Integrator’s Manual

GM 12

GSM Module

ERICSSON

CE

The product described in this manual conforms to the TTE directive 91/263/EEC and EMC directive 89/336/EEC. The product fulfils the requirements according to ETS 300 342-1.

Second edition (February 1999)

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Safety advice and other precautions

The GM 12 should be handled like any mobile telephone. Therefore, you (the integrator) should read this information before integrating the module with your application.

To find out more about safety issues, refer to the list of web sites in the chapter *For further reading*.

Safety

- The module must not be used with or close to any medical life support equipment.
- The module has no built-in fuse. To protect the power supply cables and fulfil the fire safety requirements, it is required that a fuse to be mounted as close to the terminals of the power supply as possible.
- Never use the module at a gas station, refuelling point, or blasting area, or other explosive environment.
- Used in proximity to personal medical electronic devices, such as hearing aids and pacemakers, the module may present a hazard. Make sure that use of the module is permitted: as a rule, mobile phone equipment must be switched off at hospitals, on airplanes, etc.
- If the antenna is to be mounted outdoors, consider the protection from possible lightning. Follow the instructions provided by your local antenna manufacturer.

Product care

- Never exceed the environmental and electrical limits as specified in the chapter *Technical data* in this manual. If you do, it could damage the module.
- Operating the module close to other electronic devices, such as antennas, television sets and radios, may cause electromagnetic interference.
- Never connect more than one module to a single antenna. The module could be damaged by radio frequency energy from the transmitter of another module.

- Never connect any component or product to the GM 12 that is not compatible with the interface for the module specified in this manual. Ericsson does not warrant defects, non-conformities and/or deviations caused thereby.

  The integrator is responsible for the final integrated system. Observe that the use of external components, such as improperly made connections, antennas that are incorrectly designed or installed, may cause radiation limits to be exceeded, which could disturb the GSM network and lead to malfunctions in the module or equipment.

- Before inserting and removing the SIM card, make sure that your hands are not charged with static electricity. Use proper precautions to avoid electrostatic discharges. The module must be switched off. We also recommend the connecting cables to be removed.

  When the SIM card hatch of the module is opened, the SIM card connectors lie exposed under the SIM card holder. Do not touch these connectors. If you do, you may release an electrical discharge that could damage the module or the SIM card.

- Never place the module close to magnetic storage media, such as computer diskettes, credit cards, etc.

- Never try to dismantle the module yourself. There are no components inside the module that can be serviced by the user. If you do, you may loose warranty.

Introduction

The GM 12 GSM module is a mobile telephone for the GSM 900 MHz network. It is a class 4 mobile station (2 W output power).

The module is GSM phase 2 compliant, and handles Short Message Service (SMS) and Cell Broadcast Message (CBM), controlled from its host application over a V.24/V.28 serial interface by AT commands.

The module can also be used as a phone for speech calls. During a speech call, Dual-Tone Multi-Frequency (DTMF) tones can be transmitted to the public network.

Who should use the Integrator's Manual

This manual is intended as a guide for system integrators who will be developing systems that use the GM 12. The manual was written in order to explain how this is done, and to show the most important points to consider.

To be able to integrate the GM 12 with the application, you are expected to have a basic understanding of:

- GSM networking
- Wireless communication and antennas
- AT commands
- ITU-T standard V.24/V.28

Contents of the Integrator's Manual

The manual begins with a description of the interface and functions of the GM 12, followed by guidelines for integrating the module with the application. See also the chapter *Safety advice and other precautions*, which describes some of the common mistakes and causes of failure that you can avoid.

The AT commands implemented for GM 12 are described in the chapter *Using AT commands*. Some of the abbreviations and terminology used are explained in the *Glossary* chapter at the end of the manual.

Definitions

To make it easier for the integrator to read the manual, the following terminology is used:

Application	An application is the system, into which the GM 12 is integrated.
Controller	The controller might be either a computer or an embedded microcontroller connected to the serial port of the GM 12 to control the module.
Module	The GSM module GM 12.
Module software	The software in the GM 12.

GM 12 interface description

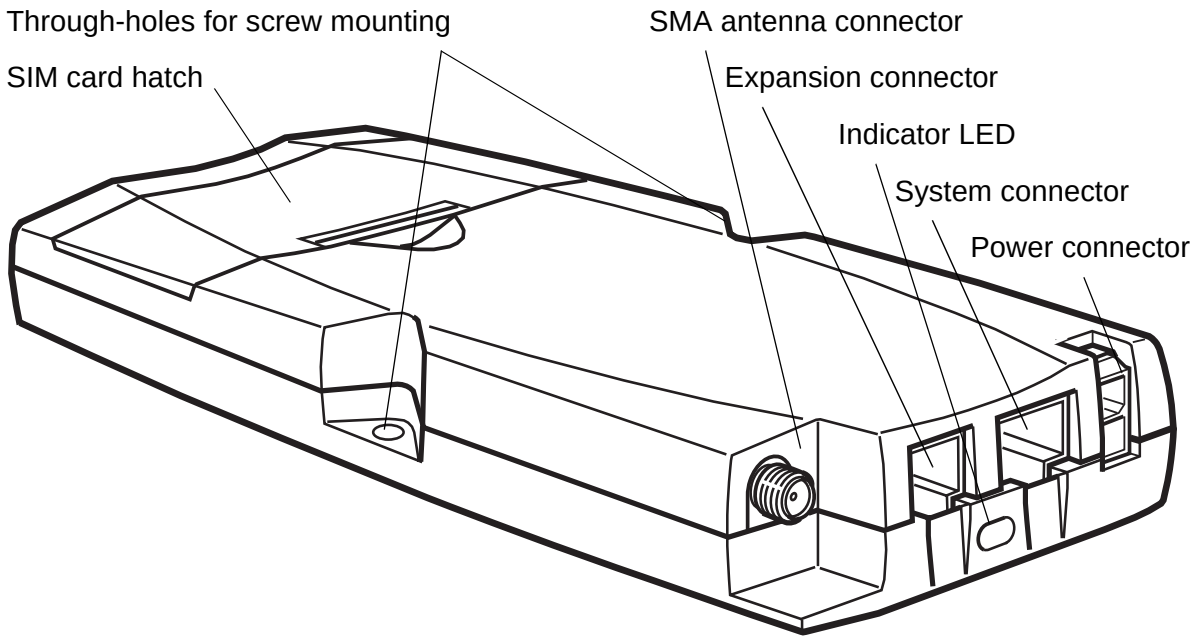

Figure 1 Front view of GM 12.

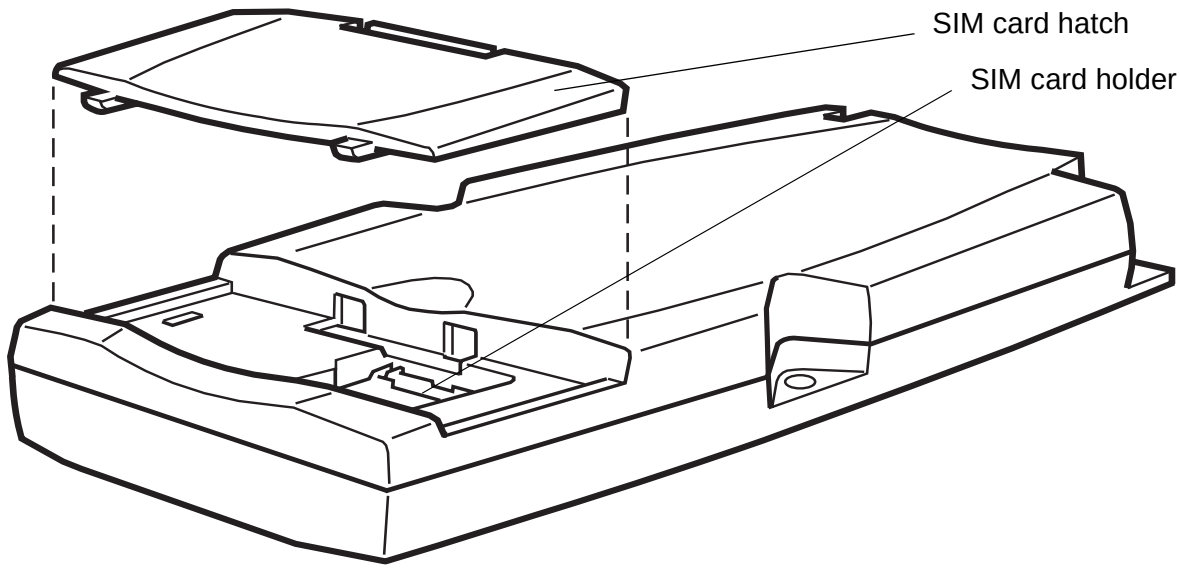

Figure 2 SIM card housing in the GM 12.

Mechanical description

The module is housed in a plastic case with a shielding metal layer. It has standard connectors, which are placed on the same side to facilitate installation. Two external screw holes on the case, 4 mm in diameter, allow for screw-mounted installation.

The LED is the dual color indicator on the case, which displays the basic status of the module.

The SIM card is mounted in a holder under a removable hatch accessible from the top face of the case.

The module has no keypad, display, microphone, speaker, or battery.

See the chapter *GM 12 functional description.*

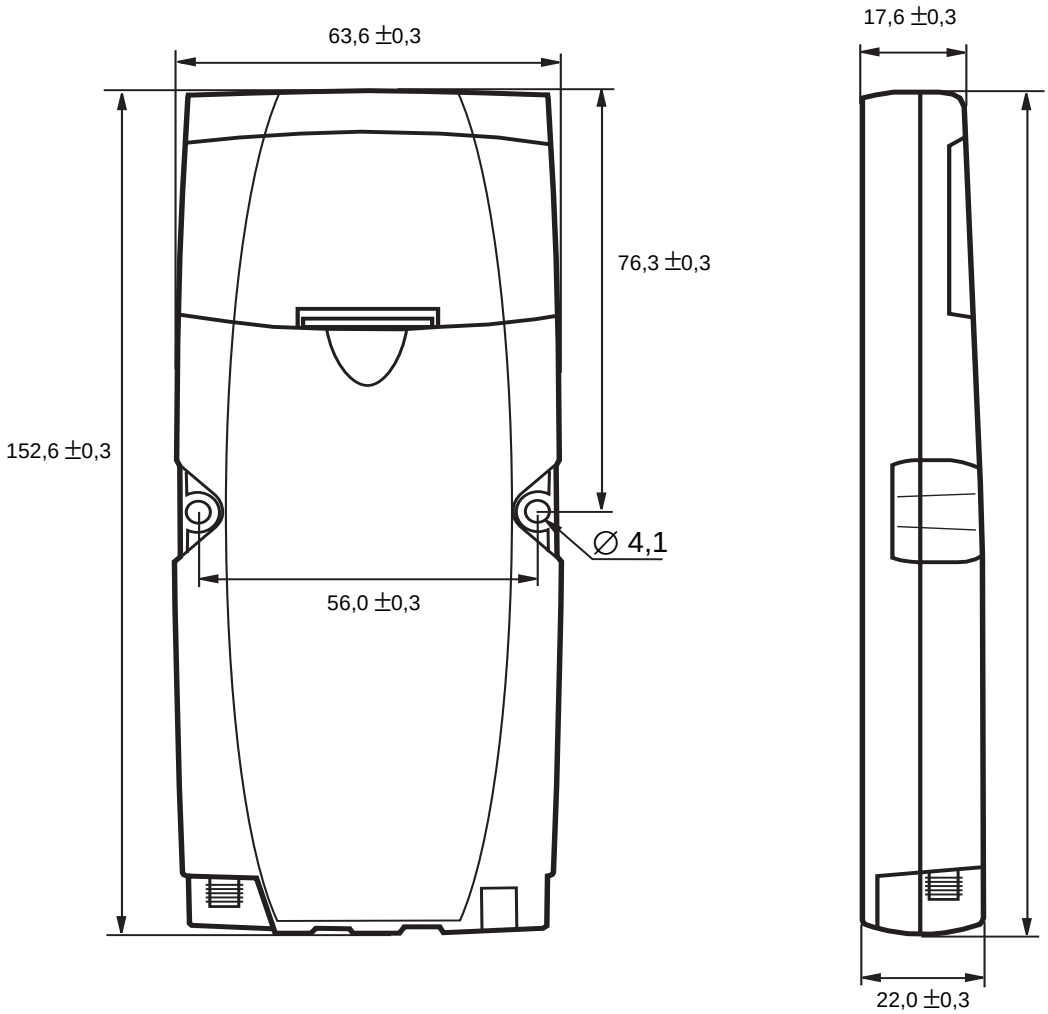

Figure 3 GM 12. Plan and side view with dimensions in millimetres.

