GT47/GT48
Integrators Manual

Sony Ericsson

CE

The product described in this manual conforms to the Radio and Telecommunication Terminal Equipment (R&TTE) directive 99/5/EC with requirements covering EMC directive 89/336/EEC and Low Voltage directive 73/23/EEC. The product fulfils the requirements according to 3GPP TS 51.010-1, EN 301 489-7 and EN60950.

SAR statement: This product is intended to be used with the antenna or other radiating element at least 20 cm away from any part of the human body.

First edition (August 2003)

Sony Ericsson Mobile Communications International publishes this manual without making any warranty as to the content contained herein. Further ***Sony Ericsson Mobile Communications International*** reserves the right to make modifications, additions and deletions to this manual due to typographical errors, inaccurate information, or improvements to programs and/or equipment at any time and without notice. Such changes will, nevertheless be incorporated into new editions of this manual.

Publication number: LZT 123 7605 P1C

Printed in UK

Contents

Overview

1. Introduction

1.1 Target Users

GT47 and GT48 Control Terminals are designed to be integrated into machine-machine or man-to-machine communications applications. They are intended to be used by manufacturers, system integrators, applications developers and developers of wireless communications equipment.

1.2 Prerequisites

It is assumed that the person integrating the GT47/GT48 into an application has a basic understanding of the following:

- GSM networking;
- Wireless communication and antennas (aerials);
- AT commands;
- ITU-T standard V.24/V.28;
- Micro controllers and programming;
- Electronic hardware design.

1.3 Manual Structure

The manual is composed of two parts

Part 1- Overview

This section provides a broad overview of the GT47/GT48 and includes a list of abbreviations used in the manual.

Part 2 - Integrating the Control Terminal

This section describes each of the signals available on the GT47/GT48 Control Terminal, along with mechanical information. The section also provides you with design guidelines and explains what is needed to commercialise an application from a regulatory point of view.

2. GT47/GT48 Control Terminals

2.1 Description

Two Control Terminals make up the family; GT47 and GT48, for use in the E-GSM900/GSM1800 and GSM850/GSM1900 bands respectively. The Control Terminal has a radio device embedded in it. The GT47 incorporates the GR47 radio device; the GT48 incorporates the GR48 radio device.

Note! This manual refers to the GT47 and GT48 as Control Terminals. If there is a difference in the functionality of the Control Terminals the GT47 and GT48 information will be listed separately.

The Control Terminal is a powerful and flexible device that can be used in a wide range of telemetry and telematics applications that rely on the remote exchange of data, voice, SMS or faxes via the GSM cellular network.

Small and lightweight, the Control Terminal has standard connectors and an integral SIM card reader making it easy and quick to integrate. As well as providing a standard RS232 serial communication interface the Control Terminal also has an audio interface allowing an analogue handset to be connected. When the Control Terminal is integrated into an external application, a wireless communications system is created.

A typical end-to-end system consists of a micro controller in an external application communicating, via the Control Terminal, with a remote terminal or host using the GSM network. The micro controller uses a set of AT commands to control the Control Terminal, and to set up the end-to-end communications link, via its 9-way RS232 serial interface.

These Control Terminals are intended to be used by manufacturers, system integrators, application developers and developers of a wide range of equipment and business solutions, typically in the following fields:

- Security and alarms
- Vending
- Monitoring and control
- Utilities
- Fleet Management

2.2 Highlights

- Intelligent, versatile GSM/GPRS Control Terminal
- Dual band, EGSM 900/GSM1800 (GT47);
  GSM 850/GSM1900 (GT48)
- Customised applications can be embedded and run independently
- Self contained terminal with standard connectors

- 2 x RS232 interfaces with a useful range of configurable IOs
- TCP/IP stack
- Data: GPRS, HSCSD, CSD, SMS
- Voice: full rate, enhanced full rate, half rate; AMR (GT48)
- SMS: mobile-originated, mobile-terminated, cell broadcast
- Fax: Group 3, Classes 1 & 2
- 15 way high density connector
- 5V to 32V d.c. input
- 4-wire audio connection
- Antenna connection (FME male)
- R&TTE type approved (GT47)

2.3 Control Terminals in a Communication System

Figures 2.1 and 2.2 illustrate the main blocks of a wireless communication system using the Control Terminal. Figure 2.1 shows the communication system when the script is embedded on the Control Terminal and figure 2.2 shows the communication system when a micro-controller is used. They also show the communication principles of the system and the interface between the Control Terminal and the application. The definitions in the figures, as used elsewhere in this manual, are in accordance with the recommendations of GSM 07.07.

- The MS (mobile station) represents the Control Terminal and SIM card. The Control Terminal excluding SIM card, is known as the ME (mobile equipment).
- The DTE (data terminal equipment) is the controlling application. This can be either an external host or an internal embedded application.
- The DCE (data circuit terminating equipment) is the serial communication interface of the MS.

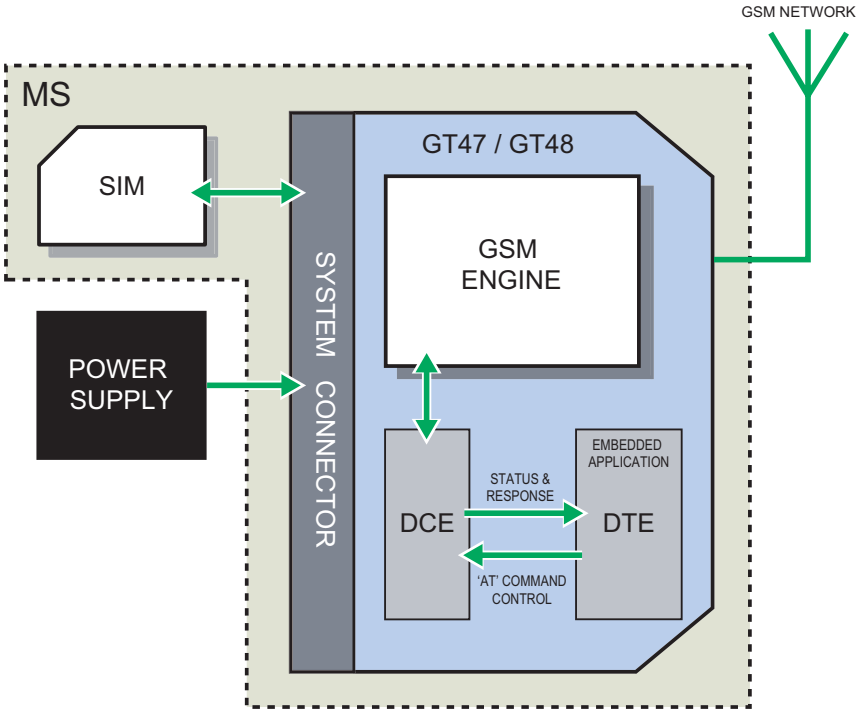


Figure 2.1 Main Blocks in a Wireless System (embedded application)

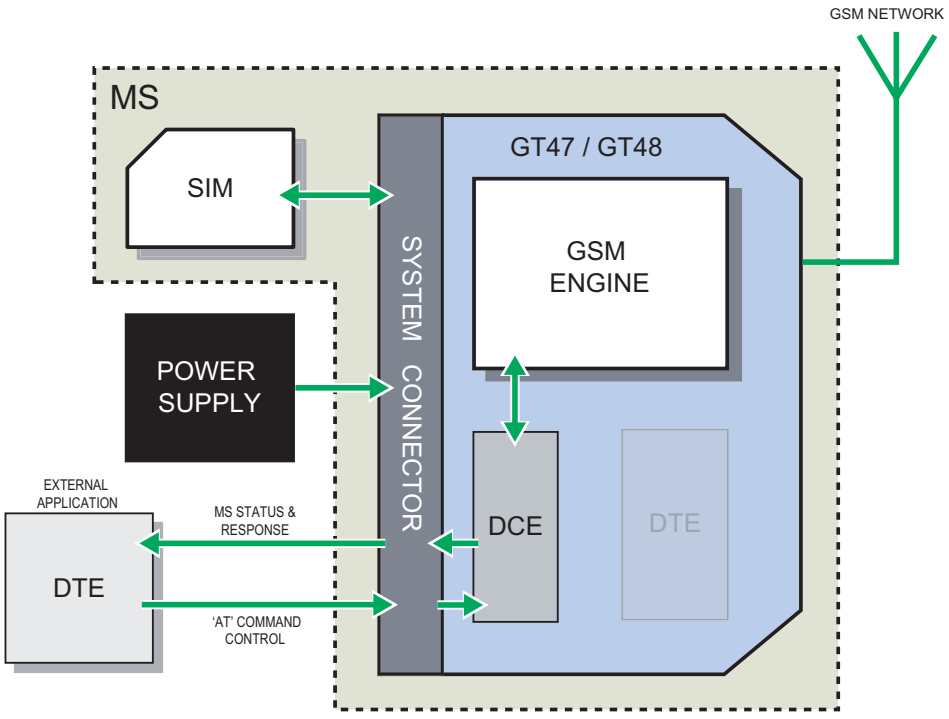


Figure 2.2 Main Blocks in a Wireless System (external micro-controller)

In accordance with the recommendations of ITU-T (International Telecommunication Union - Telecommunications Standardisation Sector) V.24, the TE communicates with the MS over a serial interface.

