the URC "SHUTDOWN" has been issued. Otherwise you run the risk of losing data.

While the GSM engine is in POWER DOWN mode the application interface is switched off and must not be fed from any other source.

4.2.6 Maximum number of turn-on/turn-off cycles

Each time the modems are shut down, data will be written from volatile memory to flash memory. The guaranteed maximum number of write cycles is limited to 100.000.

4.2.7 Automatic GPRS Multislot Class change

Temperature control is also effective for operation in GPRS Multislot class 10. If the board temperature increases to the limit specified for restricted operation (*see 2.3 for temperature limits known as restricted operating*) while data are transmitted over GPRS, the module automatically reverts from GPRS Multislot TANGO55/56 /I56i returns to the higher Multislot class. If the temperature stays at the critical level or even continues to rise, TANGO55/56 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 not 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 module may even switch off. For GPRS connection see related document [2].

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5 GENERAL GUIDELINES FOR THE USE OF THE TANGO55/56

5.1 Getting started

5.2 Hardware & software requirements

- ✓ A valid SIM card.
- ✓ Free compatible COM serial port
- ✓ Pentium 90 or higher.
- ✓ System memory: At least 64MB
- ✓ Operating system: Windows® 95, 98/Me/2000/XP

For data, Web and email applications.

- ✓ Dial-up networking configured to your ISP (Internet Service Provider).

5.2.1 Minimum hardware interface to get started

As a minimum, it is necessary to connect the following interfaces to operate the TANGO55/56 properly:

5.2.1.1 Connecting the external antenna (SMB type)

If you are using a Dual-Band GSM antenna (see chapter 7.2 Possible external antenna), connect the SMB-female antenna connector to the modem SMB-male connector.

For other external antennas, please refer to manuals of manufacture's GSM antenna. Make sure the external antenna is for the GSM 900/1800 or 850/1900 frequencies with impedance of 50Ω, and also the connector is secured tightly.

Note: Please use antenna designed for GSM 900/1800 or 850/1900 MHz operation. Incorrect antenna will affect communication and even damage the modem.

Figure 8: Connect the GSM antenna

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5.2.1.2 Installing the SIM card

Keep all miniature SIM cards out small children's reach. The SIM card and its contacts can be damaged by scratches or bending, so be careful when handling, inserting or removing the SIM card.

Open the cover cap on the underside of the modem, push the SIM card holder forwards on the inscription "PUSH ▲ OPEN", flap the holder upwards and insert the SIM card into the SIM card holder and push it down (ensure that the bevelled corner is on the top right and the golden contact area is facing downwards). Make sure that the SIM card is fit in the SIM card holder. Push the cap of SIM card holder down until it closed. Close the opening with the cover cap.

Figure 9: Open the cover cap.

Figure 10: Push the inscription "PUSH ▲ OPEN" to open the SIM card holder.

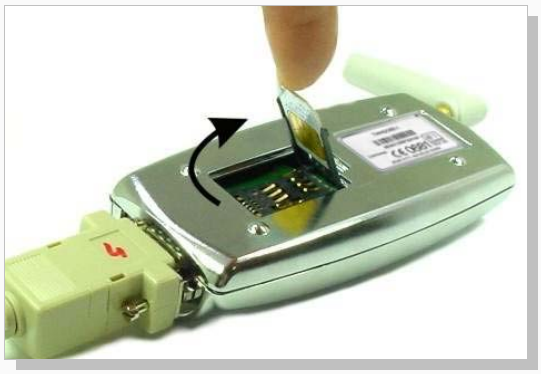

Figure 11: Insert the SIM card.

Hints: To remove the SIM card please follow the steps above and remove.

Important: Do **not** insert or remove the SIM card when the device is under power.

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5.2.1.3 Mounting the terminal

Figure12.a Place the modem on the cradle and firmly fixed.

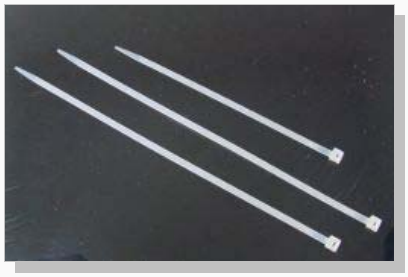

Figure12.b Cable ties

Place the modem (if it is needed) on the cradle and push it down, make sure that the modem does not move up and down inside the cradle, the cradle is in the sales package. After that, the user have to use the cables ties for fixing (figure 12.a) the modem and the power supply cable. For power supply cable use the small cable ties and for modem use one of the length cable ties. The dimensions of cable ties are 200 x 3.5 mm and 140 x 3.5 mm.

Note: If you want to mount the modem on a wall or vehicle, first attach the cradle to the wall or vehicle as described on the chapter below before placing the modem on the cradle.