Connectors

- 2-pin DC power connector socket of the type Molex Mini-Fit Jr
- 8-pin modular RJ45 (8/8) system connector socket
- 6-pin modular expansion connector socket
- SMA antenna connector

For further description of these types of connectors, see the chapter *How to integrate GM 12 with the application*.

Electrical description

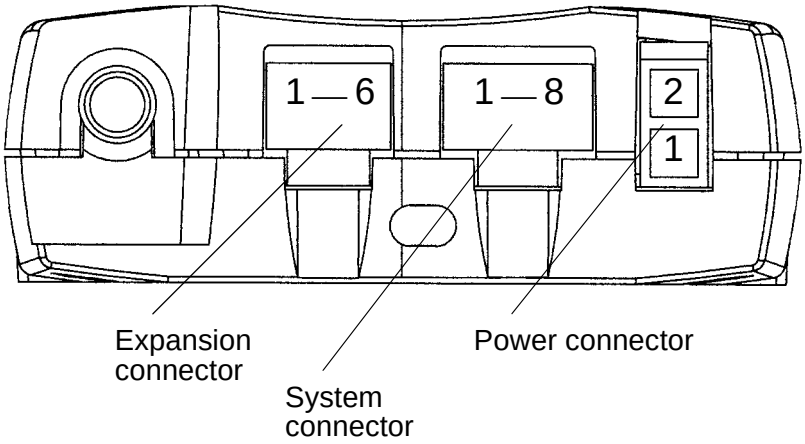

Figure 4 *A front view of the connector side of the module. The connector pins are numbered as in the picture.*

Pin-numbering

System connector

The system connector contains serial in or out, audio in or out and power on or off.

Pin	*Name*	*Description*	*See section*
1	TD	Transmitted data (from the controller)	Serial
2	RD	Received data (from the controller)	Serial
3	SGND	Signal ground	Serial
4	VPPFLASH	Flash-programming voltage-control input	VPPFLASH
5	PON	Power on/off	Power control
6	AGND	Audio ground	Audio
7	AIN	Audio in	Audio
8	AOUT	Audio out	Audio

Expansion connector

Leave the expansion connector unconnected. When the module is integrated with the application, the connector is not to be used. Therefore, it is not described in this manual.

Power connector

Pin	*Name*	*Description*	*See section*
1	V+	Power supply	Power supply
2	PGND	Power supply return	Power supply

Serial data

Serial communication will be handled by the RD and TD signals in the interface. Note that the module is a DCE (like a landline modem) and the controller a DTE. This means that the module transmits data on RD to the controller and receives on TD.

Voltage levels for RD and TD signals

The RD and TD signals for the module comply with ITU-T V.28 standard. See the table below:

TD input to the module:	± 25 V, absolute maximum ratings ± 3 V, minimum input level
RD output from the module:	+ 3.7 V minimum at 3 kΩ load to SGND – 3.7 V maximum at 3 kΩ load to SGND

SGND – Signal ground

The SGND is a ground reference for the signals RD, TD, PON and VPPFLASH.

VPPFLASH – Flash-programming voltage-control input

This signal is used when loading the module software. Leave VPPFLASH unconnected or connected to SGND.

Audio

AIN – Analog audio input to the module

Input impedance:	See figure 5.
Nominal input level:	125 mV ± 75 mV p-p
Maximum input level:	800 mV p-p

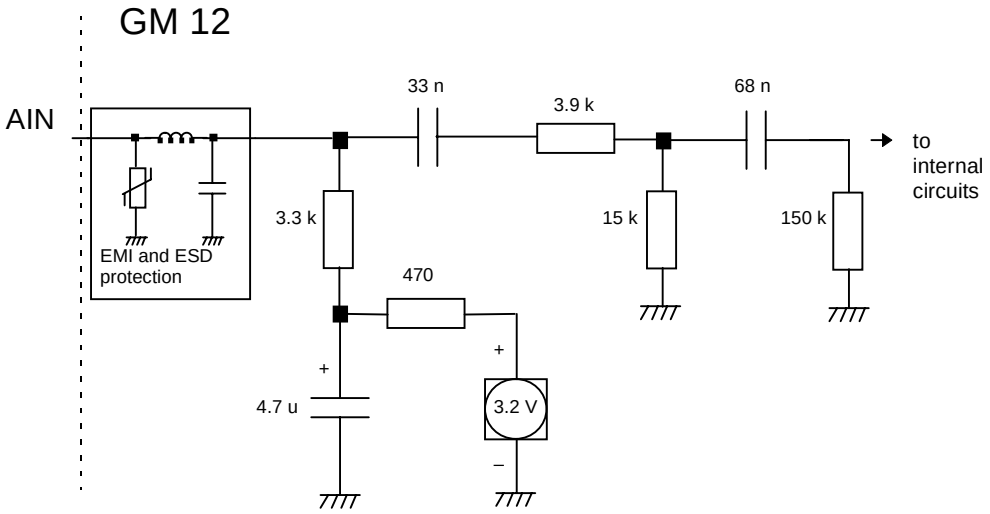

Figure 5 Equivalent schematic diagram of the audio input circuit to the module.

The audio signal source should have a flat frequency response between 300 and 3400 Hz. Outside this frequency span, the response should be flat or attenuating.

The EMI and ESD protection circuitry do not affect the frequency response or input impedance of the audio input.

The AIN signal should always be AC-coupled and should not exceed 800 mVp-p, otherwise you will get distorted audio (higher voltages will be clipped).

AOUT – Analog audio output from the module

Output impedance:	See figure 6.
Nominal output level:	125 mV ± 75 mV p-p
Maximum output level:	2.8 V p-p (without external load)

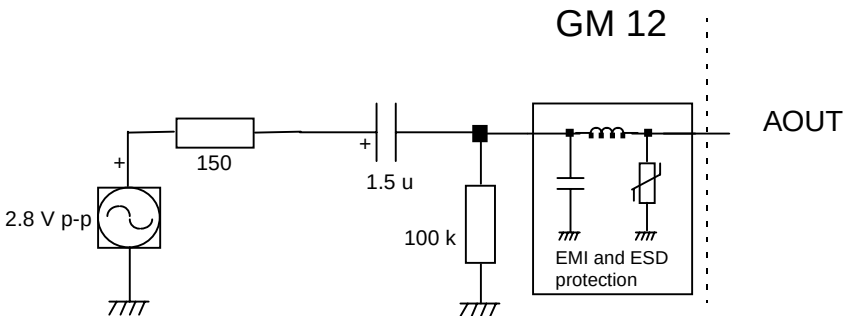

Figure 6 Equivalent schematic diagram of the audio output circuit from the module.

Load impedance < 1 kΩ will result in maximum 3% distortion.

Load impedance > 1 kΩ will result in maximum 2% distortion.

The EMI and ESD protection circuitry do not affect the frequency response or output impedance of the audio output.

AGND – Audio ground

The AGND is is a ground reference for the audio signals only: AIN and AOUT.

Power supply

The module must be powered from an external power source. The power connector supplies DC power to the module (see figure 13).

See the current consumption values in the chapter *Technical data*.

Figure 7 is an attempt to illustrate what the integrator should take into account when designing the power supply of the module. The figure shows the typical current wave form of the module in busy mode during a speech call on the GSM network. Transmission occurs with repetitive sequences of current bursts at every 4.6 ms.

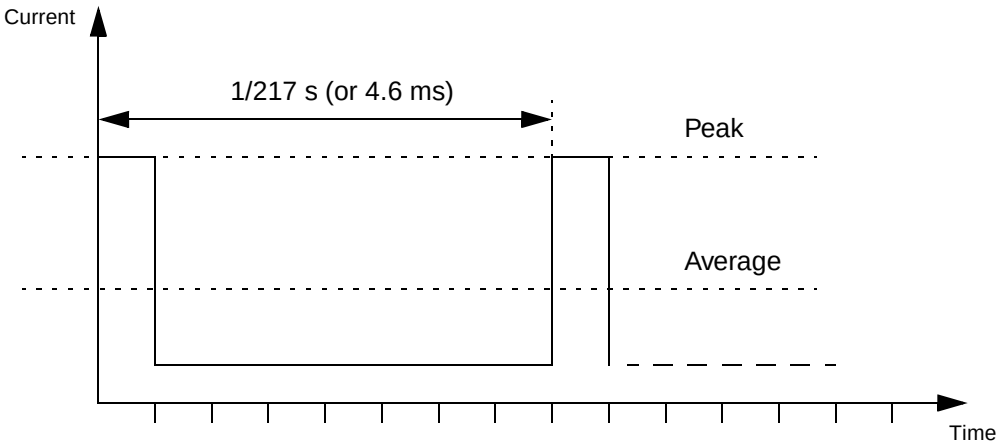

Figure 7 The typical current wave form of the module in busy mode (transmission).

PON – Power control

The power control functionality of the module allows the remote power to be switched on or off.

When V+ is applied, the module is controllable from the PON signal in the system connector. The module is toggled on or off by applying a low pulse on the PON signal.

When power is connected and the module is switched off, the PON pulse will switch on the module. A second PON pulse will switch off the module. Power off can also be controlled by software via the serial interface.

When the module is switched on, it can be either in idle or busy mode.

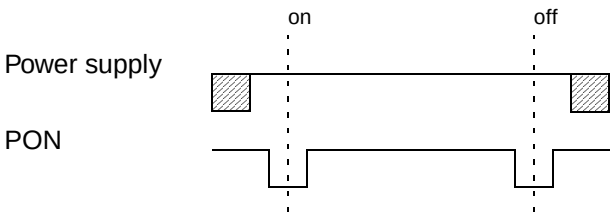

Figure 8 The PON pulse switches the module on or off.

Note! The PON signal must be applied for longer than 1 second. If the signal is supplied for a shorter period, then the GM 12 will enter a state where the module is not completely on, a charge-only state which is not used by the module. The unit can then be completely turned on by using AT+CFUN=1 or by issuing another PON pulse greater than 1 second, see the section *Software-commanded off* and the chapter *Using AT commands.* Similarly, from this state, AT+CFUN=0 or a PON pulse greater than 1 second will switch the module off.

Power modes

The following power modes are valid for the module:

Power mode (operational status)	*Description*
Powerless	Power to the module is absent.
Off	Power to the module is present. The module is switched off, but waiting for a PON signal for activation.
Idle	The module is switched on in idle mode. Fully operating serial interface and telephony functions.
Busy	A call, either speech or SMS transfer, is in progress.

Note! The transient mode, during which the module software executes on/off sequence or searches for the GSM network, is not included in the table above.

On/Off sequence and timing

The PON signal will have to be activated with a minimum of 1.0 seconds in order to switch the module on or off.

Upon activation of the module, the following sequence starts:

- SIM card check. If the SIM card is locked by a PIN code, the code must be given.
- Network search. If a valid network is found, the module will register with the network.

The serial interface on the system connector will be active shortly after power-on. However, the commands available when the module is not registered in a network are limited. See the chapter *Using AT commands.*

When the module is preparing for power mode off, it will:

- Register off from the network
- Wait for PON to be deactivated

When both conditions are met, the module will enter power off mode.

Software-commanded off

A software command can be used to switch the module off (AT command AT+CFUN). The PON signal must be inactive (high) to be able to switch off the module.

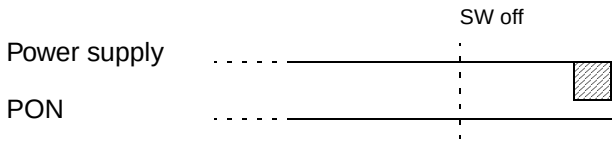

Figure 9 A software command can switch the module off.

Timing restrictions

After a power off initiated either by PON or the software off-command, the module will start the switch-off procedure including registering off from the network. The time required for this (indicated by A in the picture below), can be up to 5 seconds. This worst-case figure is the minimum time between a power-off and a subsequent power-on sequence.