The functions of the radio device follow the recommendations provided by ETSI (European Telecommunications Standards Institute) and ITU-T.

ETSI specifies a set of AT commands for controlling the GSM element of the Control Terminal; these commands are supplemented by Sony Ericsson specific commands.

Note! To find out how to work with AT commands, see the GR47/GR48 AT Commands Manual.

2.4 Main Features and Services

The Control Terminal performs a set of telecom services (TS) according to GSM standard phase 2+, ETSI and ITU-T. The services and functions of the Control Terminal may be implemented using customised applications embedded on the device, or by AT commands over the RS232 serial interface.

2.4.1 Types of Mobile Station

The GT47 and GT48 are dual band Control Terminals with the GSM radio characteristics shown in the table below.

GT47	*E-GSM900*	*GSM1800*
Frequency Range (MHz)	TX: 880-915 RX: 925-960	TX: 1710-1785 RX: 1805-1880
Channel spacing	200kHz	200kHz
Number of channels	174 carriers *8 time slots	374 carriers *8 time slots
Modulation	GMSK	GMSK
TX phase accuracy	< 5° RMS phase error (burst)	< 5° RMS phase error (burst)
Duplex spacing	45MHz	95MHz
Receiver sensitivity at antenna connector	< –102dBm	< –102dBm
Transmitter output power at antenna connector	Class 4 2W (33dBm)	Class 1 1W (30dBm)
Automatic hand-over between EGSM900 and GSM1800		

GT48	*GSM850*	*GSM1900*
Frequency Range (MHz)	TX: 824-849 RX: 869-894	TX: 1850-1910 RX: 1930-1990
Channel spacing	200kHz	200kHz
Number of channels	124 carriers *8 time slots	299 carriers *8 time slots
Modulation	GMSK	GMSK
TX Phase Accuracy	< 5° RMS phase error (burst)	< 5° RMS phase error (burst)
Duplex spacing	45MHz	80MHz
Receiver sensitivity at antenna connector	< –102dBm	< –102dBm
Transmitter output power at antenna connector	Class 4 2W (33dBm)	Class 1 1W (30dBm)
Automatic hand-over between GSM850 and GSM1900		

2.4.2 Short Message Service

The Control Terminal supports the following SMS services:

- Sending; MO (mobile-originated) with both PDU (protocol data unit) and text mode supported.
- Receiving; MT (mobile-terminated) with both PDU and text mode supported.
- CBM (cell broadcast message); a service in which a message is sent to all subscribers located in one or more specific cells in the GSM network (for example, traffic reports). This feature is network dependent.
- SMS STATUS REPORT according to GSM 03.40.
- SMS COMMAND according to GSM 03.40.

The maximum length of an SMS message is 160 characters when using 7-bit encoding. For 8-bit data, the maximum length is 140 characters. The Control Terminal supports up to 6 concatenated messages to extend this function.

2.4.3 Voice Services

The Control Terminal offers the capability of mobile originated and mobile terminated voice calls, as well as supporting emergency calls. Multi-party, call waiting and call divert features are available. Some of these features are network-operator specific.

For the inter-connection of audio, the Control Terminal offers a balanced 4-wire analogue interface.

DTMF (Dual Tone Multi Frequency) is supported.

The Control Terminal supports HR, FR and EFR vocoders. The GT48 also supports the Adaptive Multi Rate (AMR) type of vocoder.

2.4.4 Data

The Control Terminal supports the following data protocols:

- ***GPRS (General Packet Radio Service).***
  The Control Terminal is Class B, which provide simultaneous activation and attachment of GPRS and GSM services. GT47 is a GPRS class 8 (4+1) enabled devices, which are capable of transmitting in one timeslot per frame (up link), and receiving at a maximum of four timeslots per frame (down link).
- ***CSD (Circuit Switched Data).***
  The Control Terminal GT47 is a capable of establishing a CSD communication at 9.6kbps.
- ***HSCSD (High Speed Circuit Switched Data).***
  The Control Terminal supports HSCSD class 2 (2+1) communication, with one timeslot per frame capacity in the up link and two timeslots per frame capacity in the down link.

2.4.5 Fax

The Control Terminal allows fax transmissions to be sent and received by commercial fax software installed on the application computer. Group 3 fax Classes 1 and 2 are supported.

2.4.6 Supplementary Services

- Call forwarding
- Call hold, waiting and multiparty
- Calling/called number identification
- Advice of charge
- USSD
- Alternate line service
- Customer service profile
- Preferred networks
- Operator selection
- Network registration
- Call barring
- Call transfer

2.4.7 Serial Communication

The Control Terminal enables an end-to-end communication path to be established between the telemetry/telematics application, either hosted internal or connected externally, and a remote terminal or host, via the GSM network. Once a path has been set up, voice or data communication can take place. An RS232 9-signal serial interface is available via the Control Terminal's 15-way high density data connector.

This primary serial interface can be used to:

41Frqwuro#wkh#JW7:#yld#dq#h{whuqdo#SF#ru#plfur0frqwuroohu#xvlqj#DW#frppdqgv>

51Vhqg#dqg#uhfhlyh#gdwd1#

The Control Terminal supports the full set of AT commands according to GSM 07.05 and GSM 07.07. It also supports an extended set of Ericsson proprietary AT commands to add extra functionality.

AT commands are used to operate the Control Terminal with a broad range of functions including:

- configuring general parameters of the Control Terminal
- setting up and controlling communications to and from the GSM network
- obtaining GSM network status information

Additionally the Control Terminal provides a second RS232 serial interface, operating as a 4-signal and GND interface, with hardware flow control (Rx, Tx, CTS and RTS). This 4-signal serial interface is controllable via embedded applications and may be used to control external accessories e.g. a GPS receiver.

For more detail on the AT commands supported by the Control Terminal see GR47/GR48 AT Commands Manual.

2.4.8 Extended I/O Interface

The Control Terminal contains several general purpose, configurable, input and output signals. Signals may be reconfigured by AT command or by intrinsic function when using embedded applications.

- 1 analogue input
- 3 digital inputs
- 5 digital outputs
- + 4.8V DC output

In addition, 6 of the control signals on the primary RS232 interface can be reconfigured for use as digital inputs or outputs if required.

The drivers controlling certain outputs have been designed to carry higher currents than normal logic IOs. They can be used to activate or power external devices, for example a switch or a relay.

A+4.8V output is available, if required, to power external devices.

2.4.9 Interfacing with the Control Terminal

The Control Terminal uses the following industry standard connectors;

- 15 pin high density socket (RS232 serial port and extended I/O interface)
- RJ12 (plug-in power supply and extended I/O connector)
- RJ9 (handset audio connector)
- Integral SIM card reader
- FME male (antenna connector)

2.5 Service and Support

To contact customer support please use the details below:

Customer Support
Sony Ericsson Mobile Communications
1 Lakeside Road
Aerospace Centre
Farnborough
Hampshire
GU14 6XP

E-mail: modules.support@sonyericsson.com
or
modules.info@sonyericsson.com

Information about Sony Ericsson and its products is available on the following web site:

http://www.SonyEricsson.com/M2M

2.6 Precautions

As a standalone item, the Control Terminal is designed for indoor use only. To use outdoors it must be integrated into a weatherproof enclosure. Do not exceed the environmental and electrical limits as specified in “Technical Data”, page 49.