5.2.1.4 Mounting the cradle and placing the terminal

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

Place the modem in a proper location, for example on the desk far enough from your PC or . It is also possible to install the terminal to a wall or a vehicle:

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1. Choose a location far enough from electronic devices so that no interference occurs.
2. Drill appropriate screws through the two indentations on the cradle.
3. After you have secured the cradle to the wall or vehicle, place the terminal as described above in section "**Mounting the terminal**"

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

5.2.1.5 Connecting the Modem to external device cable

You can use the optional RS232 serial cable to connect the D-SUB connector (Interface B) to external controller/computer. Connect the 9-pin Sub D-female serial cable to COM1 or COM2 on your PC (or to another free serial interface port), as shown in **Figure 13.a**. Connect the other end of the 9-pin Sub D-male serial cable to the 9-pin serial interface port on the TANGO55/56 modem, as shown in **Figure 13.b**.

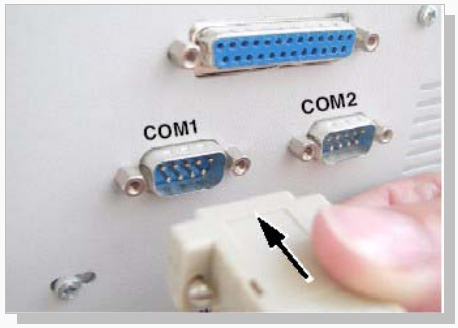

Figure 13.a: Connect 9-pin serial to PC

Figure 13.b: Connect 9-pin serial to modem.

5.2.1.6 Connecting the DC power supply

Connect the open ending of the power supply cable to a power adapter (10.8...31.2 VDC). Refer to the following table for power supply requirement.

Power Supply Requirement:

Parameters	Min	Typical	Max	Unit
Supply voltage	**10.8**	**12**	**31.2**	**V DC**

Table 14: Required power supply

Connect the power supply cable with 4-pin Micro-Fit-male connector to the modem's 4-pin Micro-Fit-female connector, and supply voltage via the power adapter (see figure 14.b). Then, connect the Ignition line provided on this power adapter also to the Vin+ pin (apply 10.8...31.2 VDC on this pin).

Once the Vin+ and Ignition line are connected to the external source of 10.8...31.2 VDC, the Modem will turn on automatically. The status indicator (green and yellow) on the top of RJ45-Audio interface will be lit when power is on. After a few seconds after you have entered the PIN number (if needed) the green LED will go flashing slowly (that means registration into the network is successfully).

Note: Do not used the external cable for power supply without a voltage adapter.

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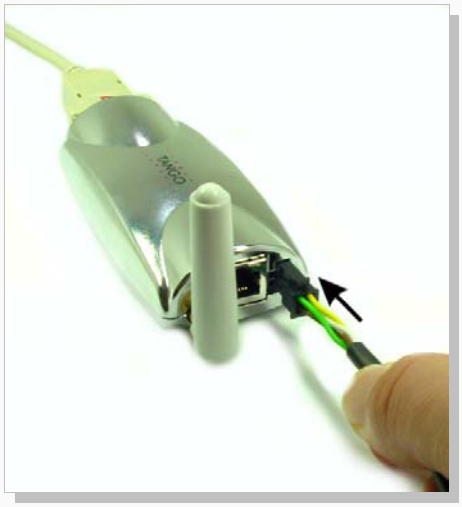

Figure 14.a: Connect the DC power supply

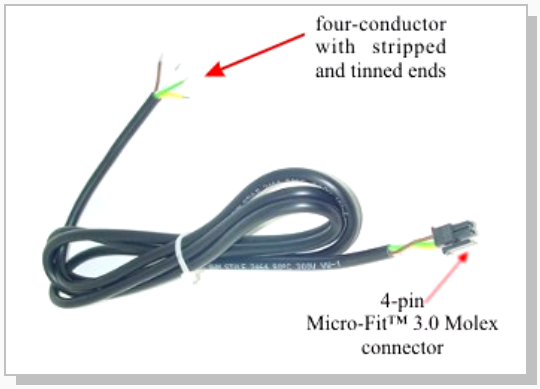

Figure 14.b: Power supply cable (see Figure 2, for Pin-out)

5.2.2 Terminal emulator setup

Below is an example based on the Windows™ Hyperterminal application (terminal emulator program).

The instructions below describe how to use the TANGO55/56 Modem with a PC running Windows 2000.

5.2.2.1 Checking the Modem (using Microsoft Windows™ Hyper Terminal as example)

By usning a terminal program you can communicate with the modem through one of the provided RS232 serial ports, see example below:

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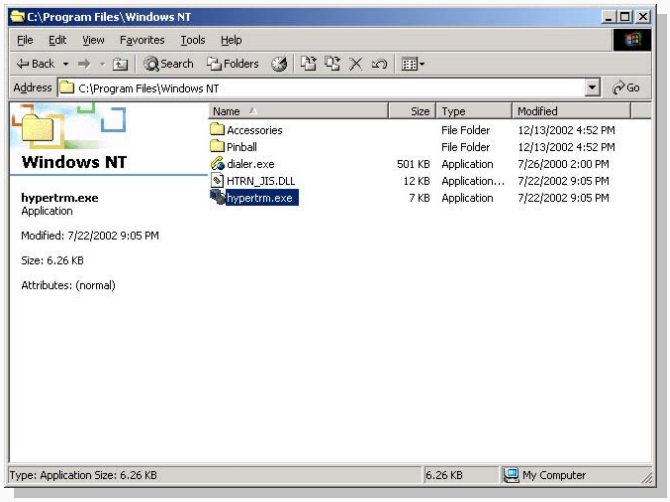

Figure 15: Using Microsoft Windows™ Hyper Terminal

On Windows 2000, start the Hyper Terminal program. Assign the name for a new session on the displayed window.