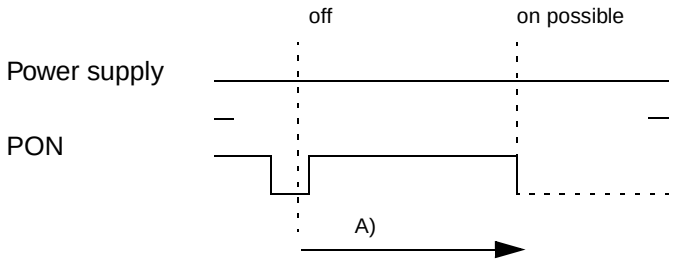

Figure 10 The time between a power-off and a subsequent power-on sequence can be up to 5 seconds.

Autostart

It is possible to get an automatic power-on sequence when power V+ is applied. If the PON is kept low (hard-wired), the module will automatically switch on when power is applied. If a software off-command is issued, it will be executed, but the module will switch itself on immediately thereafter.

The only way to switch off the module is by removing power V+. This functionality is intended for systems in which the module is always switched on. We do not recommend that you switch V+ on and off as the regular means of controlling the module power.

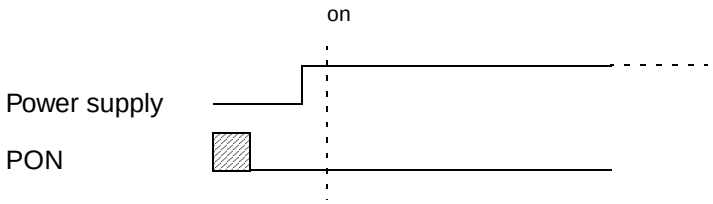

Figure 11 Autostart.

Low-voltage detection

The power V+ input voltage is monitored, and when the voltage drops below the normal-operating range, the indicator LED will switch from green to red. An internal circuit will switch off the module when the input voltage reaches a level where functionality cannot be upheld. Note that a short voltage glitch will also be detected and cause the module to switch off.

See the chapter *Technical data*.

Power On signal input (PON)

The minimum high-level input voltage and the maximum low-level voltage will make it possible to connect a V.24/V.28 signal to the PON, and to use TTL or CMOS levels.

An internal pull-up resistance will keep the module in off position until the PON is activated (< 0.8 V).

State	*Parameter*	*Minimum V*	*Maximum V*
Active	Low-level input voltage	–12	0.8
Inactive	High-level input voltage	3.7	12

Absolute maximum ratings for the PON signal input are ± 15 V.

As shown in the table below, the input impedance varies depending on the input voltage:

Input voltage, V	*Impedance*
0–12	> 1 MΩ
< 0	> 3.5 kΩ

Software interface description

Communication protocol

GM 12 has a set of implemented AT commands. These commands consist of a subset of the following standards:
GSM 07.05, GSM 07.07, and ITU-T V.25ter.

In addition, a number of Ericsson proprietary AT commands are provided.

For details, see the chapter *Using AT commands*.

Communication parameters

The following communication parameters are valid:

- Format: The communication format is 1 start bit, 8 data bits, 1 stop bit, no parity.
- Bitrate: 9600 bits per second.
- Flow control: No flow control is available.

GM 12 functional description

This chapter describes the functionality of GM 12. The module fulfils a set of telecom services (TS) according to GSM standard phase 2, as defined by ETSI. For a list of references, see the chapter *For further reading*.

The functions of the display and keypad usually used to make calls are implemented by issuing AT commands over the serial interface. To find out how to send SMS messages, make speech calls and send DTMF tones, see the chapter *Using AT commands*.

Short Message Service

The module supports the following SMS services:

- Sending: Mobile Originated (MO) according to TS22
- Receiving: Mobile Terminated (MT) according to TS21
- Cell Broadcast Message (CBM) according to TS23

The maximum length of an SMS message is 160 7-bit characters. For 8-bit data, the maximum length is 140 bytes.

CBM is a service, in which a message is sent to all subscribers located in one or more specific cell(s) in the GSM network, for example, traffic reports.

Speech calls

The module offers the following telecom services:

- Telephony according to TS11
- Emergency according to TS12

The module has no audible ring signal implemented. An incoming call is indicated by an AT result code (RING).

The audio input and output signals in the interface will carry analog speech in full duplex (transmitting and receiving signals simultaneously). The module supports both Full-Rate speech coding and Enhanced Full-Rate (EFR), if EFR

is available in the network. To use EFR, changes must be made in the module's internal parameters.

Dual-Tone Multi-Frequency

The module supports the transmission of DTMF tones to the public network (AT command AT+VTS).

Supplementary services

The module supports the following GSM phase 2 supplementary services:

- **Calling Line Identification Presentation (CLIP).** Enables the called module to get the CLI (phone number) of the calling party. See GSM 02.81.
- **Calling Line Identification Restriction (CLIR).** Allows the calling module to enable or disable the presentation of the CLI (phone number) to the called party when originating a call (dialling). See GSM 02.81.
- **Call Forwarding.** Permits the called module to have the network send incoming calls to a desired phone number. See GSM 02.82.
- **Call Waiting.** Permits the module to be notified of an incoming call, for example, if the module is engaged in an active or a call on hold. The module can either accept, reject or ignore the incoming call. See GSM 02.83.
- **Call Holding.** Allows the module to interrupt communication on an active call and, if desired, re-establish the communication. See GSM 02.83.
- **Conference Calls (Multiparty).** Permits the module to maintain a simultaneous communication with more than one party. See GSM 02.84.
- **Call Barring.** Allows the module to bar certain categories of outgoing or incoming calls. The categories are determined by one or more barring programs. See GSM 02.88.
- **Unstructured Supplementary Service Data (USSD).** Is a data-bearer service that allows transfer of information strings between the module and the GSM network. See GSM 02.90.

Supplementary services may vary depending on your service provider's network.

Indicator LED

The LED on the module uses green or red light to indicate functionality status:

- **Fast flashing green light:**
  - Incoming SMS message
  - Incoming speech call
- **Slow flashing green light:**
  - The module is working and is connected to the network
- **No light:**
  - The module is not powered
  - The module is not connected to the network

If the power supply is below the normal-voltage operating range, the LED will change to red light.

Handling the SIM card

The SIM card is placed in the holder under the removable hatch (on the upper side of the module case). When the SIM card is inserted, it should be covered by the hatch in order to protect the module from dirt and dust.

To find out what certain terms mean, see the SIM card housing, figure 2.

To avoid ESD, or other damage to the module or the SIM card, see the chapter *Safety advice and other precautions.*

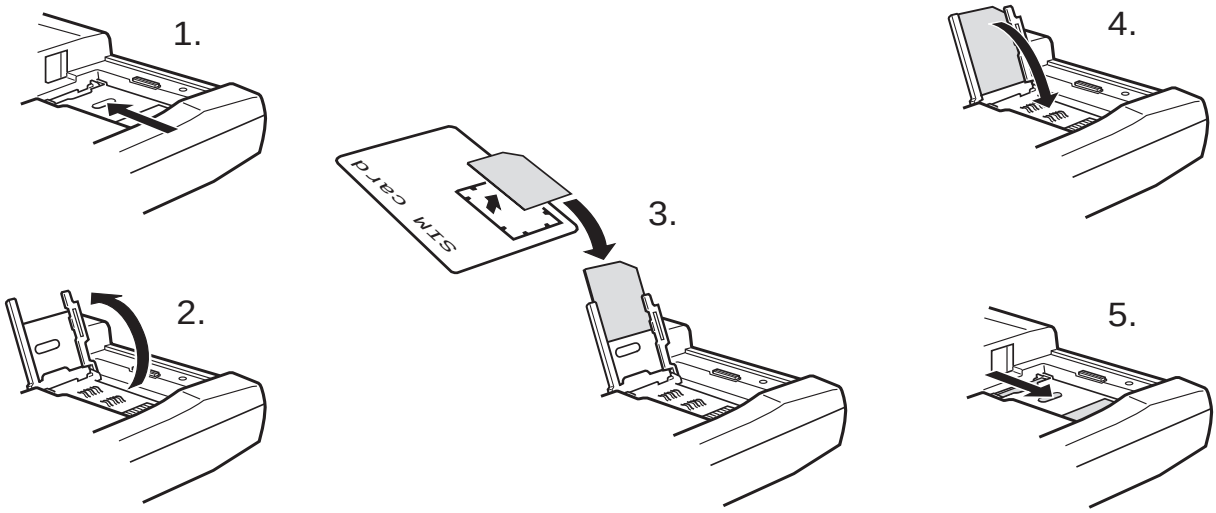

Figure 12 How to put the SIM card into the holder. The instructions below correspond to the picture.

To begin with, switch off the module before inserting or removing the SIM card. We also recommend that you remove the connecting cables. Open the SIM card hatch.

1. Open the lock on the SIM card holder by pushing it gently in the direction shown by the arrow.
2. Fold back the SIM card holder.
3. Insert or remove the SIM card gently into the SIM card holder. The SIM card circuits should be turned down towards the connectors (which lie exposed under the holder).
4. Fold down the SIM card holder.
5. Close the lock on the SIM card holder by pushing it gently in the direction shown by the arrow. Close the SIM card hatch.

How to integrate GM 12 with the application

This chapter, which gives you advice and helpful hints on how to integrate the GM 12 with the application, should be taken as a guide.

Please consider the information in the chapter *Safety advice and other precautions*, for example, regarding the precautions to avoid ESD and EMI.

Prerequisites

Antenna and connecting cables are not included with the module, therefore we recommend that you consider the choice of these external components carefully.

Here is a list of preparations that you should make before beginning the integration work that is described in this chapter:

- Where to install the module
- Network and subscription
- SIM card
- Fuse
- Connector
- Connecting cable
- Antenna

Where to install the module

Make sure that the module will be installed so that the environmental conditions, such as temperature, humidity, vibration etc, are not beyond the limits specified for it. See the chapter *Technical data.*

Make sure that the signal strength is sufficient. To improve signal strength, move the antenna to another position. Signal strength may depend on how close the module is to a radio base station. Degradation in signal strength could

be a result of disturbance from other source, for example, an electronic device nearby. (When an application is developed, you can verify signal strength by issuing AT command AT+CSQ. See the chapter *Using AT commands.*)

Tip! Before installing the module, use an ordinary mobile telephone to check possible location. Consider signal strength as well as cable length in determining location for the module and the antenna. That way, you will find out if it is practical to install the module where you intended.

Safety standards

You are responsible for observing your country's safety standards and the relevant wiring rules.

Network and subscription

Make sure that the GSM network provides the necessary telecommunication services. Contact your service provider. Make sure that the location at which you intend to use the module is within the network coverage.

If you intend to use SMS for the application, ensure that this is included in your (voice) subscription.

Also consider the choice of the supplementary services, as described in the chapter *GM 12 functional description.*

SIM card

Use a plug-in type SIM card (small-size). See figure 12 to find out how to insert and remove the SIM card.

When integrating the module with the application, take into account the SIM card's accessibility. We always recommend that you have the SIM card protected by a PIN code. This will ensure that if the SIM card is left unsupervised, or if it is lost or stolen, it cannot be used by anyone who is not authorized.

Fuse

The module has no built-in fuse. The fuse must be mounted as close to the terminals of the power supply as possible.

The recommended cut-off current value is 0.5 to 2.5 A, depending on the actual voltage supplied to the module.

In the table below, we recommend the following values for the fuse:

Power supply, V	*Recommended fuse values, A*
7–10	2.5
10–20	1.0
20–32	0.5

Connector

In this section, we describe the plug connectors that should be connected to the module.

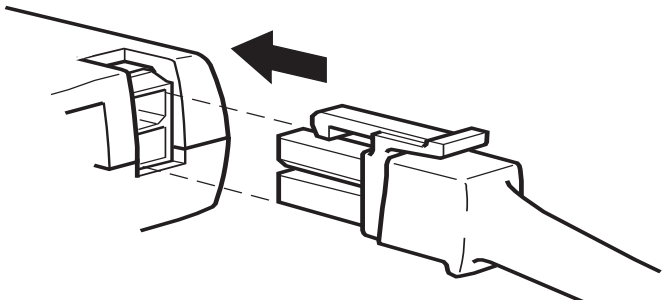

Figure 13 The Molex Mini-Fit Jr power connector with clasp.