3. Abbreviations and Definitions

Abbreviation	*Explanations*
AMR	Adaptive Multi Rate
CBM	Cell Broadcast Message
CBS	Cell Broadcast Service
CSD	Circuit Switched Data
DCE	Data Circuit Terminating Equipment
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi Frequency
EFR	Enhanced Full Rate
EMC	Electro-Magnetic Compatibility
ETSI	European Telecommunication Standards Institute
FR	Full Rate
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
High Side Switch	Pin is driven high, to Vin, in the active state
HR	Half Rate
HSCSD	High Speed Circuit Switched Data
ITU-T	International Telecommunication Union - Telecommunications Standardisation Sector
Low Side Switch	Pin is driven low in the active state. High state requires external pull up.
ME	Mobile Equipment
MO	Mobile Originated
MS	Mobile Station
MT	Mobile Terminated
PDU	Protocol Data Unit
RLP	Radio Link Protocol
RF	Radio Frequency
RTC	Real Time Clock
SIM	Subscriber Identity Module
SMS	Short Message Service

Abbreviation	*Explanations*
TA	Terminal Adapter
TE	Terminal Equipment
TS	Telecommunication Services
USSD	Unstructured Supplementary Service Data

Integrating the Control Terminal

4. Mechanical Description

4.1 Overview

The pictures below show the mechanical design of the Control Terminal along with the positions of the different connectors and mounting holes. The Control Terminal case is made of durable PC/ABS plastic.

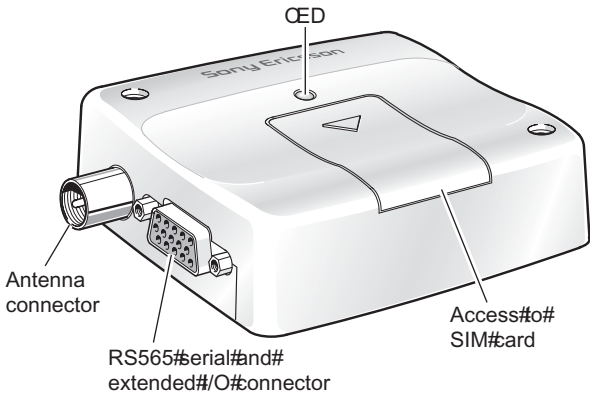


Figure 4.1 Control Terminal viewed from the left side

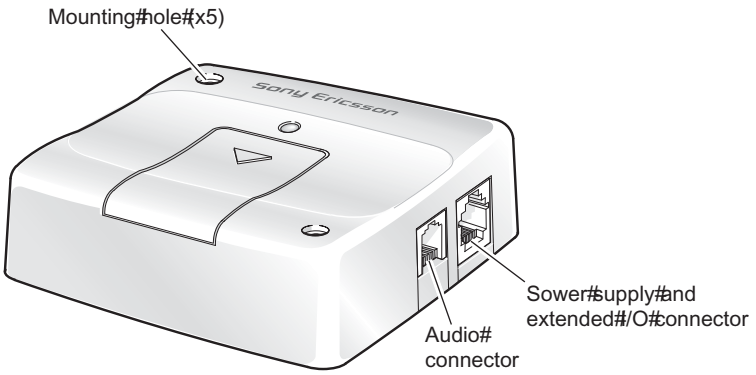
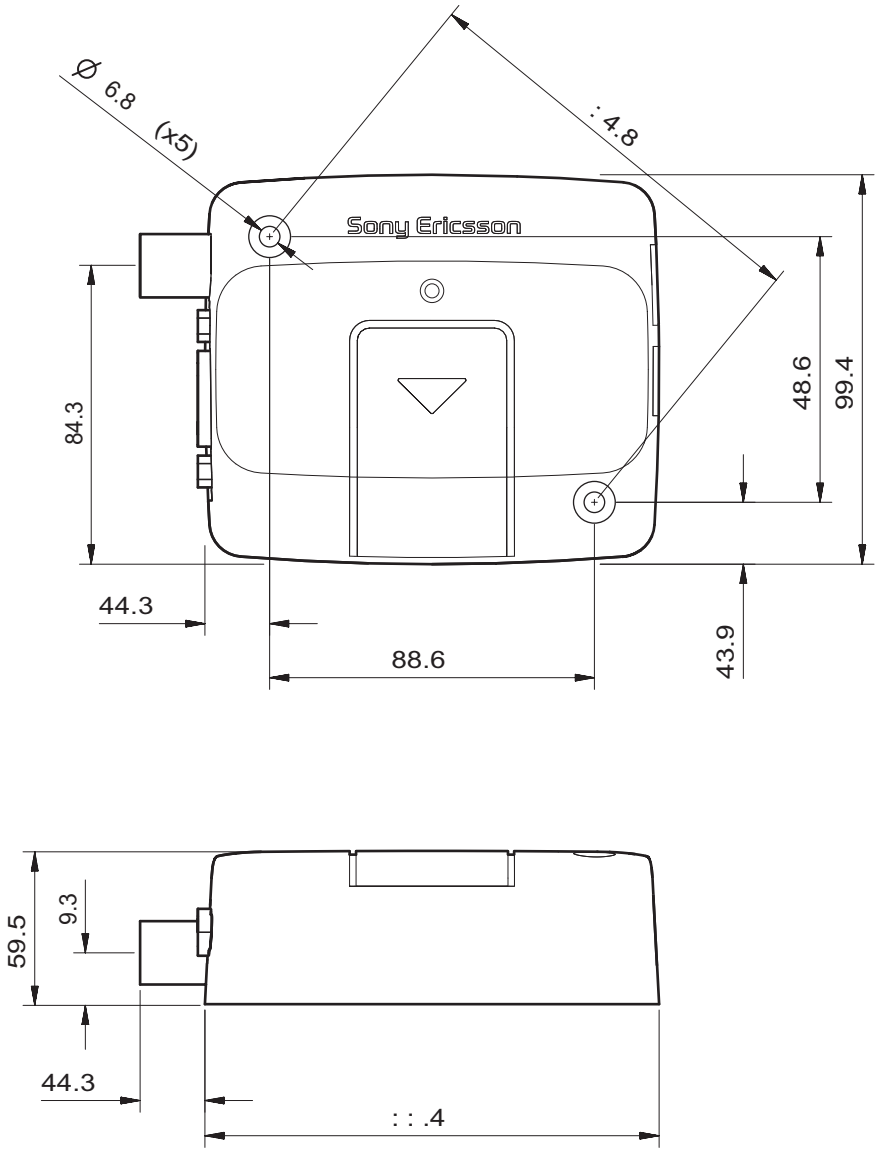


Figure 4.2 Control Terminal viewed from the right side

Please note the following:

- Mounting holes positioned at two of the corners make it possible to securely bolt the Control Terminal into your application.
- Keypad, display, microphone, speaker and battery are not part of the Control Terminal.
- The SIM card is mounted in the Control Terminal.
- The pins and electrical characteristics of the Control Terminal's various connectors are described in "Electrical Description", page 22.
- Information about the antenna connector is found in "Antenna Connector", page 33.

4.2 Physical Dimensions



Measurements are given in millimetres. See also “Technical Data”, page 49.

5. Electrical Description

All electrical connections to the module are protected in compliance with the standard air (8kV) and contact (4kV) Electrostatic Discharge (ESD) tests, of EN 61000-4-2.

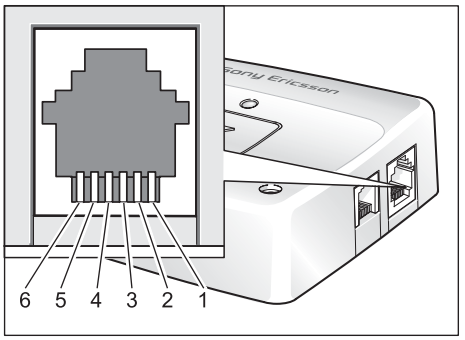
The module uses the following industry standard connectors:

- High density 15 pin (RS232 serial and extended I/O interface)
- RJ12 6-way (power supply and extended I/O connector)
- RJ9 4-way (handset connector)
- SIM card reader
- FME male coaxial jack (antenna connector)

5.1 Power Supply and Extended I/O Connector

An RJ12 6-way connector, as shown and described below, serves as a means of supplying and controlling d.c. power to the modem. Additionally there are several extended input/output signals available that can be used to control or interface external systems and devices.