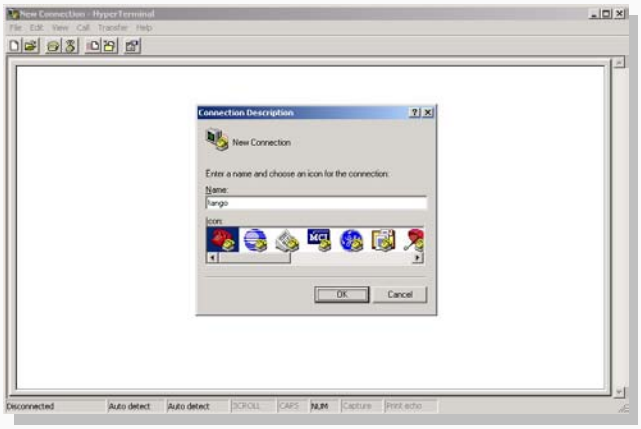

Figure 16: Assign the name for a new session

Choose the correct COM Port and baud rate settings (9600bps, 8 bit, no parity bit, 1 stop bit).

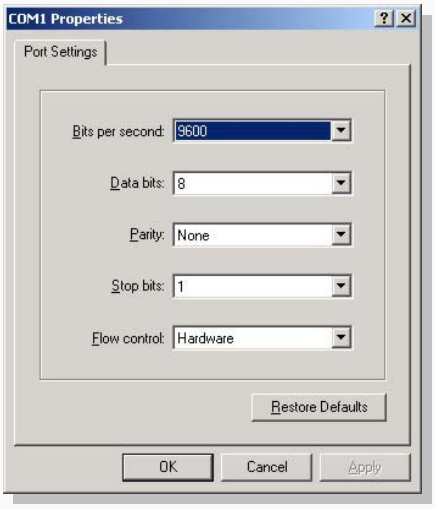

Figure 17: COM Port transmission settings

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On the terminal screen, type “AT” to check the “OK” response from the Modem.

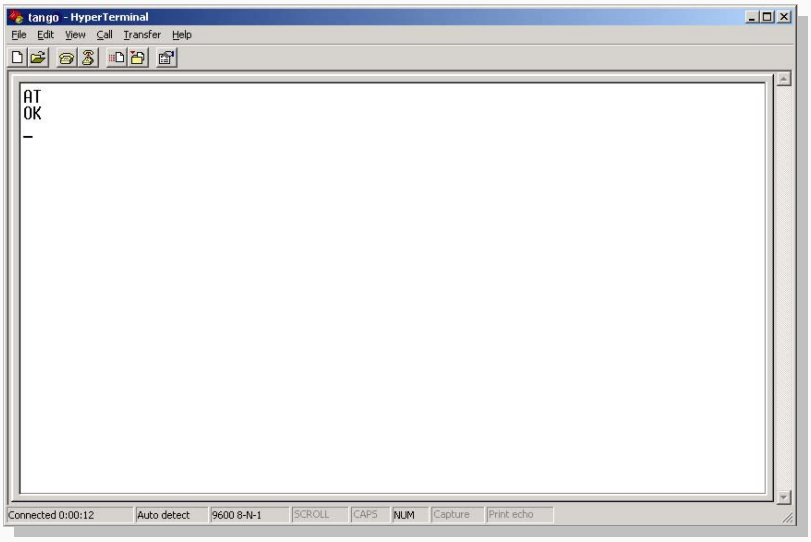

Figure 18: Check the response from TANGO55/56

Now you can configure the TANGO55/56 modem according to your requirements and according to the AT-Command set.

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5.2.3 Getting started to GPRS Network

The following instructions are available only for TANGO55/56 versions providing GPRS.

- What is GPRS:
  - ✓ GPRS is a complete new part of the existing GSM network.
  - ✓ GPRS is packed switched high speed mobile data.
  - ✓ GPRS is an efficient approach to upgrade the existing GSM to a packet switched system.
  - ✓ GPRS is an important step in direction to mobile internet.
- What you need?
  - ✓ GPRS settings from your network provider
    - APN (name of access point that connects the mobile network to the Internet)
    - Primary and secondary DNS
    - IP header compression
    - IP address (DHCP or static)
    - User name and password (may be optional)
    - Dial number
  - ✓ Modem installation and configuration
  - ✓ Dial-Up Network installation and configuration

Should the standard 19200 modem not installed, you have to install it, else please refer to the separated manual "`gprs_startup_user_guide.pdf`".