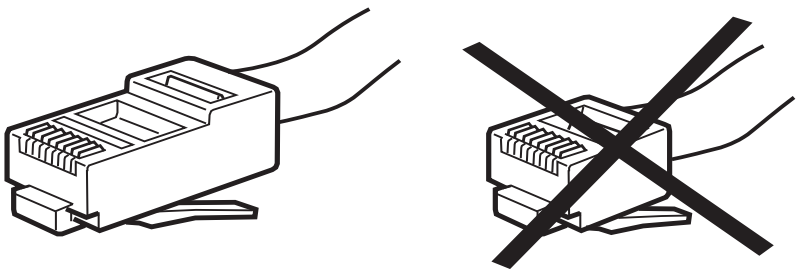

Figure 14 The 8-pin RJ45 modular plug connector. Note that we do not recommend the shorter connector type for use.

- 2-pin DC power connector of the type Molex Mini-Fit Jr.
- 8-pin modular RJ45 (8/8) system plug connector. See figure 14. We recommend that you use the plug connector with long contacts and a long clasp, which can be designed for round or flat cables. Use high-quality connectors with gold plated pins.

  (If there is not enough room for the connector, it is possible to use the RJ modular plug connector with short contacts. The purpose of figure 14 is to make it clear that you should be aware of the difficulties involved in removing the connector from the socket. A tool is necessary, which could damage the module.)
- An SMA antenna connector, to which you can connect a cable attached antenna. For a further description in this chapter, see the section about antennas and antenna cables.

To find out more about these connectors, see the web sites referred to in the chapter *For further reading*.

Cable

Any cable connected to the module must not be longer than 7 metres.

Power connector cable

For the power supply, use a high-quality power supply cable with low resistance. Never use the shield of any connection cable as a power supply return.

System connector cable

We recommend that you shield the system connector cable if it is longer than 1 metre. The ground shield should be connected to SGND at both cable ends. See the pin-numbering description in the chapter *GM 12 interface description*.

Antenna cable

In order to avoid loss of the signal power between the antenna and the module, use a low-loss cable and high-quality connectors (for the frequency range up to at least 1 GHz). Both the cable and the connectors must have the same impedance as the antenna connector on the module (50 Ω). Also, the antenna cable should be as short as possible.

The Voltage Standing-Wave Ratio (VSWR) may depend on how effective the antenna, the cable and the connectors are. In order to get reliable communication, keep the VSWR value stable and at less than 2, measured at the antenna connector of the module.

In addition, if you use an adapter between the antenna cable and the SMA antenna connector, the more important it is that you use a high-quality, low-loss cable. Use as few extension cables, connectors and adapters as possible between the antenna and the antenna connector on the module. Each cable, connector or adapter results in a loss of signal power.

Antenna

The antenna is a very important component of the integrated system that maintains the radio link between the GSM network and the module. Because the antenna must transmit and receive electromagnetic energy, its efficiency will depend on:

- The type of antenna (for example, circular or directional)
- The placement of the antenna
- The surroundings in which the antenna operates

Example: If the signal strength is weak, it may be practical to have a directional antenna oriented in the direction of the closest radio base station. This could increase the signal strength to be received by the module.

Contact your local antenna manufacturer for further advice in choosing antenna types, cables, connectors, antenna placement and surroundings, etc. Consider also if the antenna should be grounded or not. The local antenna manufacturer might on request be able to design special antennas suitable for the application.

Antenna type

Make sure that you choose the right kind of antenna for the module. Consider the following four requirements:

- The antenna must be designed for the GSM 900 MHz frequency band.
- The impedance of the antenna and antenna cable must be 50 Ω .
- The antenna-output power-handling must be minimum 2 W.
- The VSWR value should be less than 2. See the section about antenna cables above.

Antenna placement

Always follow the instruction supplied by your antenna manufacturer.

You should place the antenna away from electronic devices or other antennas. The recommended minimum distance between adjacent antennas operating in a similar radio frequency band is at least 50 centimetres.

Possible communication disturbances

- **Noise** can be caused by electronic devices and radio transmitters.
- **Path-loss** occurs as the strength of the received signal steadily decreases with the distance from the transmitter.
- **Shadowing** is a form of environmental attenuation of radio signals that is caused by hills, buildings, trees or even vehicles. Inside buildings, this can cause problems, 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 mobile phone simultaneously. Flat surfaces such as buildings, streets, vehicles, etc, can reflect signals.
- **Hand-over** occurs when you move from one cell to another in the GSM network. It transfers your present mobile phone call from one cell to another. Hand-over will interfere briefly with communication and could cause a delay, or at worst, a disruption.

Grounding

The SGND, AGND, PGND signals, and the antenna shield are interconnected internally in the module. These signals should be kept externally separated (galvanically isolated).

However, if this proves difficult, take precautions to minimise ground current effects. The audio, with its low-level voltages, is especially sensitive. Good engineering practice is to use low-resistance cables and to keep the cables as short as possible.

Tip!

- The module is protected from reversed polarity. However, be aware that when more than one ground of the module is externally connected and the power supply wires are reversed by accident, a possible short circuit can occur from positive power supply via the second ground (any of SGND, AGND, or the antenna shield).
- To separate the power supply ground and the antenna shield, a DC-Block (screen and centre conductor) can be placed on the antenna cable between the module and the antenna.
- When long power cables must be used, an electrolytic capacitor, placed close to the power terminals of the module, will act like a filter and reduce possible disturbance from burst currents.

Shielding

The module is housed in a plastic case with a shielding metal layer. No additional shielding of the module is necessary.

Like any mobile telephone, the module emits radio frequency energy. To avoid EMI, you must determine whether the application or equipment in the application's proximity needs further protection against radio emission and the disturbances it might cause. The protection must be secured either by shielding the surrounding electronics or by moving the antenna away from the electronics.

The modules's peak output power can reach about 2 W. Near the antenna, the RF field strength, which depends on the antenna type, can be up to 70 V/m within a distance of 10 centimetres and 7 V/m within a distance of 1 metre.

In general, CE-marked products for residential, commercial and light industry can withstand at least 3 V/m.

Using AT commands

This chapter contains the implemented AT commands for GM 12, with which it is possible to control the module.

The first section describes the terminology used in this chapter.

The second section tells you how you can get started with AT commands.

The third section exemplifies a selection of AT commands.

The fourth section describes the AT command syntax.

The fifth section contains a table with character sets that are supported by the module.

Finally, the sixth section starts with a table of contents, in which all implemented AT commands for GM 12 are listed, followed by a description of each command. Some commands are restricted with non-implemented parameters. These parameters are not described in this manual.

The GM 12 supports AT commands according to the GSM phase 2, as defined by ETSI. Please see the chapter *For further reading*, which contains references to the underlying GSM standards, for a deeper understanding of the AT commands listed in this chapter.

Terminology

The terminology used in this chapter corresponds with the terminology in the GSM standard. See GSM 07.05 and 07.07.

Note that instead of the DTE and DCE interface, the GSM standard defines it as TA and TE as shown in figure 15.

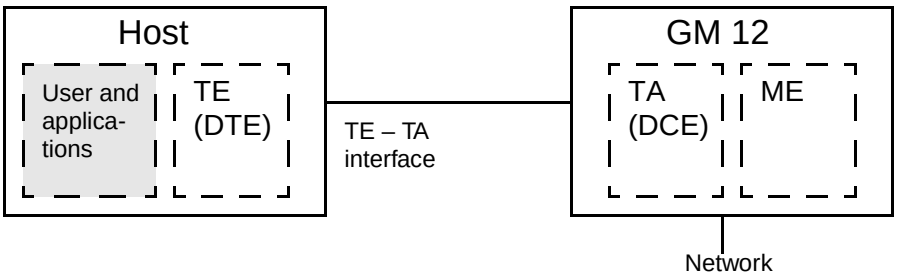

Figure 15 The figure illustrates the definitions used in this chapter as they are applied to GM 12.

ME+TA	The module consists of the mobile equipment and the terminal adapter. The terminal adapter is the part of the module that interfaces to the controller.
MS	Mobile Station. Basically, a mobile station is mobile equipment with a SIM card.
TE	Terminal Equipment, which in this case is the same as the controller.

Getting started

For testing AT commands, the GM 12 can be connected to any computer environment, as long as it has a V.24/V.28 serial interface. The commands can be issued with, for example, HyperTerminal in Windows 95 or other emulator programs.

To set up the correct communication parameters, see the parameters listed in the chapter *GM 12 interface description.*

The connectors that will be connected to the module are specified in the chapter *How to integrate GM 12 with the application.*

The connecting cable should be an RJ45 modular plug connected to the system-connector socket of the module, and a type D-SUB connected to the computer COM port socket.

Figure 16 shows a connection between the module and a computer that enables manual switch on or off by a push button switch. Note that DSR, RTS and CTS should be connected together to be compatible with existing terminal software. The D-SUB connector's signal names are defined in the EIA/TIA-232-E standard, which is often referred to as RS232.

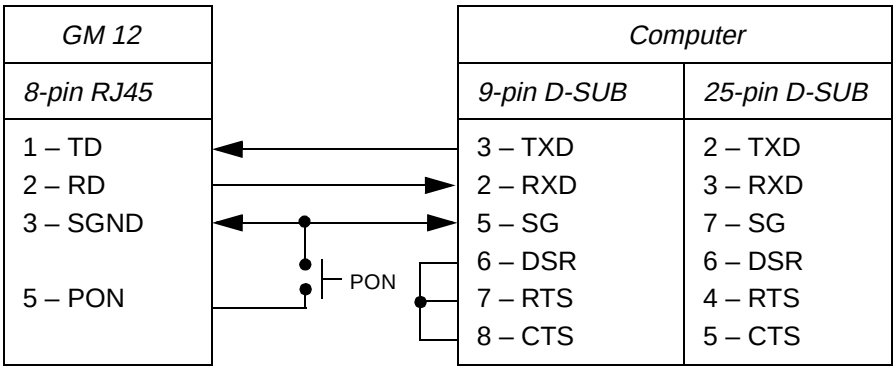

Figure 16 The figure shows how to connect the module with a computer.

AT command examples

This section shows how some sequences of AT commands and their responses can look on the screen. Here, the entered AT commands are shown in bold and the result codes in plain type. A short description of each line is also provided.

How to dial and terminate a speech call

AT	Start with a simple functional control. Press Enter.
OK	The command is accepted by the module with OK.
AT+CPIN?	You are asking if a PIN code is required.
+CPIN: SIM PIN	Yes, PIN code is required.
OK	
AT+CPIN="9876"	Enter the PIN code, in this example 9876. Note that the PIN code is a string, and must be enclosed in quotation marks. Press Enter.
OK	The PIN code is accepted by the module with OK.
AT+CPIN?	You are asking again if PIN code is required.
+CPIN: READY	No, PIN code has already been given.
ATD+4681111111;	Type ATD. Here, an international call is shown. The dial string contains a plus sign (+), country code, area

	code and telephone number. Do not forget the semicolon. Begin dialling by pressing Enter.
ATH	Type ATH to terminate the call. Press Enter.

How to answer an incoming call

AT*ECAM=1	You are setting the Call Monitoring command active.
OK	The command is accepted by the module with OK.
	Let's assume that you receive an incoming call:
*ECAV: 1,6,1	Call Monitoring reports an incoming call (alerting) by the unsolicited result code *ECAV.
RING	This is how an incoming call looks on the screen (non-audible ring signal). See the section with result codes listed at the end of this chapter.
ATA	You are answering the call manually. Press Enter.
OK	
*ECAV: 1,3,1	Call Monitoring reports that the call is connected (active).
	The call is hung up by the calling party. Here, the *ECAV reports normal ending of the call and that the phone status has changed to idle:
*ECAV: 1,0,1,08,031	
	A new call is coming in:
*ECAV: 1,6,1	Call Monitoring reports an incoming call (alerting).
RING	
ATH	You are rejecting the call manually. Press Enter.
OK	
	By rejecting the call, the calling party will hear a busy tone, a function called UDUB. Here, the *ECAV shows that the phone status has changed to idle due to a normal clearing:
*ECAV: 1,0,1,08,016	
	Yet another call is coming in:
*ECAV: 1,6,1	Call Monitoring reports an incoming call (alerting).