General signal description:



4##V_IN
5##OUW5##
6##IN-4## #
4##WO_IN##
8##OUW4##
9##GND

The power connector electrical characteristics are listed below:

Pin	*Signal*	*Dir*	*Limits*	*Description*
1	V_{IN}	I	5 to 32V	Positive power input
2	OUT-2	O	32V, 0.25A	Low side switch, short circuit protected
3	IN-1	I	–0.5 to 32V	Digital Input V_{IH} > 3V, V_{IL} < 2.8V Internal Pull Down of 40kΩ
4	TO_IN	I	–0.5 to 32V	Active low control line used to switch the GT47 off/on. V_{IH} > 5V, V_{IL} < 2V Power off/on: t > 0.2s Internal Pull Up to V_{IN} of 20kΩ
5	OUT-1	O	V_{IN}, 0.4A	High side switch, short circuit protected
6	GND	I	-	Negative power (ground) input and return path for TO_IN and the extended inputs and outputs

Note! Signal OUT-2 on the RJ12 connector is switched in parallel to signal OUT-4 on the 15-pin high density socket. The individual output signals are generated by two different low side switches inside the module driven from a common control signal.

5.1.1 Power Supply Interface

The supply voltage V_{IN} and GND are protected against polarity reversal and over voltage.

The Control Terminal switches on automatically once the V_{IN} voltage is applied.

Note! The Control Terminal will not switch on if TO_IN is shorted to ground when the dc supply is applied.

Note! For more information on switching the Control Terminal on and off please see section “Operation”, page 39

Note! Please be aware that the total current carried via either the V_{IN} or GND pins will be the sum of the intrinsic power consumption of the Control Terminal and any drive current supplied via OUT-1 or OUT-2 (or other IOs). The current on either of the V_{IN} or GND pins must not exceed 1.5A.

Caution! It is recommended that the system integrator provides appropriate fusing otherwise the Control Terminal may be damaged. See “Current Consumption with external +4.8V Supply Active”, page 53 for more details.

Extended I/O Signals

Digital Inputs

The digital input IN-1 is available on pin 3 of the RJ12 connector. Its state is detected by IO5 of the embedded Radio Device engine, see Control Terminal-Radio Device signal cross reference table, page 30.

The distinction between low level and high level signals is at the voltage level of 3 V. Voltages above 3 V are detected as high level voltages and voltages below 2.8 V are detected as low level.

Digital Outputs

The RJ12 power supply connector has two different output drivers:

- OUT-1 is driven by a high side switch that applies V_{IN} to pin 5 of the RJ12 connector. IO1 of the embedded radio device is used to activate the OUT-1 signal, see Control Terminal - radio device signal cross reference table, page 30.
- OUT-2 is driven by a low side switch that shorts pin 2 of the RJ12 connector to ground when activated. IO3 of the embedded Radio Device engine is used to activate OUT-2, see Control Terminal - Radio Device signal cross reference table, page 30.

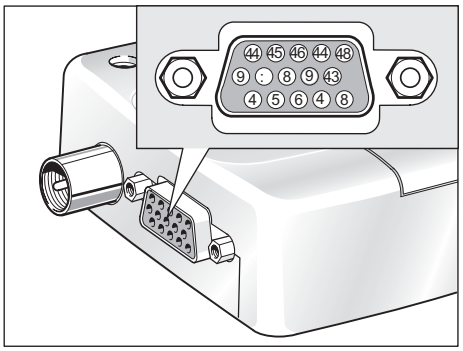
IMAGE -TBD

V_{IN} Monitoring

The voltage, V_{IN}, can be monitored internally by the Control Terminal, for example if the Control Terminal is supplied from an external battery. ADC1 on the Radio Device is used for this purpose, see Control Terminal-Radio Device signal cross reference table, and is calibrated to operate in the voltage range 0 – 31.875 V. The resolution of the 8 bit converter, ADC1, provides a measurement accuracy of approximately 3%.

5.2 RS232 Serial and Extended I/O Interface

The Control Terminal supports a standard 9 signal RS232 serial interface (EIA/TIA 574) on the 15 pin high density connector together with a range of configurable I/Os including a second 4-wire logic level RS232 interface.



Signals that support an alternative configuration can be reconfigured using the appropriate AT command (e.g. AT+E2IO) or via an intrinsic function if using an embedded application.

Note! When reconfiguring a Control Terminal signal, via AT command or intrinsic function, the corresponding Radio Device signal name must be used, see Control Terminal-Radio Device signal cross reference table, page 30.

The electrical characteristics of the serial port signals are shown below:

Pin	*Control Terminal Signal*	*Dir*	*Max. Voltage limits*	*Description*
1	DCD	O	±13.2V	RS232 signal Data carrier detect $V_{out} \geq \pm 5V$
2	RD	O	±13.2V	RS232 signal: Received data $V_{out} \geq \pm 5V$
3	TD	I	± 25V	RS232 signal: Transmitted data $V_{IL} < 0.6V$, $V_{IH} > 2.4V$
4	IN-3	I	-0.5 to 32V	Digital input $V_{IH} > 3V$, $V_{IL} < 2.8V$ PullDown with 40kΩ
5	OUT-3	O	32V, 0.25A	low side switch, short circuit protected
6	DSR	O	±13.2V	RS232 signal: Data set ready $V_{out} \geq \pm 5V$
7	RTS	I	±25V	RS232 signal: Request to send $V_{IL} < 0.6V$, $V_{IH} > 2.4V$

Pin	*Control Terminal Signal*	*Dir*	*Max. Voltage limits*	*Description*
8	CTS	O	±13.2V	RS232 signal: Clear to send $V_{out} \geq \pm 5V$
9	4.8V	O	0 to +4.8V, 75mA	Voltage supply for external devices Supply voltage +4.8V, max. current 75mA
10	RI	O	±13.2V	RS232 signal: Ring indicator $V_{out} \geq \pm 5V$
11	IN-2	I	-0.5 to 32V	Digital input $V_{IH} > 3V$, $V_{IL} < 2.8V$ PullDown with 40kΩ
12	OUT-4	O	32V, 0.25A	low side switch, short circuit protected
13	DTR	I	±25V	RS232 signal: Data Terminal Ready $V_{IL} < 0.6V$, $V_{IH} > 2.4V$
14	GND	I	-	Ground connection and return path for the extended inputs/outputs
15	ANA_IN	I	-0.5 to 32V	Analog input measurement range: 0 to 12.75V

5.2.1 Standard RS232 Serial interface and Signals

The module supports a standard RS232 serial interface (EIA/TIA 574) via its 15 pin high density connector, shown above.

5.2.2 Serial Data

The Control Terminal supports the standard data character format of 1 start bit, 8 bit data, no parity plus 1 stop bit, in total 10 bits per character. In line with serial communication terminology the module is the data circuit-terminating equipment (DCE) and the external application or computer is the data terminating equipment (DTE).

5.2.3 Serial Data Signals - RD, TD

The default baud rate is 9.6kbps, however higher bit rates up to 230.4kbps are supported and can be set by AT commands. At start-up the module transmits and receives data at the default rate of 9.6kbps in either standard AT mode or binary mode (the first received data - AT or binary format - determines the operating mode).

Serial Data From GT47 (RD) *Pin 2*

RD is an output signal that the Control Terminal uses to send data to the external application.

Serial Data To Control Terminal (TD) *Pin 3*

TD is an input signal, used by the external application to send data to the Control Terminal.

5.2.4 Control Signals - RTS, CTS, DTR, DSR, DCD, RI

Request to Send (RTS) *Pin 7*

Used to condition the Control Terminal for data transmission. The default level is inactive by internal pull down.

The exact behaviour of RTS is defined by an AT command. Software or hardware flow control can be selected. Hardware flow control is the default selection.

The application must pull RTS high to enable transmission from the Control Terminal.

Clear To Send (CTS) *Pin 8*

CTS indicates that the Control Terminal is ready to transmit data. The default level is high. You can define the exact behaviour of CTS through an AT command, and can select software or hardware flow control.

Data Terminal Ready (DTR) *Pin 13*

DTR indicates that the DTE is ready to send and receive data. It also acts as a hardware 'hang-up', terminating calls when switched low. The signal is active high. You can define the exact behaviour of DTR with an AT command.

Data Set Ready (DSR) *Pin 6*

An active DSR signal is sent from the Control Terminal to the application (DTE) to confirm that a communications path has been established. DSR has two modes of operation, use the AT command AT&S to set the mode.

Data Carrier Detect (DCD) *Pin 1*

DCD indicates that the Control Terminal is receiving a valid carrier (data signal) when high. You can define the exact behaviour of DCD with an AT command.

Ring Indicator (RI) *Pin 10*

RI indicates that a ringing signal is being received by the Control Terminal when high. You can define the exact behaviour of RI with an AT command.

Alternative Configuration

It is possible to reconfigure one or more of the signals in this section (RTS, CTS, DTR, DSR DCD and RI) to be used as digital inputs or outputs if the full RS232 serial interface is not required. Configuration is achieved using AT command (AT+E2IO) or via embedded application intrinsic functions, please refer to Control Terminal-Radio Device signal cross reference table, page 30.