5.3 Basic Operation

Followings are example of some AT-commands. Please refer to the AT Command manual for a full discription.

The AT Command manual is available on the Falcom's Website

➔ http://www.falcom.de/

NOTE: Issue `AT+CMEE=1` to have extended error code (`+CME ERROR`)

Description	AT Commands	Modem responce	Comments
Network registration checking	AT+CREG?	CREG=<mode>,1	Modem registered into the network
		CREG=<mode>,2	Registration lost, re-registration attempt
		CREG=<mode>,0	Modem not registration into the network, no registration attempt
Receiving an incoming call		RING	An incoming call is waiting
	ATA		Answer the call
		OK	
Make a call	ATD0123456789;		Do not forget the < ; > at the end for < voice > call
		OK	Communication established
		CME ERROR: 11	PIN code not entered (with + CMEE=1 mode)
		CME ERROR: 3	AOC credit exceeded or a communication is already established
Make an emergency call	ATD112;		Do not forget the < ; > at the end for < voice > call
		OK	
Communication loss		NO CARRIER	
Hang up	ATH		

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		OK	
Enter PIN code	AT+CPIN=0123		
		OK	PIN code accepted
		CME ERROR: 16	Incorrect PIN Code (with + CMEE=1 mode)
		CME ERROR: 3	PIN already entered (with + CMEE=1 mode)
Save parameter non-volatile memory	AT&W	OK	The configuration settings are stored

Table 15: AT-commands for basic operation

5.3.1 Troubleshooting

1. The modem status indicators do not light:
   - Check if the modem is connected to a 10.8 .. 31.2 V DC power supply properly.
   - Check if also the Ignition Line is connected to a 10.8 .. 31.2 V DC power supply properly.
   - Check if the power connector is properly inserted.

2. The modem does not respond to the terminal program:
   - Check if the RS232 cable is connected properly.
   - Check if your program has proper settings. Manufacture settings of the modem are as below:

     Upto 115200 bps
     8 data bits
     No parity bit
     1 stop bit
     2

3 GPRS troubleshooting
   - Refer to the separate manual "gprs_startup_user_guide.pdf".

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6 HOUSING

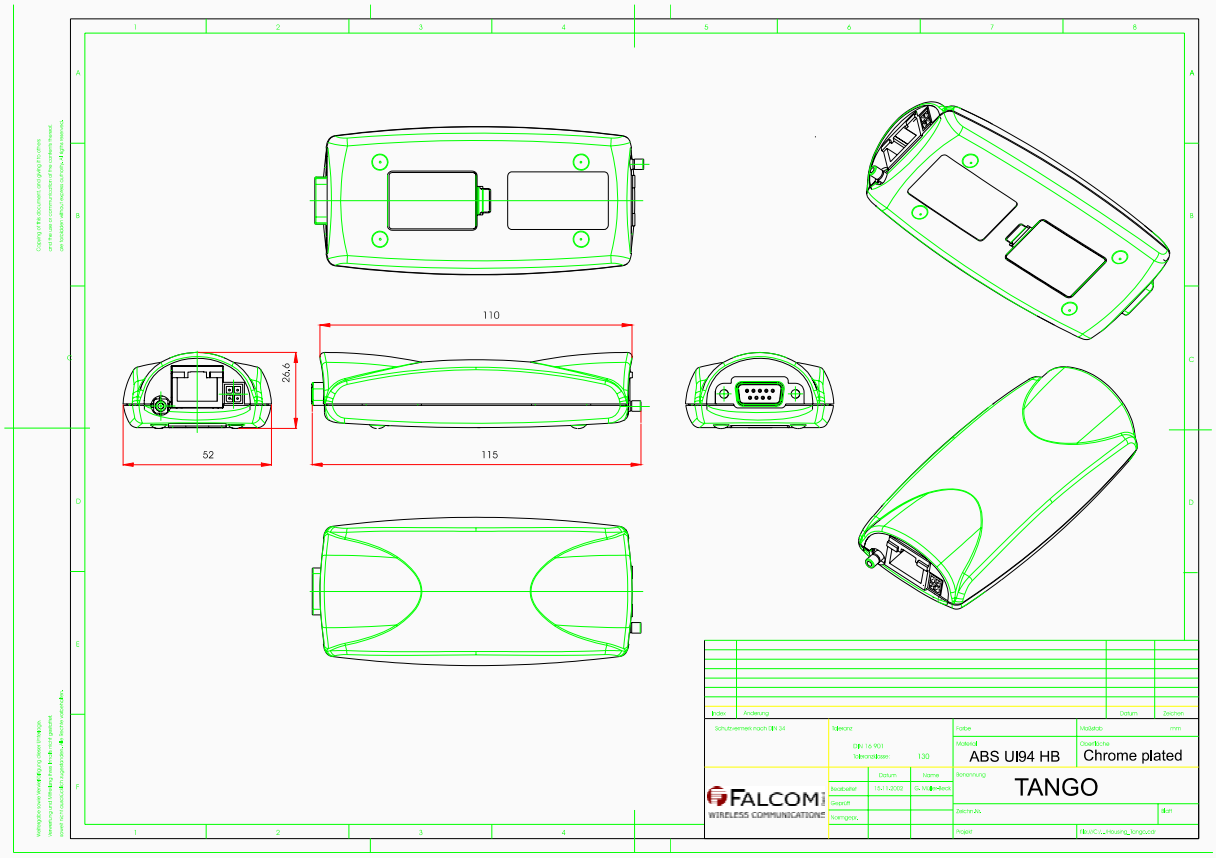

Figure 40: Housing of TANGO55/i and TANGO56/i

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6.1 Housing of cradle

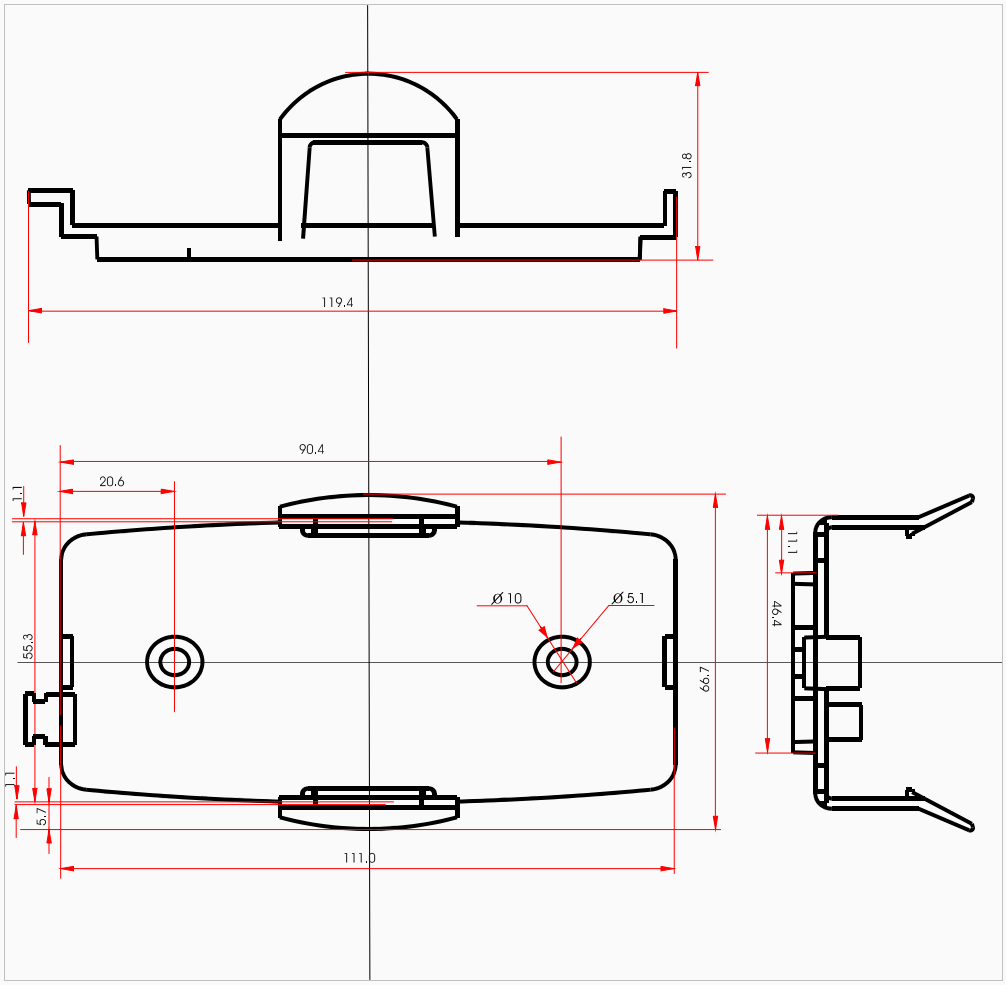

Figure 41: Dimensions of the cradle.

Figure 42: View of the cradle.

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7 APPENDIX

7.1 Recommendations for power supply

It is recommended to use the PS002 power supply. Also any other power supply in the range of 10.8 ... 31,2 V DC can be used. It should be able to deliver 2A peak current (for 577µs, rise time 10µs, period 4.615ms, caused by GSM-typical radio transmission), where the ripple voltage of the power supply is recommended to be lower than 300mV.

If the power supply is using input-voltages of more than 50 Vrms or 75 V DC it is the response of the applicant to conform with the safety requirements of Telecommunication Terminal Equipment (such as 73/23/EEC).

7.1.1 External cable for power supply

Power cable, included in the package, shall be used for power supply connection. The external power cable is a four-conductor cable with stripped and tinned ends. Connect the white and yellow leads of the external power cable to the positive side of the DC power source. Connect the brown lead of the external power cable to the negative side of the DC power source. The green lead of the external power cable should be left open (not connected).

COUTION: Observe polarity when connecting the external power cable. Incorrect input polarity can damage the power adapter.

The connector of power cable is a Micro-Fit 3.0 one.