`RING`	
	The call is hung up by the calling party before it is answered. Call Monitoring reports FAILURE_NOT_OFF_HOOK (idle):
`*ECAV: 1,0,1,08,222`	

How to check and change parameters

`AT`	Start with a simple functional control. Press Enter.
`OK`	
`ATQ=?`	You are asking which the possible parameter settings are for the command Q. Press Enter.
`Q: (0-1)`	The possible parameters are 0 or 1.
`OK`	
`ATQ?`	You are asking for the current parameter setting of the command Q. Press Enter.
`Q: 0`	The current parameter setting is 0.
`OK`	
`ATQ1`	You are changing the parameter to 1, which represents suppressed result codes. Press Enter.
`OK`	The change is accepted with OK.
`ATQ?`	You are checking the changed parameter. Press Enter.
`Q: 1`	No result code is visible any longer.

How to handle SMS messages

This section gives examples of the AT commands for sending and receiving SMS (Small Message Service) messages with the GM 12. First we will discuss what an SMS is and some details on how an SMS message is sent in the GSM network.

The Short Message Service (SMS) allows a user to send up to 140 bytes (140 octets) of information from one mobile station (MS) to another, using the receiving MS phone number as the destination address. What happens with this information when it arrives at the destination is dependent on the receiving station. For instance, if an SMS is sent from one mobile telephone to another, an SMS usually takes the form of a simple personal text message. If the

receiving mobile station is a GSM module like the GM 12, then maybe the received information is some kind of data which will be processed by an application.

Whatever the destination of the SMS message, the message is always sent via a Service Centre (SC). One of the SC's jobs, among others, is to forward SMS messages to the destination, or store the SMS until the receiving MS becomes available in the GSM network. The message can be stored at the SC up to a maximum time period decided by the sender. Also the message is "time stamped" at the SC and its contents are interpreted according to choices made by the sender.

The conclusion of this is that an SMS message, along with other information decided upon by the sender, always contains 2 addresses. First the Service Centre Address (SCA), and then the destination address. Also, other useful information is added at the SC.

Setting Service Centre Address (SCA)

The service centre address is usually stored on the SIM card, but it can be set manually using the AT command AT+CSCA (see the chapter *Using AT commands*). Note that the SCA must be given in the international phone number format. For the Telia service centre address in Sweden, that is:

AT+CSCA="+46705008999", 145

When you press enter you should get OK.

If you are unsure of the SCA you should use, then contact your GSM operator.

Format of an SMS message

It is important to realize that SMS messages sent with the GM 12 are not sent in the same manner as with a normal mobile phone. The GM 12 uses the PDU (Packet Data Unit) mode message format to send SMS, where as a normal mobile telephone uses text input, and menu choices to send SMS. The PDU format is described in detail in the GSM specifications GSM 03.40 and GSM 03.38.

What is PDU mode? First a PDU is a Service Centre Address (SCA) followed by a Transport Protocol Data Unit (TPDU). There are several formats of TPDU, but the GM 12 only uses two forms:

SMS-SUBMIT TPDU	Outgoing SMS messages "submitted" to the SC from the originating MS.
SMS-DELIVER TPDU	Incoming SMS messages "delivered" by the SC to final destination MS.

Therefore we have the following general format of an SMS message:

PDU=SCA+TPDU

The TPDU format is a hexadecimal encoded binary format, which means that 2 hexadecimal digits represents a byte or an octet. In general there is a header part of the TPDU, containing the control information, and then follows user data, which can be any type of information (default 7-bit GSM alphabet, 8-bit ISO8859-1 alphabet or even 8-bit data).

Let's start with some examples of PDU SMS messages using an SMS-SUBMIT type TPDU. For simplicity's sake we will send a text message which reads "TEST", using the default GSM 7-bit alphabet.

Here is the message written out in full:

0011000B916407861582F50000A704D4E2940A

Equivalently, we could write this as:

07916407058099F911000B916407861582F50000A704D4E2940A

These two have one difference, and that is how we have chosen to describe the SCA. In the first SMS we use:

00	This is a valid SCA with a length equal to zero. Therefore we are using the default SCA given by the SIM card, or as given by the AT command AT+CSCA, described before.
07916407058099F9	Here is the SCA for Telia, Sweden again, but now represented in the PDU format. Remember, this is now hex encoded binary. The first octet (07) is a length indicator, in this case there are 7 octets to follow. The second octet (91) tells us about the numbering plan and type of number of the coming address. In this case the 91 says that the address is in international phone number format. Then follows the actual service centre address (6407058099F9). It does not look like a phone number, does it? Until you realize that every pair of digits is swapped, that there is an odd number of digits in the phone number and therefore, a half byte of fill digits is required at the end (hence the hexadecimal F9). The exact meaning of all the octets and fields in the SCA address is described in detail in GSM 03.40.

Let's analyse the message by breaking it down into its component parts:

11	This octet contains many 1-bit and 2-bit fields which are described in detail in GSM 03.40. These include: • TP-MTI – message type indicator • TP-RD – more messages waiting indicator

	• TP-VPF – validity period format • TP-SRR – status report request flag • TP-UDHI – user data header indicator flag • TP-RP – replay path setting flag Please refer to GSM 03.40 for the exact meaning of these flags.
00	This octet is only associated with the 8-bit field TP-MR and is basically a message reference number, which can be chosen by the user. Here we have set the message reference number to zero (00HEX).
0B916407861582F5	This is the destination address (TP-DA). The format of the address field is given in detail in GSM 03.40. It is similar to the format of the SCA, but now it refers to the phone number of the receiving MS. The first octet (0B) is a phone number length indicator. In this case the phone number of the destination MS consists of 11 digits. The second octet (91) is the numbering plan and type of number of the coming address. The address is in international phone number format. Then follows the mobile number with every pair of digits in reverse order, and because we have an odd number of digits a half octet of fill bits are required (hence the F5HEX).
00	This is the protocol ID (TP-PID) which refers to a possible higher level protocol being used or indicates interworking with certain types of telematic devices. This can usually be left set to zero.
00	This is the data coding scheme field (TP-DCS) which is described in detail in GSM 03.38. Basically this octet tells us what kind of user data is being sent. For instance, if we are using a 7-bit or 8-bit alphabet, or we are sending 8-bit data. It also informs the receiving MS about the class of the SMS message, which tells it how to handle and store the incoming SMS message.
A7	This is the validity period (TP-VP). The validity period is how long the SC will store the SMS, waiting for the receiving MS to come in contact with the GSM network. If the SMS is not received by the destination MS within this time, then the message will be discarded. GSM 03.40 describes this field in detail.
04	TP-UDL. This is the length of the user data. It is given in septets, if TP-DCS describes the message as using the default 7-bit GSM alphabet, or octets otherwise.

D4E2940A	Finally we come to the user data (TP-UD). This is 4-septets long, defined above in TP-DCS and TP-UDL. The message reads “TEST”. Note that one character is not represented by one octet, but by a septet (7-bits), and therefore it can be quite complicated to decipher a GSM text SMS by looking at the PDU. GSM specification 03.38 describes in detail how the 7-bit GSM alphabet works and how to convert from the hexadecimal to the characters. You may know that one can send 160 characters in an SMS message. This is only possible in 140 bytes using a 7-bit alphabet.

Before we finish we should also take a look at the TPDU of SMS-DELIVER type. This is the PDU one would see when reading an SMS that has been sent to the module:

07916407058099F9040B916407861582F500009910702123040004D4E2940A

The TPDU breaks down as follows:

04	TP-MTI, TP-MMS, TP-SRI, TP-UDHI, TP-RP
0B916407861582F5	This is the originating address (TP-OA).
00	TP-PID
00	TP-DCS
99107021230400	This is the service centre time stamp. Every pair of digits are reversed. This time stamp reads, in octets, from left to right: the date 990107 (year, month, day), the time 123240 (hours, minutes, seconds). Finally the last octet is a reference for the difference in time between local time and GMT.
04	TP-UDL
D4E2940A	TP-UD

Sending SMS messages

Now we know how to construct an SMS message. Let’s try to send a message using AT commands. The AT command to use is AT+CMGS. The total number of octets in the TPDU is given as a parameter for the command. Notice that this is the length of the TPDU and not the PDU, so it does not include the SCA. The length of the message is 4 octets and the message reads “TEST”.

Example 1

AT+CMGS=18 <CR>

>0011000B916407861582F50000A704D4E2940A <CTRL-Z>

+CMGS: 122

OK

The response string contains a message reference number (MR), in this case 122. Here pressing Ctrl-Z terminates the message, or alternatively the process can be aborted by pressing Esc. Notice also that we used the default SCA in the PDU (00Hex), entered using the AT command AT+CSCA instead of entering it manually in the PDU.

In the following example the SMS service centre address is included. The message is coded in 7-bit GSM characters. After being converted, the text message can be read as "This is a PDU message" (below in underlined text). The length of the actual message is 19 octets. Finish by pressing Ctrl-Z or cancel with Esc.

Example 2

AT+CMGS=32

>07916407058099F911000A8170607896200000A71354747A0E4ACF4161
10945805B5CBF379F85C06

+CMGS: 123

OK

Receiving SMS messages

SMS messages can be stored in the module's (ME, mobile equipment) memory, or on the SIM card (SM, SIM card). The GM 12 can hold ten SMS messages in ME. The number that can be stored in the SIM depends on the operator and SIM card, but it is usually higher than in ME.

In general, incoming SMS messages are normally stored automatically in ME, but this depends on other factors such as the class of the incoming SMS message, and if the receiving module has been initialised using any AT commands which affect storage.

Setting the SMS message storage

Of the two physical memory storage places, there are three logical types of memory:

<mem1> indicates which physical storage messages are read into or deleted from. Affected AT commands are +CMGR, +CMGL and +CMGD.

<mem2> indicates which physical storage outgoing messages (written to memory by the user) are stored into. Affected AT commands are +CMGS and +CMG.

<mem3> indicates which physical storage incoming messages are stored into. For GM 12 this is always set “ME”.

We can start by setting up the memory for incoming messages using the AT command AT+CPMS. First we query the module with this command.

AT+CPMS?

+CPMS: "ME", 0,10 This relates to <mem1> meaning we have zero messages of a possible ten.

+CPMS: "ME", 0,10 This relates to <mem2> meaning we have zero messages of a possible ten.

+CPMS: "ME", 0,10 This relates to <mem3> meaning we have zero messages of a possible ten.

OK

Perhaps we wish to change <mem2> to the SIM card “SM”.

AT+CPMS=“ME”,“SM”

+CPMS: 0,10,0,10,0,10

OK

The response shows that all the memory places are empty.

Now we send three SMS messages to the module and query the module again and we get the response:

AT+CPMS?

+CPMS: "ME", 3,10 This relates to <mem1> meaning we have three messages of a possible ten.

+CPMS: "SM", 0,10 This relates to <mem2>.

+CPMS: "ME", 3,10 This relates to <mem3>.

OK

We see that “ME” now contains three messages.

Reading SMS messages from storage

To read SMS messages from storage, the AT commands AT+CMGL and AT+CMGR should be used. Both commands read messages from selected <mem1> storage.

So let's try and read the first message that we have sent to "ME":

AT+CMGR=1

+CMGR: 1, ,23

07916407058099F9040B916407950303F10000892122214014000 4D4E2940A

OK

Here we see a SCA followed by a TPDU of the SMS-DELIVER type (try and decipher it yourselves). The status code is 1, indicating that it is a received and read message. The length of the message is 23 octets (the length of the TPDU and not the PDU). Note the two commas. They reserve an empty field for a non-implemented parameter.

Alternatively to the AT+CMGR command we could list all the messages:

AT+CMGL=4 The 4 here means "all messages". See the AT command list later in this chapter for more details.

+CMGL: 1,1,23

07916407058099F9040B916407950303F10000892122214014000 4D4E2940A

+CMGL: 2,1,26

07916407058099F9040B916407950303F10000892122216000000 841E19058341E91

+CMGL: 3,1,27

07916407058099F9040B916407950303F10000892122217064000 941E19058341E9149

OK

Deleting SMS messages

To delete an SMS message from the selected <mem1>, use the AT+CMGD command.

AT+CMGD=1

OK

This will erase the SMS message at position 1. There is no function for erasing more than one message at a time.

Memory management in the GM 12 module and SIM card

As stated previously, there are three types of logical memory (<mem1>, <mem2> and <mem3>) mapped onto the two types of physical memory ("ME" in the module, and "SM" on the SIM card). <mem3> is always mapped onto ME, that is to say, incoming messages are stored in ME.

However, if ME becomes full (ME holds more than 10 messages), then new incoming SMS messages will begin to be stored in SM, while there are memory places available.