To be reconfigured as a digital IO, each signal must retain the direction and the logic voltage levels attributed to it when used as an RS232 signal. For example DSR can only be reconfigured as a digital output with $V_{out} \geq \pm 5V$.

5.2.5 Extended I/O Signals

Please refer to Control Terminal-Radio Device signal cross reference table, page 30, for more information on the relationship between signal names and pin numbers of the Control Terminal and the embedded Radio Device engine.

Digital Inputs *Pin 4 & 11*

Digital inputs IN-2 and IN-3 are available on the HD15 connector via pins 11 and 4 respectively. The inputs are detected via signals IO4 and IO7 of the embedded Radio Device engine.

Note! As an alternative configuration signals IN-2 and IN-3 can be used to support a second RS232 serial interface as RTS-2 and TD-2. Further information is given below.

Analog Input *Pin 15*

The signal ANA_IN can be used for measuring analog input values in the range 0 to 12.75V. ADC2 of the embedded GR47 is used to detect ANA_IN.

The resolution of the converter is 8 bit with an measurement accuracy of about 3%.

The input impedance of the ANA_IN pin is 50 kΩ.

Digital Outputs *Pin 5 & 12*

Digital outputs OUT-3 and OUT-4 are available on the HD15 connector via pins 5 and 12 respectively. The outputs are controlled via signals IO8 and IO3 of the embedded Radio Device engine.

Signal OUT-4 on the HD15 connector is switched in parallel to signal OUT-2 on the RJ12 connector. The individual output signals are generated by two different low side switches inside the terminal driven from the common control signal, IO3. All Control Terminal output signals

driven by low side switches return to open circuit when deactivated. This allows the external application hardware to determine the desired logic voltage levels with the appropriate pull-up.

The output drivers are low side switches which short the pin to GND if they are activated.

Note! As an alternative configuration signals OUT-3 and OUT-4 can be used to support a second RS232 serial interface as RD-2 and CTS-2. Further information is given below.

+4.8V Output Supply *Pin 9*

There is a voltage regulator implemented inside the module that is capable of supplying an external voltage source of +4.8V with a maximum current of 75 mA.

The voltage source can be switched on/off with the DAC signal of the internal Radio Device GSM engine.

By default the voltage source is switched on. A high level of 2.75V at the DAC output of the Radio Device GSM engine will switch the voltage source off.

Note! The +4.8V source may be switched on/off via an embedded or external application and so may be used as an optional digital output with levels of +4.8V and open circuit.

5.2.6 Second RS232 Serial Interface

IN-3 and OUT-3 can be automatically reconfigured as signals TD-2 and RD-2, of a second serial interface, by enabling UART3 of the internal Radio Device. UART 3 may be enabled using AT command or intrinsic function.

In addition, IN-2 and OUT-4 can be automatically reconfigured as signals RTS-2 and CTS-2 of the second serial interface by enabling hardware flow control for UART3 on the internal Radio Device. Hardware flow control can be enabled using intrinsic function only.

Note! The signal level thresholds for each of the digital inputs of the second serial interface are: $3V < V_{IH} < 32V$ and $V_{IL} < 2.8V$.

An external RS232 transceiver component may be used to convert the serial interface to standard RS232 electrical levels. The Control Terminal's +4.8 V output can be used to provide power for the transceiver.

5.2.7 Relationship between Control Terminal and Radio Device signals

When reconfiguring a Control Terminal signal, via AT command or intrinsic function, the corresponding Radio Device signal name must be used, see the Control Terminal-Radio Device signal cross reference tables overleaf.

Control Terminal - Radio Device Signal Cross-reference Table A

Control Terminal (CT)			*Relationship to the Radio Device (RD) engine*	
CT Pin	*CT Primary Signal*	*Dir.*	*RD Pin*	*Corresponding RD Signal*
HD15 Connector				
1	DCD	O	38	DCD
2	RD	O	42	RD
3	TD	I	41	TD
4	IN-3	I	43	IO7
5	OUT-3	O	44	IO8
6	DSR	O	32	DSR
7	RTS	I	39	RTS
8	CTS	O	40	CTS
9	+4.8V	O	20	DAC
10	RI	O	36	RI
11	IN-2	I	24	IO4
12	OUT-4	O	23	IO3†
13	DTR	I	37	DTR
14	GND			
15	ANA_IN	I	27	ADC2
RJ12 Connector				
1	V_{IN}			
2	OUT-2	O	23	IO3†
3	IN-1	I	13	I05
4	TO_IN			
5	OUT-1	O	21	IO1
6	GND			
Control Terminal Internal Function				
	V_{IN} Monitoring	I	26	ADC1
	Power Save Mode	O	22	IO2

†# IR6#q#kh#hp ehgghg#Udglr#Ghylfh#sur ylghv#kh#fr p p r q#fr qwr o#lj qdo# ir u#er vk#Fr qwr o#Whup lqdo#lj qdov#RXW05#dqg#RXW071

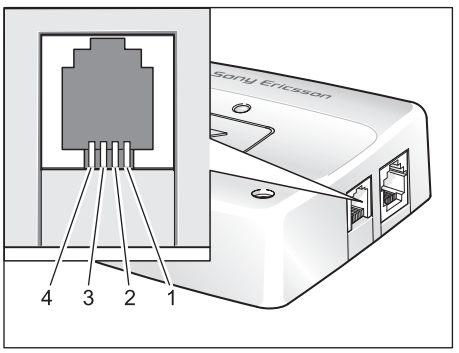
Control Terminal - Radio Device Signal Cross-reference Table B

Control Device (CT)			*Relationship to Radio Device (RD) engine*	
CT Pin	*CT Alternative signal*	*Dir.*	*Pin*	*Corresponding RD Signal*
HD15 Connector				
1	OUT-6	O	38	O1
2		I	42	
3		O	41	
4	TD-2	I	43	TD3
5	RD-2	O	44	RD3
6	OUT-7	O	32	O3
7	IN-4	I	39	IO9
8	OUT-8	O	40	O4
9	OUT-5	O	20	DAC
10	OUT-9	O	36	O2
11	RTS-2	I	24	IO4
12	CTS-2	O	23	IO3
13	IN-5	I	37	IN1
14				
15				

5.3 Audio Connector

A 4-way RJ9 connector, as shown below, allows a telephone handset to be plugged into the Control Terminal, giving access to the microphone and earpiece signals. The connector may also be used to drive other analogue audio sub-systems or devices.

The module is configured to work with a range of handsets. If necessary, changes can be made to the characteristics of the audio interface by sending the Control Terminal appropriate AT commands.



1 MICN 3 BEARP
2 BEARN 4 MICP

Audio signal descriptions are listed below:

Pin	*Signal*	*Dir*	*Description*
1	MICN	I	Microphone negative input
2	BEARN	O	Earpiece negative output
3	BEARP	O	Earpiece positive output
4	MICP	I	Microphone positive input

MICP and MICN are balanced differential microphone input signals. These inputs are compatible with an electret microphone.

BEARP and BEARN are the speaker output signals. These are differential-mode outputs. The electrical characteristics are given in the table below.

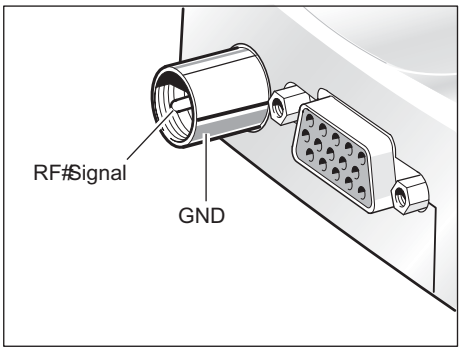
Parameter	*Limit*
Output level (differential)	≥4.0 V_{pp}
Output level (dynamic load = 32Ω)	≥2.8 V_{pp}
Distortion at 1 kHz and maximum output level	≤5%
Offset, BEARP to BEARN	±30 mV
Ear piece mute switch attenuation	≥40 dB

The following table shows the ear piece impedances that can be connected to BEARP and BEARN.

Ear piece model	*Impedance*	*Tolerance*
Dynamic ear piece	[32Ω + 800µH] // 100pF	±20%
Dynamic ear piece	[150Ω + 800µH] // 100pF	±20%
Piezo ear piece	1kΩ + 60nF	±20%

5.4 Antenna Connector

The antenna connector allows transmission of radio frequency (RF) signals between the Control Terminal and an external customer-supplied antenna. The module is fitted with a 50Ω, FME male coaxial jack as shown below.