Part number: 43025-0400 (male)

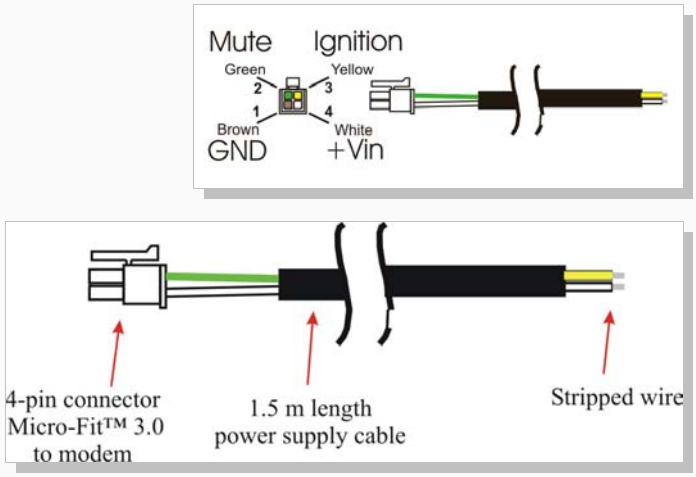

Figure 43: View of external cable for power supply

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7.2 Possible external antenna

There is no antenna included in the deliver package, but the below designed antennas can be used.

The designed antenna in the figure below are provided by Falcom GmbH.

The order numbers are:

- **ANT-001-M** (with FME-male connector, for TANGO55/i)
- **ANT-010** (with FME-male connector, for TANGO56/i)
- **Dual-Band GSM antenna** (with SMB-female connector, for TANGO55/i)
- **KA08-F** (antenna cable with SMB-female and FME-female connectors)

The TANGO55 modem with SMB connector incorporates a 'Snap On' latching action in order to make the connection easier with an excellent RF performance. An additional advantage is its small physical size. Figures (44.a and 44.b) below shows the possibilities of external GSM/GPRS antennas.

If your TANGO55 modem provides an external SMB connector on the antenna interface both of the below designed GSM/GPRS antennas can be used. In case of using the ANT-001-M with FME connector, FALCOM GmbH provides a special adapter cable between the TANGO55 and FME antenna connector. The FALCOM type code of this adapter cable is KA08-F.

Figure (44.a) shows an external GSM/GPRS antenna with FME connector (ANT-001-M). If your TANGO55 modem provides an external FME connector on the antenna interface only a GSM/GPRS antenna with FME connector (ANT-001-M) can be used.

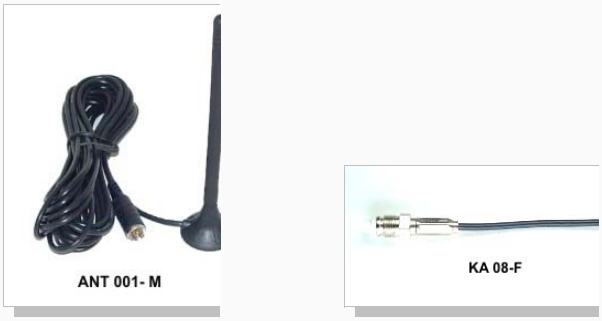

Figure 44.a: ANT-001-M with FME-male connector and KA08-F with SMB-female and FME-female connector.

Figure 44.b: Dual-Band GSM antenna with SMB-female connector

7.3 Possible external headset

A different microphone inputs and a different speaker outputs are supported by the TANGO55/56 modem, so an external headset interface through the RJ45 connector (interface C) is available.

Follow the characteristics to install a headset:

2KΩ differential	Microphone impedance
2V	Microphone bias voltage
0,5mA	Microphone input current
>32Ω (<1nF)	Speaker impedance