Once both SM and ME are full, then the module will receive no new messages, and SMS messages will be buffered in the Service Centre until the following happens:

- The validity period of the message expires. The validity period is set by TP-VP.
- A message is deleted, by using AT+CMGD, from ME or SM. An empty memory position becomes available and the module can receive a new message.
- A message in ME is read by using AT+CMGR or AT+CMGL. **Once an SMS message stored in memory changes status from received-unread (0) to received-read (1), then it can be overwritten by SMS messages waiting in the Service Centre.** The status is changed when SMS messages are read by AT+CMGR or AT+CMGL. It can be assumed that once an SMS message is read from the module it can be acted upon by the application, or stored somewhere else. In this way the module is always ready to receive SMS messages. If the module is receiving frequent SMS messages, and they are being read frequently by the application, it may be wise to let overwriting occur instead of deleting the messages. **It should be noted that messages stored by the user in the module or SIM are never overwritten.**

There are other ways to control the storage of SMS messages. In the TPDU field, TP-DCS, one can set the class of the SMS message. Basically the different SMS classes are as follows:

Classless SMS	(TP-DCS=00hex). This is usually the type sent by a mobile telephone. They are stored in the available memory, usually ME.
Class 0 SMS	(TP-DCS=F0hex). These are not stored anywhere, but are sent directly to the telephone display. In the GM 12, since there is no display one can forward the messages

to the TE by means of the AT command setting AT+CNMI=3,2.

Class 1 SMS (TP-DCS=F1hex). These are directed specifically to ME if there is a memory storage available, otherwise it will be stored in SM.

Class 2 SMS (TP-DCS=F2hex). These are directed specifically to SM.

Class 3 SMS (TP-DCS=F3hex). These messages shall normally be transferred to the terminal equipment or application, if requested to do so. This is controlled by the AT command AT+CNMI (see the AT commands later in this chapter).

For a deeper explanation and more information regarding the different SMS classes and their use see the GSM specification 03.38.

Syntax description

This section gives a brief description of the syntax used for the GM 12 AT command set. See ITU-T recommendation V.25ter for further information.

The International Reference Alphabet (IRA) is used as default in the TE – TA interface.

The TA may echo characters received, depending on the setting of the command E. As a default, echo is enabled, and characters are echoed at the same rate, parity, and format as received.

The character defined by parameter S5 (default, BS, IRA 8) is interpreted as a request from the TE to delete the previous character.

<CR>	Carriage return character, whose value is specified by command S3, default IRA 13.
<LF>	Linefeed character, whose value is specified by command S4, default IRA 10.
<...>	The name enclosed in angle brackets is a syntactical element. The brackets do not appear in the command line.
[...]	Strings enclosed in square brackets are optional items (subparameters). The brackets do not appear in the command line.

Other characters, including '?', '=', parentheses, etc, appear in commands and responses as written.

AT command syntax

A command line is made up of three elements: the prefix, the body, and the termination character. The command line prefix consists of the characters 'AT'.

GM 12 supports a set of commands referred to as basic syntax commands, and a set of extended syntax commands, the latter prefixed with a plus sign (+) or a star (*). Ericsson-defined commands use the star (*).

Basic syntax command

The format of basic syntax commands, except for the command D, is as follows:

<**name**>**[**<**value**>**]**

Example: ATV1<CR> *(set text form result codes)*
<CR><LF>OK<CR><LF> *(response)*

A version of the basic syntax is also used by the S parameter commands:

S<parameter_number>=[<value>]

Additional commands may follow a command on the same command line without any character being required for separation. For the command D parameters, see the description for the command in question.

Extended syntax command

+**<name>[=<value>]** or ***<name>[=<value>]**

Example: AT+CFUN=0<CR> *(power down the module)*
<CR><LF>OK<CR><LF> *(response)*

If several values are included in the command, they are separated by commas. It is also possible to enter commands with no values.

Read command syntax

The read command (trailing **?**) is used to check the current values of subparameters:

+<name>? or ***<name>?** or **<name>?**

Example: AT+CSCS?<CR> *(show current character set)*
<CR><LF>"IRA"<CR><LF> *(information text response)*
<CR><LF>OK<CR><LF> *(final result code response)*

Test command syntax

The test command (trailing **=?**) is used to test whether the command has been implemented or to give information about the type of subparameters it contains:

+<name>=? or ***<name>=?**

Example: ATS3=?<CR> *(show supported S3 values)*
<CR><LF>S3: (0-127)<CR><LF> *(information text response)*
<CR><LF>OK<CR><LF> *(final result code response)*

If the indicated name is not recognised, an result code ERROR is issued.

Additional commands may follow an extended syntax command on the same command line if a semicolon (**;** IRA 3B) is inserted after the preceeding extended command as a separator.

AT response syntax

The default mode response which is text mode, is shown below. See the command V for further details. The format of a response is as follows:

<CR><LF>[<response>]<CR><LF>

The <response> can be:

- Basic format result code, such as OK.
- Extended syntax result code, prefixed with a plus sign (+) or a star (*): +<name>: <value> or *<name>: <value>

  Note that a single space character separates the colon character from the <value>. If several values are included in the result code, they are separated by commas. It is also possible that result codes have no value. Unlike basic format result codes, extended syntax result codes have no numeric equivalent, and are always issued in alphabetic form.
- Information text response may contain multiple lines separated by <CR>. The TE detects the end of information text responses by looking for a final result code response, such as OK.

There are two types of result code responses:

Final result code

A final result code indicates to the TE that execution of the command is completed and another command may be issued.

If you typed an implemented AT command, you should get the result code OK.

If you typed an AT command that was not implemented, or which had the wrong parameter or syntax, you will get the result code ERROR or else, for example, +CME ERROR followed by an error code.

Final result codes are OK, ERROR, NO CARRIER, NO DIALTONE, NO ANSWER. See the section about result codes at the end of this chapter.

Unsolicited result code

Unsolicited result codes, such as RING, indicate the occurrence of an event not directly associated with a command being issued from the TE.

To find out more about unsolicited result codes, see how to dial and terminate a speech call in the section with AT command examples.

Implemented character sets for GM 12

The GM 12 supports several character sets. The module interprets the received character codes depending on which character set has been selected with the command AT+CSCS. The following character sets are supported:

- International Reference Alphabet (IRA) character set according to ITU-T T.50. Default character set for the module. Character range is 0 – 127.
- GSM default character set according to GSM 03.38. Character range is 0 – 127.
- Latin 1 character set according to ISO 8859-1. Character range is 0 – 255.
- Ericsson character set is identical to the GSM default character set in the character range 0 – 127, and contains a second copy of the GSM default character set in the range 128 – 255.

7-bit characters are sent in the TE – TA interface as 8-bit characters with the most significant bit set to zero (0).

Which character set to be used

Note! The GSM character hexa-decimal number 00 should not be used in order to get the "commercial at" character (@). Character code 00 will be interpreted as an end of line in the AT protocol. Instead, use hexa-decimal number 80 in the Ericsson character set.

Table of character sets

The table on the next page shows how the characters are interpreted by the module for each character set. Every string character that is sent to the module via AT commands is internally converted into a corresponding GSM character. Characters from the IRA and Latin 1 sets are converted to GSM characters according to GSM 07.05. Deleted characters are shown as light grey fields.

Example: The module will convert the hexa-decimal number 13 to 'Γ' if you have selected the GSM default character set with the command +CSCS. But if you have chosen IRA, it will be deleted.

With the Ericsson character set, the GSM character 11 hex can be sent to the module as character 91 hex (11 + 80).

Dec	*Hex*	*IRA*	*GSM*	*ISO 8859-1*	*Ericsson*
000	00		@ (not valid)		@ (not valid)
001	01		£		£
002	02		$		$
003	03		¥		¥
004	04		è		è
005	05		é		é
006	06		ù		ù
007	07		ì		ì
008	08		ò		ò
009	09		Ç		Ç
010	0A	LF	LF	LF	LF
011	0B		Ø		Ø
012	0C		ø		ø
013	0D	CR	CR	CR	CR
014	0E		Å		Å
015	0F		å		å
016	10		Δ		Δ
017	11		–		–
018	12		Φ		Φ
019	13		Γ		Γ
020	14		Λ		Λ
021	15		Ω		Ω
022	16		Π		Π
023	17		Ψ		Ψ
024	18		Σ		Σ
025	19		Θ		Θ
026	1A		Ξ		Ξ
027	1B		1)		1)
028	1C		Æ		Æ
029	1D		æ		æ
030	1E		ß		ß
031	1F		É		É
032	20	SP (space)	SP (space)	SP (space)	SP (space)
033	21	!	!	!	!
034	22	"	"	"	"
035	23	# (IRV)	#	#	#

Dec	*Hex*	*IRA*	*GSM*	*ISO 8859-1*	*Ericsson*
036	24	$ (IRV)	¤	$	¤
037	25	%	%	%	%
038	26	&	&	&	&
039	27	' (apostrophe)	' (apostrophe)	' (apostrophe)	' (apostrophe)
040	28	(	(	(	(
041	29	)	)	)	)
042	2A	*	*	*	*
043	2B	+	+	+	+
044	2C	, (comma)	, (comma)	, (comma)	, (comma)
045	2D	- (hyphen minus)	- (hyphen minus)	- (hyphen minus)	- (hyphen minus)
046	2E	. (full stop)	. (full stop)	. (full stop)	. (full stop)
047	2F	/	/	/	/
048	30	0 (zero)	0 (zero)	0 (zero)	0 (zero)
049	31	1	1	1	1
050	32	2	2	2	2
051	33	3	3	3	3
052	34	4	4	4	4
053	35	5	5	5	5
054	36	6	6	6	6
055	37	7	7	7	7
056	38	8	8	8	8
057	39	9	9	9	9
058	3A	: (colon)	: (colon)	: (colon)	: (colon)
059	3B	; (semicolon)	; (semicolon)	; (semicolon)	; (semicolon)
060	3C	<	<	<	<
061	3D	=	=	=	=
062	3E	>	>	>	>
063	3F	?	?	?	?
064	40	@	¡ (inv excl mark)	@	¡ (inv excl mark)
065	41	A	A	A	A
066	42	B	B	B	B
067	43	C	C	C	C
068	44	D	D	D	D
069	45	E	E	E	E
070	46	F	F	F	F
071	47	G	G	G	G
072	48	H	H	H	H

Dec	*Hex*	*IRA*	*GSM*	*ISO 8859-1*	*Ericsson*
073	49	I	I	I	I
074	4A	J	J	J	J
075	4B	K	K	K	K
076	4C	L	L	L	L
077	4D	M	M	M	M
078	4E	N	N	N	N
079	4F	O	O	O	O
080	50	P	P	P	P
081	51	Q	Q	Q	Q
082	52	R	R	R	R
083	53	S	S	S	S
084	54	T	T	T	T
085	55	U	U	U	U
086	56	V	V	V	V
087	57	W	W	W	W
088	58	X	X	X	X
089	59	Y	Y	Y	Y
090	5A	Z	Z	Z	Z
091	5B		Ä		Ä
092	5C		Ö		Ö
093	5D		Ñ		Ñ
094	5E		Ü		Ü
095	5F	_ (underscore)	§	_ (underscore)	§
096	60		¿		¿
097	61	a	a	a	a
098	62	b	b	b	b
099	63	c	c	c	c
100	64	d	d	d	d
101	65	e	e	e	e
102	66	f	f	f	f
103	67	g	g	g	g
104	68	h	h	h	h
105	69	i	i	i	i
106	6A	j	j	j	j
107	6B	k	k	k	k
108	6C	l	l	l	l
109	6D	m	m	m	m

Dec	*Hex*	*IRA*	*GSM*	*ISO 8859-1*	*Ericsson*
110	6E	n	n	n	n
111	6F	o	o	o	o
112	70	p	p	p	p
113	71	q	q	q	q
114	72	r	r	r	r
115	73	s	s	s	s
116	74	t	t	t	t
117	75	u	u	u	u
118	76	v	v	v	v
119	77	w	w	w	w
120	78	x	x	x	x
121	79	y	y	y	y
122	7A	z	z	z	z
123	7B		ä		ä
124	7C		ö		ö
125	7D		ñ		ñ
126	7E		ü		ü
127	7F		à		à
128	80				@
129	81				£
130	82				$
131	83				¥
132	84				è
133	85				é
134	86				ù
135	87				ì
136	88				ò
137	89				Ç
138	8A				LF
139	8B				Ø
140	8C				ø
141	8D				CR
142	8E				Å
143	8F				å
144	90				Δ
145	91				–
146	92				Φ