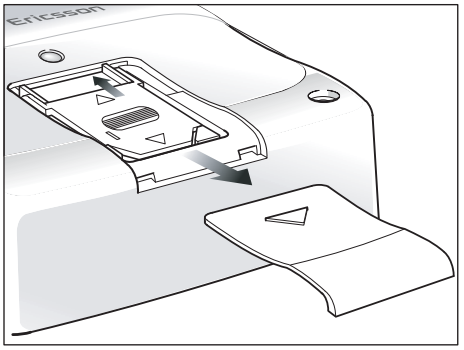
The table below shows the antenna electrical characteristics:

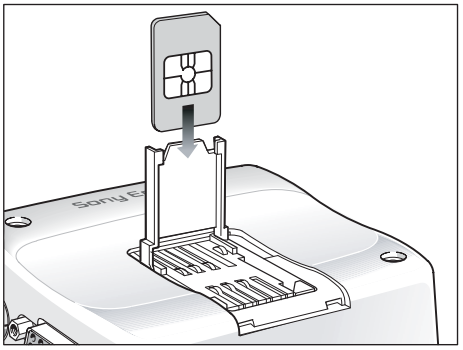
Parameter	*Limit*	*Description*
Nominal impedance	50Ω (SWR better than 2.5:1)	
Output Power	2 Watt peak (Class 4)	EGSM 850/EGSM 900
	1 Watt peak (Class 1)	GSM1800/GSM 1900
Static Sensitivity	Better than –102dBm	EGSM 850/ EGSM 900
	Better than –102dBm	GSM1800/ GSM 1900

For information on antenna refer to “Antenna”, page 46.

5.5 SIM Card Reader

The module is fitted with a SIM card reader designed for 3 V and 5 V SIM cards. It is the flip-up type which is lockable in the horizontal position and is accessed through a removable panel as shown below.





The SIM card reader incorporates a SIM presence switch which detects whether a SIM card is inserted. The full operation of the Control Terminal relies on a SIM card being inserted.

Caution! Some Control Terminal functionality may be lost if you try to operate it without a SIM card.

The SIM presence switch also ensures that when a SIM card is inserted or removed the unit is reset, as long as the Control Terminal is switched ON.

Loggin with the SIM In

TBA

Logging with the SIM Out

TBD

5.6 Real Time Clock

The module contains a real time clock (RTC) to maintain accurate timekeeping and to enable "timestamping" of messages.

The RTC is powered all the time that the Control Terminal is turned on. When the Control Terminal is powered off, a storage energy device within the module provides back-up power to maintain the RTC for several hours - please contact Sony Ericsson Customer Support for more information.

The RTC back-up is fully charged after approximately 10 hours with the control terminal turned on. Once fully charged the RTC back-up will maintain the Real Time Clock for at least 8 hours.

5.7 Software Updates

It is possible, and sometimes necessary, to update the module software. Updates must be carried out by a Sony Ericsson approved technician. Please contact your supplier for details (see "Service and Support", page 9).

6. Embedded Applications

The module has the capability to store, and run customer written code in the form of a script during the processors idle time, through the use of an on board interpreter.

6.1 Features

Main features of embedded applications are as follows.

- C based scripting language (Sony Ericsson specific)
- Over the air upgrade of scripts (NOT GSM software)
- Library of intrinsic functions
- Two radio device scripts can be stored, but only one can run at any one time.

6.2 Implementation

The module has up to 44kbytes of space available for storage of two scripts in the scripting language and 25kbytes of operating RAM. Structures included in this language are:

- If - then - else statements
- While loops
- For loops

All hardware interfaces that are normally available to the module through the AT commands are available to the embedded application. Further drivers have been written such as M bus and I^2C for use by the embedded application (EA) through the use of the I/O pins.

6.2.1 Limitations

Since the module is processing the script using its own memory, limitations are placed onto the scripts that are run.

- A direct comparison cannot be made to a fully compiled C program in terms of size but a gauge of script size is that if each line were 128 characters long in the script then the script could be 350 lines long.
- Processing power is something that needs to be considered as the script is run as a low priority process within the software. However, controller mode stops GSM operation and provides all the processing power for the script to be run. See the M2*m* Power Application Guide for more details.
- Code cannot be ported directly from an existing application and loaded directly onto the radio device. It must be re written in the Sony Ericsson Mobile script language so that the radio device interpreter can function correctly.

6.2.2 M2*m*power IDE (Integrated Developers Environment)

The IDE is a windows based package which allows the user to write, simulate, debug and download the application into a radio device with the embedded application (EA) software. The standard version is designed to run on Windows XP and 2000, other versions are available for 98 if required.

A M2*m* Power application guide is available for implementing applications using the developers kit and the embedded application (EA) functionality.

This is a required package to be able to implement an embedded application (EA).

For further information please contact SEM customer support.

7. TCP/IP Stack

An on board IP/TCP/UDP stack has been integrated into the software negating the need for the customer to implement one in their own code base.

This is available through the embedded applications (see previous section) using intrinsic functions and also through AT commands (see GR47/GR48 AT commands manual).

7.1 Implementation

The following types of commands allow various functions:

- Open/closing IP connection - Negotiates/closes a dynamic IP address with the web server.
- Send/Receive TCP packets - Performs all TCP operations to send and receive packets.
- Send/Receive UDP packets - Performs all UDP operations to send and receive packets.
- Resolve URL to an IP address - Similar to lookup command in DOS

When the unit is set up and controlled using the embedded applications either the embedded applications or an external application can generate data to be sent and pass it to the radio device for transmission.

This effectively provides a transparent communication link to an internet server from the application over GPRS.

8. Operation

8.1 Switching On the Control Terminal

The Control Terminal is turned ON automatically once DC power is applied. If the Control Terminal is turned OFF, using one of the methods described in 8.2, the Control Terminal can be turned ON again through one of two methods:

- pull signal TO_IN to ground for t >0.2s, then release.
- activate the main RS232 control line DTR, low to high for >0.2s

The Control Terminal is fully operational after 4 seconds. Logging onto a network may take longer than this and is outside the control of the Control Terminal.

Note! The Control Terminal will not switch on if TO_IN is shorted to ground when the dc supply is applied.

8.2 Switching Off the Control Terminal

There are two ways to switch off the Control Terminal as described below.

- Use the appropriate AT command (AT+CFUN);
- pull signal TO_IN to ground for t >0.2s, then release.

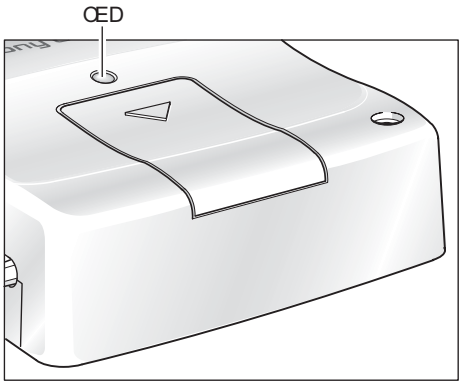
8.3 Resetting the Control Terminal

A full system reset, independent of the status of the software, may be applied to the Control Terminal as follows:

- assert HR_IN high for > 3.5s.

8.4 Operating States/LED

The Control Terminal has a green LED, as depicted below, which is used to indicate various operating states. These states are described in following table.



Operating state	*LED*
After switching on the Control Terminal	On after 4s
Control Terminal switched off or power removed from the module	Off
Standby or talk	Flashing
No network, network search, no SIM card, no PIN entered	On

8.5 Power Save

The Control Terminal can power down the main RS232 IC when not needed in order to minimise power consumption. The IC is powered up automatically at start-up but can be powered down by setting the output of IO2 on the embedded Radio Device (pin22) to low via AT command or embedded application. Once powered down, the IC can be woken up by setting the output of IO2 high on the Radio Device via AT Command.

Even when powered down the IC is able to pass a DTR signal received on the serial interface. Therefore an embedded application that monitors DTR, while the IC is powered down, can be made to wake up the IC, if a signal is received, by setting IO2 on the Radio Device high.

8.6 Controller Mode

The Control Terminal, when powered up, will normally start up its GSM signalling software and look to register on the GSM network. Any embedded application script runs as a background process as and when the GSM software is idle. A feature available via embedded applications allows the Control Terminal to be placed in 'controller mode' whereby the Control Terminal powers up with a minimal subset of radio functionality. The GSM signalling software is halted and the embedded applications script has full control of the processor.