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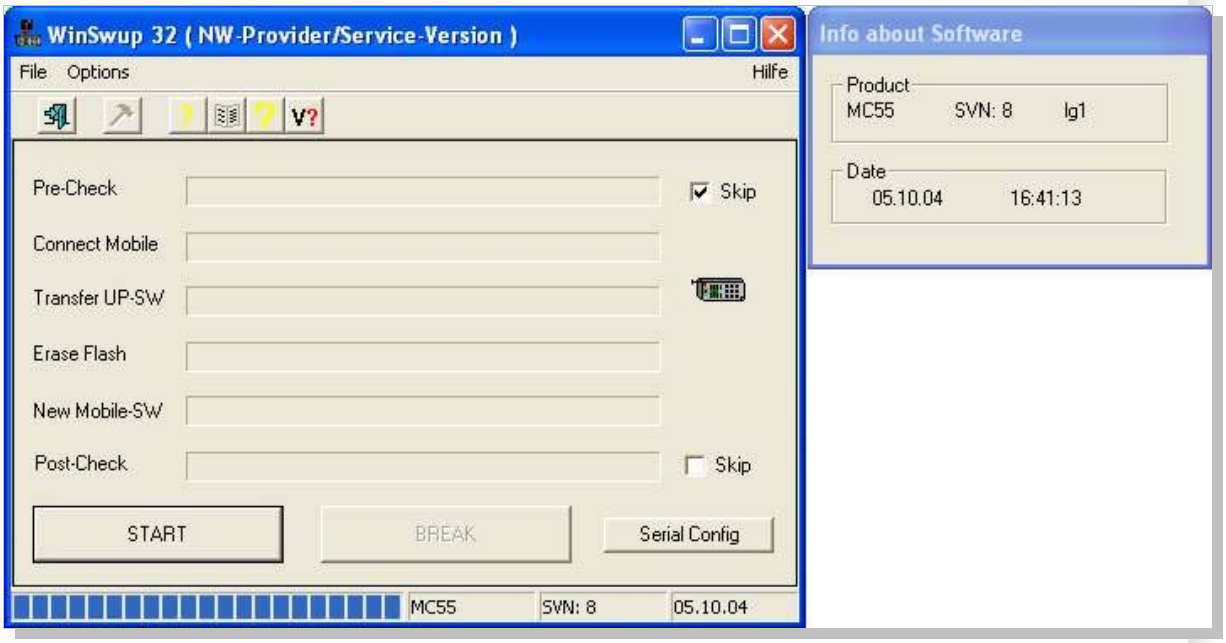
8 HOW TO UPDATE THE NEW FIRMWARE INTO THE TANGO55/56 MODEMS

In order to allow users of TANGO55/56 to utilize newly released firmware, a program has to be available to update the on-board Flash-Memory. The update program with the new firmware will be distributed electronically via Internet or CD.

> The update procedure of a new firmware erases the whole internal flash memory and the presettings stored on it will be absolutely erased, too.

In order to update a new TANGO55/56 firmware, please, follow step-by-step the instructions described below:

- Point your web browser to www.falcom.de, go to support ➔ drivers & firmware ➔ TANGO55 or TANGO56 and download the "wswup_mc55_x.exe" or wswup_mc56_x.exe Update program, respectively.
- Connect the serial port of the TANGO55/56 to one of the available COM ports on your PC (e.g. COM1).
- If TANGO55/56 is still powered on power it down. Make sure that the V+ and IGN lines are disconnected from the external power source.
- Start "wswup_mc55_01.06.exe" Update program. The Dialog Window shown below appears.



- Please, refer to the figure above for the following points. Select the Skip radio button near the Pre-Check progress bar.
- Click on the "Serial Config" button, and in the "Com" settings box select the COM port where your TANGO55/56 is connected (i.e COM1) and in the "Baud" settings box select the Baud rate to 115200.

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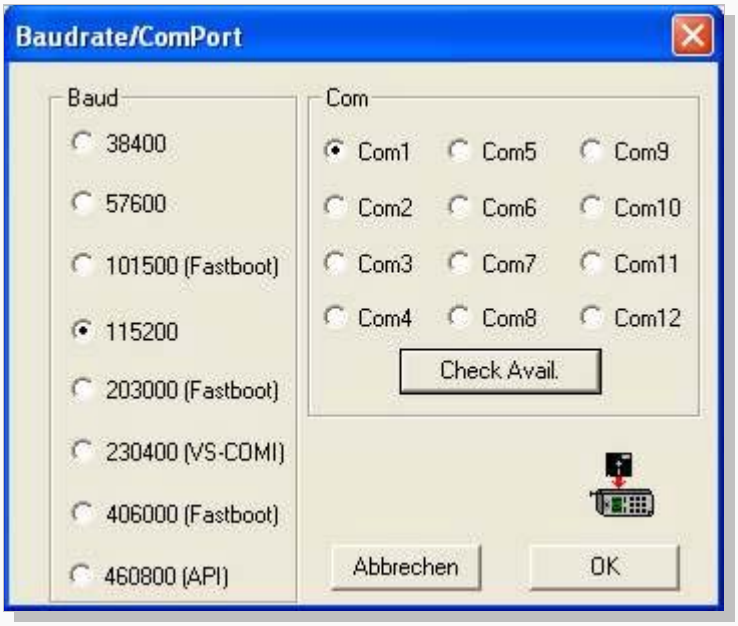
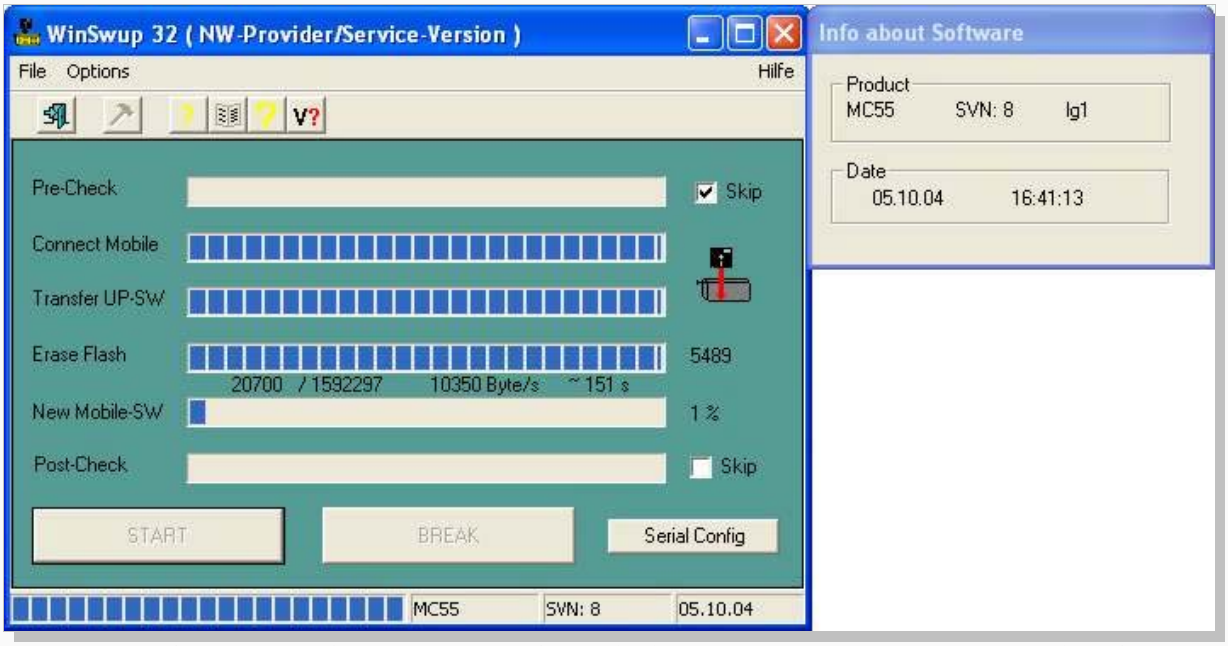