Dec	*Hex*	*IRA*	*GSM*	*ISO 8859-1*	*Ericsson*
147	93				Γ
148	94				Λ
149	95				Ω
150	96				Π
151	97				Ψ
152	98				Σ
153	99				Θ
154	9A				Ξ
155	9B				1)
156	9C				Æ
157	9D				æ
158	9E				ß
159	9F				É
160	A0				SP (space)
161	A1			¡ (inv excl mark)	!
162	A2				"
163	A3			£	#
164	A4			¤	¤
165	A5			¥	%
166	A6				&
167	A7			§	’ (apostrophe)
168	A8				(
169	A9				)
170	AA				*
171	AB				+
172	AC				, (comma)
173	AD				- (hyphen minus)
174	AE				. (full stop)
175	AF				/
176	B0				0
177	B1				1
178	B2				2
179	B3				3
180	B4				4
181	B5				5
182	B6				6
183	B7				7

Dec	*Hex*	*IRA*	*GSM*	*ISO 8859-1*	*Ericsson*
184	B8				8
185	B9				9
186	BA				: (colon)
187	BB				; (semicolon)
188	BC				<
189	BD				=
190	BE				>
191	BF			¿	?
192	C0			A	¡ (inv excl mark)
193	C1			A	A
194	C2			A	B
195	C3			A	C
196	C4			Ä	D
197	C5			Å	E
198	C6			Æ	F
199	C7			Ç	G
200	C8			E	H
201	C9			E	I
202	CA			E	J
203	CB			E	K
204	CC			I	L
205	CD			I	M
206	CE			I	N
207	CF			I	O
208	D0				P
209	D1			Ñ	Q
210	D2			O	R
211	D3			O	S
212	D4			O	T
213	D5			O	U
214	D6			Ö	V
215	D7				W
216	D8			Ø	X
217	D9			U	Y
218	DA			U	Z
219	DB			U	Ä
220	DC			Ü	Ö

Dec	*Hex*	*IRA*	*GSM*	*ISO 8859-1*	*Ericsson*
221	DD			Y	Ñ
222	DE				Ü
223	DF			ß	§
224	E0			à	¿
225	E1			a	a
226	E2			a	b
227	E3			a	c
228	E4			ä	d
229	E5			å	e
230	E6			æ	f
231	E7			Ç	g
232	E8			è	h
233	E9			é	i
234	EA			e	j
235	EB			e	k
236	EC			ì	l
237	ED			i	m
238	EE			i	n
239	EF			i	o
240	F0				p
241	F1			ñ	q
242	F2			ò	r
243	F3			o	s
244	F4			o	t
245	F5			o	u
246	F6			ö	v
247	F7				w
248	F8			ø	x
249	F9			ù	y
250	FA			u	z
251	FB			u	ä
252	FC			ü	ö
253	FD			y	ñ
254	FE				ü
255	FF			y	à

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Note! The final result codes OK, ERROR, +CME ERROR: <err>, etc, are not listed under “possible responses” for each AT command. The exception to this is the basic syntax commands Z, E, etc, where all possible result codes are listed.

Control, identification and status

AT (ATtention command)

Description	*Syntax*	*Possible responses*
Checks the presence of a MS	AT	• OK

This command is used as a simple functional control command, as to certain that contact with the MS (the module) still exists. It is always used to start sending a command line from the TE to TA.

The result code OK is returned if AT commands are implemented, and the MS is ready for AT commands.

AT&F (set to factory defined configuration)

Description	*Syntax*	*Possible responses*
Sets the parameters to the manufacturer's default setting	&F	• OK • ERROR

This command instructs the module to set parameters to their factory defaults as specified below.

Parameters and their default values after an &F command is issued:

S3 = 13	+CMEE <n> = 0	+CLIP <n> = 0
S4 = 10	+CNMI <mode> = 3	+CLIR <n> = 0
S5 = 8	+CNMI <mt> = 0	+CSSN <n> = 0
V = 1	+CNMI <bm> = 0	+CSSN <m> = 0
Q = 0	+CNMI <ds> = 0	+CREG <n> = 0
E = 1	+CUSD <n> = 0	*ECAM <onoff> = 0
+CSCS <chset> = “IRA”	+CCWA <n> = 0	*EWEE <onoff> = 0

ATZ (reset to default configuration)

Description	*Syntax*	*Possible responses*
Resets the module to a defined state	Z	• OK • ERROR

This command instructs the module to reset parameters to their factory defaults as specified for the command &F. Any call in progress will be terminated.

AT+CGMI (request manufacturer identification)

Description	*Syntax*	*Possible responses*
Request manufacturer Identification	+CGMI	• <manufacturer>
Shows if the command is supported	+CGMI=?	

One line of information text <manufacturer> is returned, identifying the manufacturer.

Defined values

<manufacturer>

ERICSSON	The manufacturer's name in upper case letters.

AT+CGMM (request model identification)

Description	*Syntax*	*Possible responses*
Request the model identification	+CGMM	• <model>
Shows if the command is supported	+CGMM=?	

One line of information text <model> is returned, identifying the specific model of ME (the module) that is connected.

Defined values

<model>

6050102	The type number of the module.

AT+CGMR (request revision identification)

Description	*Syntax*	*Possible responses*
Request revision identification string	+CGMR	• <revision>
Shows if the command is supported	+CGMR=?	

One line of information text <revision> is returned, identifying the software revision in the ME (the module).

Defined values

<revision>

yymmdd hhmm CXCxxxxxx

A string containing date (year, month, day, hour, minute) and CXC number (the manufacturer's software identity). Example:
`"980227 1405 CXC112143"`

AT+CGSN (request product serial number identification)

Description	*Syntax*	*Possible responses*
Request product serial number	+CGSN	• <sn>
Shows if the command is supported	+CGSN=?	

One line of information text <sn> is returned, identifying the individual ME (the module) that is connected.

The identity returned is the IMEI number of the ME (International Mobile Station Equipment Identity, according to GSM 03.03).

Defined values

<sn> The IMEI number.

AT+CPAS (phone activity status)

Description	*Syntax*	*Possible responses*
Request activity status	+CPAS	• +CPAS: <pas>
Shows supported parameters	+CPAS=?	• +CPAS: (list of supported <pas>s)

This command returns the activity status <pas> of the module, which can be used to interrogate the module before requesting any action.

Defined values

<pas>

0	Ready: AT commands are allowed.
3	Ringing (ready for commands, but the ringer is active).
4	Call in progress (ready for commands, but a call is in progress).
129	Idle.

AT+CFUN (set phone functionality)

Description	*Syntax*	*Possible responses*
Sets the functionality	+CFUN=[<fun>]	
Reads the current functionality	+CFUN?	• +CFUN: <fun>
Shows supported parameters	+CFUN=?	• +CFUN: (list of supported <fun>s

This command sets the functionality (power mode) of the module. Note that it is not possible to use +CFUN=1 to switch on the module. Only +CFUN=0 is valid to switch off the module. However, when <fun> is read, the value 1 is given.

Defined values

<fun>

0	The module is powered off. Default.
1	The module is powered on.

AT+CPIN (enter PIN command)

Description	*Syntax*	*Possible responses*
Enter password	+CPIN=<pin> [,<newpin>]	
Shows the current status	+CPIN?	• +CPIN: <code>
Shows if the command is supported	+CPIN=?	

The command +CPIN=<pin> sends a password to the module before it can be operated (SIM PIN, SIM PUK, PH-SIM PIN, etc). If no PIN request is pending, no action is taken, and an error message +CME ERROR, is returned to the TE.

If the PIN required is SIM PUK or SIM PUK2, the second PIN <newpin>, is used to replace the old PIN code in the SIM.

The read command +CPIN? returns an alphanumeric string <code>, indicating whether a password is required or not.

To change the password, use the command +CPWD.

For commands that are accepted with SIM PIN, SIM PUK or PH-SIM pending, see the section “Commands without PIN code control”.

Example

AT+CPIN? Type AT+CPIN?. You are asking if a PIN code is required. If it is, you should get CPIN: SIM PIN. If you get CPIN: READY, it is not necessary to enter a PIN code.

AT+CPIN="1234" Enter the PIN code. Note that the PIN code is a string, and must be enclosed in quotation marks.

Defined values

<pin>, <newpin>

Numerical string	The PIN code enclosed in quotation marks, 4 to 8 digits.

<code>

READY	No password is required.
SIM PIN	SIM PIN is required.
SIM PUK	SIM PUK is required.
PH-SIM PIN	PHone-to-SIM card password is required.
SIM PIN2	SIM PIN2 is required.

SIM PUK2	SIM PUK2 is required.
BLOCKED	SIM is blocked.

AT+CSQ (signal quality)

Description	*Syntax*	*Possible responses*
Requests the received signal strength indication	+CSQ	• +CSQ: <rssi>,<ber>
Shows supported parameters	+CSQ=?	• +CSQ: (list of supported <rssi>s), (list of supported <ber>s)

The received signal strength indication <rssi> and channel bit error rate <ber> are requested from the module.

Defined values

<rssi>

0	–113 dBm or less.
1	–111 dBm.
2...30	–109... –53 dBm.
31	–51 dBm or greater.
99	Not known or not detectable.

<ber>

As RXQUAL (quality band) and BER in percent according to GSM 05.08:

0	RXQUAL_0: BER < 0.2%
1	RXQUAL_1: 0.2% < BER < 0.4%
2	RXQUAL_2: 0.4% < BER < 0.8%
3	RXQUAL_3: 0.8% < BER < 1.6%
4	RXQUAL_4: 1.6% < BER < 3.2%
5	RXQUAL_5: 3.2% < BER < 6.4%
6	RXQUAL_6: 6.4% < BER < 12.8%
7	RXQUAL_7: 12.8% < BER
99	Not known or not detectable.

AT+CIMI (read International Mobile Subscriber Identity)

Description	*Syntax*	*Possible responses*
Reads the International Mobile Subscriber Identity (IMSI)	+CIMI	• +CIMI:<imsi>
Shows if the command is supported	+CIMI=?	

This command returns the <imsi> parameter, which identifies the individual SIM in the module.

Defined values

<imsi>

String	International Mobile Subscriber Identity (IMSI), in a string without quotation marks.

AT+CMEE (report mobile equipment error)

Description	*Syntax*	*Possible responses*
Sets error reporting	+CMEE=[<n>]	
Shows current status	+CMEE?	• +CMEE: <n>
Shows supported parameters	+CMEE=?	• +CMEE: (list of supported <n>s)

The set command disables or enables the use of a result code +CME ERROR: <err> as an indication of an error in the functions of the ME.

When enabled, ME-related errors result in a final result code +CME ERROR: <err> instead of the regular ERROR. Normally, ERROR is returned when error is related to syntax, invalid parameters, or TA functionality. See the error code +CME ERROR for possible <err> values.

Defined values

<n>

0	Disable +CME ERROR: <err> result code and use ERROR instead. Default.
1	Enable +CME ERROR: <err> result code and use numeric <err> values.
2	Enable +CME ERROR: <err> result code and use <err> values in text form.

+CME ERROR (mobile equipment error result code)

This result code is set with the command +CMEE. ME-related errors will return a final result code +CME ERROR: <err> instead of the regular ERROR. The format of <err> can be either numeric or text form.

Defined values

<err>

0	Phone failure	17	SIM PIN2 required
1	No connection to phone	18	SIM PUK2 required
2	Phone-adaptor link reserved	20	Memory full
3	Operation not allowed	21	Invalid index
4	Operation not supported	22	Not found
5	PH-SIM PIN required	23	Memory failure
10	SIM not inserted	24	Text string too long
11	SIM PIN required	25	Invalid characters in text string
12	SIM PUK required	26	Dial string too long
13	SIM failure	27	Invalid characters in dial string
14	SIM busy	30	No network service
15	SIM wrong	31	Network timeout
16	Incorrect password	100	Unknown

AT*EWEE (Ericsson Wake-Me-Up event enable command)

Description	*Syntax*	*Possible responses*
Sets Wake-Me-Up function on or off	*EWEE=<onoff>	
Shows the current mode of the function	*EWEE?	• *EWEE: <onoff>
Shows supported parameters	*EWEE =?	• *EWEE: list of supported <onoff>s

This command enables or disables the Wake-Me-Up functionality in the module. If the function is enabled, the module will send a unsolicited result code *EWEV before issuing anything else. This function is usually used to wake up a sleeping host (TE) so that it will be ready to receive the "real" result code that will be sent when the Wake-Me-Up notification is acknowledged with any AT command.