Controller mode allows an application to run with more predictable response times.

9. Safety and Product Care

Please read the information in this section and the information in “Installation of the Control Terminal”, page 44, before starting your integration work.

9.1 Safety Instructions

PLEASE READ THESE SAFETY INSTRUCTIONS AND KEEP A COPY OF THEM.

- Always ensure that use of the Control Terminal is permitted. The Control Terminal may present a hazard if used in proximity to personal medical electronic devices. As a rule, the Control Terminal must not be used in hospitals, airports or planes.
- Never use the Control Terminal at a gas station, refuelling point, blasting area or in any other environment where explosives may be present.
- Operating the Control Terminal close to other electronic devices, such as antennas, television sets, and radios may cause electromagnetic interference.
- This product is intended to be used with the antenna or other radiating element at least 20 cm away from any part of the human body. In applications where this rule cannot be applied, the application designer is responsible for providing the SAR measurement test report and declaration.
- You are responsible for observing your country's safety standards, and where applicable, the relevant wiring rules.

9.2 General Precautions

- The Control Terminal as a stand alone item is designed for indoor use only. To use outside it must be integrated into a weatherproof enclosure. Do not exceed the environmental and electrical limits as specified in “Technical Data”, page 49.
- Avoid exposing the Control Terminal to lighted cigarettes, naked flames or to extreme hot or cold temperature.
- Never try to dismantle the Control Terminal yourself. There are no components inside the Control Terminal that can be serviced by the user. If you attempt to dismantle the Control Terminal, you may invalidate the warranty.
- The Control Terminal must not be installed or located where the surface temperature of the plastic case may exceed 85° C.
- All cables connected to the Control Terminal must be secured or clamped, immediately adjacent to the Control Terminal's connectors, to

provide strain relief and to avoid transmitting excessive vibration to the Control Terminal in the installation.

- Ensure the d.c. cable, supplying power to the Control Terminal, does not exceed 3 metres. For longer distances please contact Sony Ericsson Service and Support.
- To protect power supply cables and meet the fire safety requirements when the unit is powered from a battery or a high current supply, connect a fast 1.5A fuse in line with the positive supply. An appropiate fuse should be used see section "Power Supply", page 45
- Do not connect any incompatible component or product to the Control Terminal.

Note! Sony Ericsson may refuse warranty claims where evidence of product misuse is found.

9.3 SIM Card Precautions

- Before handling the SIM card in your application, ensure that you are not charged with static electricity. Use proper precautions to avoid electrostatic discharges.
- When the SIM card hatch is opened, the SIM card connectors lie exposed under the SIM card holder.

Caution! Do not touch these connectors! If you do, you may release an electrical discharge that could damage the Control Terminal or the SIM card.

- When designing your application, the SIM card's accessibility should be taken into account. We always recommend that you have the SIM card protected by a PIN code. This will ensure that the SIM card cannot be used by an unauthorized person.

9.4 Antenna Precautions

- If the antenna is to be mounted outside, consider the risk of lightning. Follow the instructions provided by the antenna manufacturer.
- Never connect more than one Control Terminal to a single antenna. The Control Terminal can be damaged by radio frequency energy from the transmitter of another Control Terminal.
- Like any mobile station, the antenna of the Control Terminal emits radio frequency energy. To avoid EMI (electromagnetic interference), you must determine whether the application itself, or equipment in the application's proximity, needs further protection against radio emission and the disturbances it might cause. Protection is secured either by shielding the surrounding electronics or by moving the antenna away from the electronics and the external signals cable.

- The Control Terminal and antenna may be damaged if either come into contact with ground potentials other than the one in your application. Beware, ground potential are not always what they appear to be.

10. Installation of the Control Terminal

This chapter gives you advice and helpful hints on how to integrate the Control Terminal into your application from a hardware perspective.

Please read the information given in "Safety and Product Care", page 41 and then the read the information in this section before starting your integration work.

10.1 Where to Install the Control Terminal

There are several conditions which need to be taken into consideration when designing your application as they might affect the Control Terminal and its function. They are:

10.1.1 Environmental Conditions

The Control Terminal must be installed so that the environmental conditions stated in the Technical Data chapter, such as temperature, humidity and vibration are satisfied. Additionally, the electrical specifications in the Technical Data section must not be exceeded.

10.1.2 Signal Strength

The Control Terminal has to be placed in a way that ensures sufficient signal strength. To improve signal strength, the antenna can be moved to another position. Signal strength may depend on how close the Control Terminal is to a radio base station. You must ensure that the location at which you intend to use the Control Terminal, is within the network coverage area.

Degradation in signal strength can be the result of a disturbance from another source, for example an electronic device in the immediate vicinity. More information about possible communication disturbances can be found in section 10.3.5, page 47.

When an application is completed, you can verify signal strength by issuing the AT command AT+CSQ. See the GR47/GR48 AT Commands Manual for more details.

Tip! Before installing the Control Terminal, use an ordinary mobile telephone to check a possible location for it. In determining the location for the Control Terminal and antenna, you should consider signal strength as well as cable length

10.1.3 Connection of Components

The integrator is responsible for the final integrated system. Incorrectly designed or installed, external components may cause radiation limits to be exceeded. For instance, improperly made connections or improperly installed antennas can disturb the network and lead to malfunctions in the Control Terminal or equipment.

10.1.4 Network and Subscription

- Before your application is used, you must ensure that your chosen network provides the necessary telecommunication services. Contact your service provider to obtain the necessary information.
- If you intend to use SMS in the application, ensure this is included in your (voice) subscription.
- Consider the choice of the supplementary services described in section "Short Message Service", page 11.

10.2 How to Install the Control Terminal

10.2.1 Power Supply

- Use a high-quality power supply cable with low resistance. This ensures that the voltages at the connector pins are within the allowed range, even during the maximum peak current.
- When the unit is powered from a battery or a high current supply, connect a fast 1.5A fuse in line with the positive supply. This protects the power cabling and Control Terminal.

10.2.2 Securing the Control Terminal

- Before securing the Control Terminal take into account the amount of additional space required for the mating connectors and cables that will be used in the application.
- Where access is restricted, it may be easier to connect all the cables to the Control Terminal prior to securing it in the application.
- Securely attach the Control Terminal to the host application using two 3mm diameter pan-head screws of appropriate length as shown below.

Caution! Do not exceed a torque of 25Ncm when tightening the fixings screws. Excessive torque applied to the screws can crack the plastic case.

10.3 Antenna

10.3.1 General

The antenna is the component in your system that maintains the radio link between the network and the Control Terminal. Since the antenna transmits and receives electromagnetic energy, its efficient function will depend on:

- the type of antenna (for example, circular or directional);
- the placement of the antenna;
- communication disturbances in the vicinity in which the antenna operates.

In the sections below, issues concerning antenna type, antenna placement, antenna cable, and possible communication disturbances are addressed.

In any event, you should contact your local antenna manufacturer for additional information concerning antenna type, cables, connectors, antenna placement, and the surrounding area. You should also determine whether the antenna needs to be grounded or not. Your local antenna manufacturer might be able to design a special antenna suitable for your the application.

10.3.2 Antenna Type

Make sure that you choose the right type of antenna for the Control Terminal. Consider the following requirements:

- the antenna must be designed for the dual frequency bands in use: EGSM 900/GSM 1800 for GT47, GSM 850/ GSM 1900 for GT48
- the impedance of the antenna and antenna cable must be 50Ω
- the antenna output-power handling must be a minimum of 2W;
- the VSWR value should be less than 3:1 to avoid damage to the Control Terminal.

10.3.3 Antenna Placement

The antenna should be placed away from electronic devices or other antennas. The recommended minimum distance between adjacent antennas, operating in a similar radio frequency band, is at least 50cm.

If signal strength is weak, it is useful to face a directional antenna at the closest radio base station. This can increase the strength of the signal received by the Control Terminal.

The Control Terminal's peak output power can reach 2W. RF field strength varies with antenna type and distance. At 10cm from the antenna the field strength may be up to 70V/m and at 1m it will have reduced to 7V/m.

In general, CE-marked products for residential and commercial areas, and light industry can withstand a minimum of 3 V/m.

10.3.4 The Antenna Cable

Use 50Ω impedance low-loss cable and high-quality 50Ω impedance connectors (frequency range up to 2 GHz) to avoid RF losses. Ensure that the antenna cable is as short as possible.

The Voltage Standing-Wave Ratio (VSWR) may depend on the effectiveness of the antenna, cable and connectors. In addition, if you use an adapter between the antenna cable and the antenna connector, it is crucial that the antenna cable is a high-quality, low-loss cable.