- Close this dialog box by clicking on the OK button.
- Now, (**imoprtant !!!!**) to start the firmware update, firstly connect the IGN line to the external power source (set to HIGH → from 10.8 to 32 VDC), then press the "START" button and within 1 second after the "START" button has been clicked, connect the V+ line to the external power source (set to HIGH → from 10.8 to 32 VDC).
- The current positions of the programming progress will be displayed in the progress bars. The update procedure takes approximately 4 minutes.

  Note: Do not interrupt this procedure. A partially reprogrammed flash memory could lead to invalid operation of the terminal and permanent damage of the components.



- If any error is generated after clicking the "START" button or during flash programming (see figure below), check cables and retry the operation. If the the "START" button is pressed and within 1 second the V+ and IGN lines have not been connected to the external power source (set to HIGH), the error shown in the figure below will be occurred.

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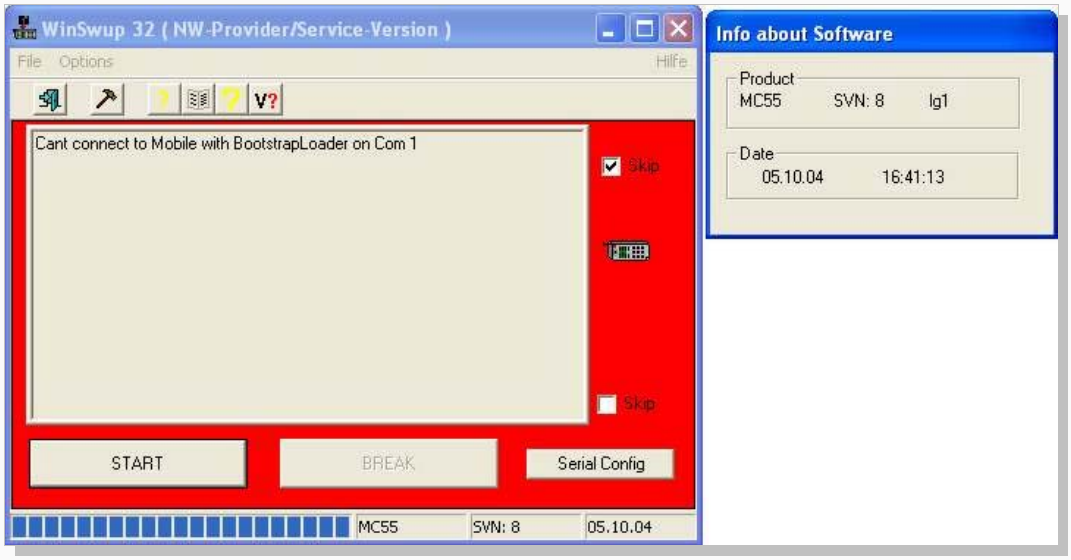

If download has been completed successfully, power down the TANGO55/56 (disconnect the V+ line). The TANGO55/56 with the new firmware is automatically started at the next power up (connect the V+ and the IGN line to the external power source).

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9 RF EXPOSURES

This device contains 850/1800/1900 MHz or 900/1800/1900 MHz GSM/GPRS functions that are operational in these frequencies respectively.

The following statements according to the FCCs are applied for the TANGO56, only. However, the TANGO56 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 15.105:

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

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