Minimize the use of extension cables, connectors and adapters. Each additional cable, connector or adapter causes a loss of signal power.

10.3.5 Possible Communication Disturbances

Possible communication disturbances include the following:

- **Noise** can be caused by electronic devices and radio transmitters.
- **Path-loss** occurs as the strength of the received signal steadily decreases in proportion to the distance from the transmitter.
- **Shadowing** is a form of environmental attenuation of radio signals caused by hills, buildings, trees or even vehicles. This can be a particular problem inside buildings, especially if the walls are thick and reinforced.
- **Multi-path fading** is a sudden decrease or increase in the signal strength. This is the result of interference caused when direct and reflected signals reach the antenna simultaneously. Surfaces such as buildings, streets, vehicles, etc., can reflect signals.
- **Hand-over** occurs as you move from one cell to another in the GSM network. Your mobile application call is transferred from one cell to the next. Hand-over can briefly interfere with communication and may cause a delay, or at worst, a disruption.

10.4 Accessories

The Control Terminal has been type approved together with a range of accessories including:

Power Supply (GT47 only)

1. **AC-DC Power Adaptor with customised d.c. lead**
   (Model # AD-0901000BS)
   Input: 230 Va.c., 50 Hz, 2 m mains lead (UK and Euro plug options)

Output: 9Vd.c., 1A. 2m d.c. lead with RJ11 connector. CE marked.

Antennas (GT47 only)

2. **Dual Band Minimag Antenna (900/1800MHz)**
   (Model # 1140.26-FME/F)
   Magnetic-mount antenna, 0dB radiator, 2.6m RG174 cable with FME female connector.

3. **Dual Band Antenna (900/1800MHz)**
   (Model # EHD1890-FME/F)
   Bulkhead-mount antenna, 0dB radiator, 0.8m low loss cable with FME female connector.

Cable (GT47 and GT48)

4. **RS232 9-way Serial Cable**
   (Model # C-E-RS232-2M)
   2m, 9-way cable, DB9 (female) to DB9 (male) connectors.

Please contact Sony Ericsson distribution channels for availability.

11. Technical Data

Data Features

CSD	Up to 9.6kbps, transparent and non-transparent
HSCSD (2+1)	Up to 28.8kbps
GPRS Class B (4+1) - P channels - Coding schemes CS1 - CS4	85.6kbps (subject to network support and terminal location)
GSM	07.10 multiplexing protocol

Short Message Service Features

SMS	Text and PDU
	Point to point (MT/MO)
	Cell broadcast
	concatenation of up to 6 SMS

Voice Features

	Full Rate, Enhanced Full Rate and Half Rate (FR/EFR/HR)/GT48 also (AMR) Adaptive Multi Role
	Echo Cancellation and Noise Reduction
	Dual Tone Multi Frequency (DTMF)

Fax Features

	Group 3
	Class 1 and 2

Data Storage

SMS storage capacity	40 in the module In addition, the unit can handle as many SMS as the SIM can store
Phone book capacity	100

Power Supply

Supply voltage range	5 to 32V d.c.

Radio Specifications

Frequency bands	GT47: EGSM 900 and GSM 1800 (dual band) GT48: GSM 850 and GSM 1900 (dual band)
Maximum RF output power	2W (EGSM 900/GSM 1800) 1W (GSM 850/GSM 1900)
Antenna impedance	50Ω
Static sensitivity	Better than –102dBm

Audio Specifications

Parameter	*Limit*
Output level (differential)	$\geq 4.0 V_{pp}$
Output level (dynamic load = 32Ω)	$\geq 2.8 V_{pp}$
Distortion at 1kHz and maximum output level	≤5%
Offset, BEARP to BEARN	±30mV
Ear-piece mute-switch attenuation	≥40dB

Ear piece model	*Impedance*	*Tolerance*
Dynamic ear piece	[32Ω + 800µH] // 100pF	±20%
Dynamic ear piece	[150Ω + 800µH] // 100pF	±20%
Piezo ear piece	1kΩ + 60nF	±20%

SIM Card Reader

Voltage type	Support for 3 V and 5 V SIM cards

Electrical Connectors and LED

Plug-in power supply connector and extended I/O	RJ12 6-way
Handset audio connector	RJ9 4-way
Antenna connector	FME male
RS232 port	high density socket, 15 pin
LED	Green

Mechanical Specification

Length	77.4mm
Width	66.4mm
Height	26.2mm
Weight	<110g

Environmental specifications

Operating temperature range	–30°C to +75°C
Storage temperature range	–40°C to +85°C
Relative humidity	5 to 95%, non-condensing
Stationary vibration, sinusoidal	Displacement: 7.5mm Acceleration amplitude: 20m/s² and 40m/s² Frequency range: 2 to 8Hz, 8 to 200Hz, 200 to 500Hz
Stationary vibration, random	Acceleration spectral density (m²/s²): 0.96, 2.88, 0.96 Frequency range: 5 to10Hz, 10 to 200Hz, 200 to 500Hz, 60min/axis
Non-stationary vibration, including shock	Shock response spectrum I, peak acceleration: 3 shocks in each axis and direction; 300m/s², 11ms Shock response spectrum II, peak acceleration: 3 shocks in each axis and direction; 1000m/s², 6ms
Bump	Acceleration: 250m/s²
Free fall transportation	1.2m
Rolling pitching transportation	Angle: ±35degrees; period: 8s
Static load	10kPa
Low air pressure/high air pressure	70kPa/106kPa

Current Consumption in Standard Operation

Supply Voltage	*5V*		*12V*		*32V*		
Power Down Mode:							
	Av	*Max*	*Av*	*Max*	*Av*	*Max*	
	5	15	5	15	20	50	mA
Standby Mode (typical):							
Frequency	*Av*	*Max*	*Av*	*Max*	*Av*	*Max*	
850/900 MHz	26	110	9	43	6	20	mA
1900/1800 MHz	26	120	9	45	6	19	mA
Talk Mode (typical):							
Frequency	*Av*	*Max*	*Av*	*Max*	*Av*	*Max*	
850/900 MHz	220	1230	90	520	40	200	mA
1900/1800 MHz	170	960	70	350	30	140	mA

Power Down Mode: DC power is applied but the Control Terminal is switched OFF.
Standby Mode: The module is switched ON and attached on to the network. No call in progress.

Talk Mode: The module is switched ON and a voice/data call is in progress.
The power consumption during transmission in Talk Mode is measured at maximum transmit power.
The power consumption in Standby Mode is measured at the maximum paging rate (Paging Rate 2).

Current Consumption with external +4.8V Supply Active

For the following calculations it was assumed that the external +4.8V load is 70mA.

Supply Voltage	*5V*		*12V*		*32V*		
Power Down Mode:							
	Av	*Max*	*Av*	*Max*	*Av*	*Max*	
	5	15	5	15	20	50	mA
Standby Mode (typical):							
Frequency	*Av*	*Max*	*Av*	*Max*	*Av*	*Max*	
850/900 MHz	112	196	45	79	19	33	mA
1900/1800 MHz	112	206	45	81	19	32	mA
Talk Mode (typical):							
Frequency	*Av*	*Max*	*Av*	*Max*	*Av*	*Max*	
850/900 MHz	306	1316	126	556	53	213	mA
1900/1800 MHz	256	1046	106	386	43	153	mA

These tables do not include the power consumption associated with any drive current supplied via further Control Terminal outputs, e.g. OUT-1 or OUT-2.

Current Consumption of UART Transceiver in Standard Operation with active/inactive serial Transmitter[1]

Note! It is assumed that every driving signal of the UART1 transceiver component inside the Control Terminal is driving an impedance of 3 KΩ to its output level of max. 5.4V (see data sheet of RS232 device: e.g. MAX3237).
The signals that are driven are: RXD, CTS, DSR, DTR, RI

Signal Voltage	*5V*	*12V*	*32V*	
Power down mode of serial transmitter:				
	4.3	1.8	0.7	µA
Serial transmitter active (no load):				
	0.9	0.4	0.15	mA
Serial transmitter active (3 KΩload):				
	11.7	4.9	1.8	mA

Certification

Directive 1999/5/EC	EMC: EN 301 489-1
	EMC: EN 301 489-7
	Safety: EN 60950-1
	GSM 3GPP TS 51.010-1
Tested according to GCF-CC	

4, Lqvwuxqdo#thj xcdwu#hiilflhqf| #A<3(