Defined values

<onoff>

0	The Wake-Me-Up function is disabled (off). Default.
1	The Wake-Me-Up function is enabled (on).

***EWEV (Ericsson Wake-Me-Up event result code)**

Description	*Syntax*	*When*
Unsolicited result code to command *EWEE	*EWEV	When the event occurs and the function is enabled.

Wake-Me-Up event reporting uses a result code *EWEV, which indicates that an unsolicited result code is about to be sent from the module, and that the receiving host must be ready to receive.

When receiving a *EWEV, an ‘AT’ should be sent to the module as an acknowledgement of the event. The AT command will result in an OK response. After that the pending unsolicited response code(s) will be issued.

As acknowledgement, AT*EWEE=0 can be sent instead of AT. This disables further sending of *EWEV.

Note! Pending unsolicited result codes are buffered in a FIFO entry (First In First Out), which reserve 12 event codes, with the “oldest” event code first. When FIFO is full, the event codes are sent, even if *EWEV has not been acknowledged.

Call control

ATA (answer incoming call command)

Description	*Syntax*	*Possible responses*
Answers an incoming call	A	• ERROR • OK

This command requests ME (the module) to answer an incoming speech call. An incoming call is indicated by the unsolicited result code RING.

To learn how to answer an incoming call, see the section of AT command examples in this chapter.

ATH (hook control)

Description	*Syntax*	*Possible responses*
Terminates a call	H	• OK

This command requests ME (the module) to terminate an active call.

ATD (dial command)

Description	*Syntax*	*Possible responses*
Originates a call	D<dial_string>;	• ERROR • NO DIALTONE • NO CARRIER • OK

This command requests the module to originate (dial) a speech call.

All characters appearing on the same command line after the D, the <dial_string>, is a considered part of the call addressing information or phone number. The dial string is terminated by a semicolon.

Characters such as parentheses, spaces and hyphens are ignored and can thus be included to format the phone number for clarity.

Example, dialling a speech call

ATD+4681111111; Type ATD. Here, an international call is shown. The dial string contains a plus sign (+), country code, area code and telephone number. Do not forget the semicolon. Begin dialling.

Defined values

<dial_string>

0 – 9, + Valid characters for originating a call.

AT+VTS (DTMF and tone generation)

Description	*Syntax*	*Possible responses*
Performs transmission of DTMF during speech call	+VTS=<DTMF>	
Shows if command is supported	+VTS=?	

This command, which allows the transmission of DTMF tones, operates only during a speech call.

Defined values

<DTMF>

String	One or more characters in the set 0 – 9, #, *, and A – D. Note that the string must be enclosed in quotation marks. Several characters may be sent, separated by commas.

AT*ECAM (Ericsson Call Monitoring enable command)

Description	*Syntax*	*Possible responses*
Sets Call Monitoring on or off	*ECAM=<onoff>	
Shows the current status for Call Monitoring	*ECAM?	• *ECAM: <onoff>
Shows supported parameters	*ECAM=?	• *ECAM: list of supported <onoff>s

This command activates or deactivates the call monitoring function in the ME. When this function is activated, the ME informs about call events, such as incoming calls, connected calls, hung-up calls, etc, by issuing an unsolicited result code *ECAV.

Defined values

<onoff>

0	The Call Monitoring is disabled (off). Default.
1	The Call Monitoring is enabled (on).

*ECAV (Ericsson Call Monitoring event result code)

Description	*Syntax*	*When*
Unsolicited result code reporting a call event	*ECAV: <ccid>, <ccstatus>, <calltype>, [<processid>] [,<exitcause>] [,<number>, <type>]	When function has been enabled and a call mode change occurs.

This is an unsolicited result code that reports changes in the call mode for a particular call indicating <ccid>. Each call, incoming or outgoing, will result in a sequence of these events being sent from the ME.

See the section of AT command examples in this chapter.

Defined values

<ccid>

Integer (1 – 7)	This is a number that uniquely defines a call in the phone (by giving the number of call control process). There cannot be two call IDs with the same number simultaneously. The maximum number of call control processes is seven: with five multiparty members, one call on hold and one call waiting.

<ccstatus>

0	Idle.
1	Calling (mobile originated).
2	Connecting (mobile originated).
3	Active (speech connection).
4	Hold.
5	Waiting (mobile terminated).
6	Alerting (mobile terminated).
7	Busy (called line busy).

<calltype>

1	Speech L1.
2	Data.
4	Fax.
128	Speech L2. Not supported.

<processid>

Integer	Reported when returning to the idle mode (<ccstatus>=0). 8 = H'08 = CC (Call control) 68 =H'44 = MM (Mobile Management) 69 = H'45 = MS (Mobile Station) 122 = H'7A = RR (Radio Resources)

<exitcause>

Integer	Exit cause according to GSM 04.08. Reported when returning to idle mode (<ccstatus>=0).

<number>

String	A string-type phone number of the format specified by <type>. This is only valid for <ccstatus>=1 (calling).

<type>

Integer	A Type-of-Address octet in integer format according to GSM 04.08. Default is 145, if the dialling string includes the international access code character '+', otherwise 129. This is only valid for <ccstatus>=1 (calling).

TE – TA interface commands

ATE (command echo)

Description	*Syntax*	*Possible responses*
Sets command echo	E[<value>]	• OK • ERROR
Shows the current setting	E?	• E: <value>
Shows supported parameters	E=?	• E: (list of supported <value>s)

The setting of the <value> parameter determines whether or not the TA will echo characters received from the TE.

Defined values

<value>

0	TA does not echo characters.
1	TA echoes characters. Default.

ATQ (result code suppression)

Description	*Syntax*	*Possible responses*
Controls whether or not the TA result codes are transmitted	Q[<value>]	• OK • ERROR
Shows the current setting	Q?	• Q: <value>
Shows supported parameters	Q=?	• Q: (list of supported <value>s)

The setting of this parameter determines whether or not the TA will transmit result codes to the TE. When result codes are being suppressed, no portion of any result code – header, result text, line terminator or trailer – can be transmitted. Information text transmitted in response to commands is not affected by the setting of this parameter.

Defined values

<value>

0	The TA transmits result codes. Default.
1	Result codes are suppressed and not transmitted.

ATV (TA response format)

Description	*Syntax*	*Possible responses*
Selects text or numeric result code format	V[<value>]	• OK • ERROR
Shows the current setting	V?	• V: <value>
Shows supported parameters	V=?	• V: (list of supported <value>s)

The setting of this parameter determines the contents of the header and trailer transmitted with result codes and information responses. It also determines whether result codes are transmitted in numeric or text form. The text portion of information responses is not affected by this setting.

Defined values

<value>

0	Numerical (short form) result codes will be sent in the following form: • Information responses: <text><CR><LF> • Result codes: <numeric code><CR>
1	Default. Text (long form) result codes will be sent in the following form: • Information responses: <CR><LF><text><CR><LF> • Result codes: <CR><LF><text><CR><LF>

AT+CSCS (select TE character set)

Description	*Syntax*	*Possible responses*
Selects character set used by the TE	+CSCS=[<chset>]	
Shows the current setting	+CSCS?	• +CSCS: <chset>
Shows supported character sets	+CSCS=?	• +CSCS: (list of supported <chset>s)

This command informs TA which character set <chset> will be used by the TE. TA is then able to convert character strings correctly between the TE and ME character sets.

If a 7-bit TE alphabet is used, the most significant bit will be set to zero.

Defined values

<chset>

“GSM”	GSM default alphabet according to GSM 03.38.
“IRA”	International reference alphabet according to ITU-T T.50. Default.
“8859-1”	Latin 1 character set according to ISO 8859-1.
”ERICSSON”	Ericsson character set.

ATS3 (command line terminator character)

Description	*Syntax*	*Possible responses*
Sets <cr>	S3=<cr>	
Shows the current setting	S3?	• <cr>
Shows supported parameters	S3=?	• S3: (0-127)

Sets the character to be used as a line termination character. The setting is used both to detect the end of the command and to format responses. The response to the command is modified to reflect the change.

Defined values

<cr>

0 – 127	Command-line termination character. Default is 13.

ATS4 (response formatting character)

Description	*Syntax*	*Possible responses*
Sets <lf>	S4=<lf>	
Shows the current setting	S4?	• <lf>
Shows supported parameters	S4=?	• S4: (0-127)

Sets the character to be used as a line formatting character. The response to the command is modified to reflect the change.

Defined values

<lf>

0 – 127	Response-formatting character. Default is 10.

ATS5 (command line editing character)

Description	*Syntax*	*Possible responses*
Sets <bs>	S5=<bs>	
Shows the current setting	S5?	• <bs>
Shows supported parameters	S5=?	• S5: (0-127)

Sets the character to be used as a command line editing character.

Defined values

<bs>

0 – 127	Command-line editing character. Default is 8.

GSM network services

AT+CNUM (subscriber number)

Description	*Syntax*	*Possible responses*
Returns subscriber number(s)	+CNUM	• +CNUM: [<alpha1>],<number1>, <type1>[,<speed>,<service> [,<itc>]] [<CR><LF>+CNUM: [<alpha2>],<number2>,<type2> [,<speed>,<service>[,<itc>]][…]]
Shows if the command is supported	+CNUM=?	

This command returns the subscriber number. If the subscriber has different subscriber numbers for different services, each subscriber number is returned on a separate line. The information returned is associated with the subscriber SIM card.

Defined values

<alpha***x***>

Alphanumeric string	String associated with <number***x***>. Default is any of “VOICE”, “ISDN”, “DATA”, “FAX”, or “ALS”.

<number***x***>

Alphanumeric string	The phone number of the format specified by <type***x***> enclosed in quotation marks.

<type***x***>

Integer	A Type-of-Address octet in integer format according to GSM 04.08. Default is 145, if the dialling string includes the international access code character ‘+’, otherwise 129.
<speed>	As defined in GSM 07.07.

<service>

0	Asynchronous modem.
1	Synchronous modem.
2	PAD Access (asynchronous).
3	Packet Access (synchronous).
4	Speech.
5	Fax.

<itc>

0	3.1 kHz
1	UDI

AT+CREG (network registration)

Description	*Syntax*	*Possible responses*
Enables or disables the presentation of an unsolicited result code +CREG	+CREG=[<n>]	
Shows status of result code presentation	+CREG?	• +CREG: <n>,<stat> [,<lac>,<ci>]
Shows supported parameters	+CREG=?	• +CREG: (list of supported <n>s)

This command controls the presentation of an unsolicited result code +CREG:

- +CREG: <stat> if <n>=1 and the ME network registration status is changed.
- +CREG: <stat>[,<lac>,<ci>] if <n>=2 and the ME network registration status or the network cell is changed.

The read command +CREG? returns the status of the result code presentation and an integer <stat> indicates registration status.

Defined values

<n>

0	Disable network registration unsolicited result code. Default.
1	Enable network registration unsolicited result code +CREG: <stat>.
2	Enable network registration and location information unsolicited result code +CREG: <stat>[,<lac>,<ci>].

<stat>

0	Not registered, the ME is not currently searching for a new operator to register with.
1	Registered, home network.
2	Not registered, but the ME is currently searching for a new operator to register with.
3	Registration denied.
4	Unknown.
5	Registered, roaming.

<lac>

String type, hexa-decimal	Two-byte location area code.

<ci>

String type, hexa-decimal	Two-byte cell ID.

AT+COPS (operator selection)

Description	*Syntax*	*Possible responses*
Request operator selection	+COPS=[<mode> [,<format> [,<oper>]]]	
Shows current settings	+COPS?	• +COPS: <mode>[,<format>,<oper>]
Shows present networks	+COPS=?	• +COPS: [list of supported (<stat>, long alphanumeric <oper1>, short alphanumeric <oper1>, numeric <oper1>)s] +COPS: [list of supported (<stat>, long alphanumeric <oper2>, short alphanumeric <oper2>, numeric <oper2>)s]

This command forces an attempt to select and register the GSM network operator. The <mode> parameter is used to select whether the selection is done automatically by the ME or is forced by this command to operator <oper>. If the selected operator is not available, no other operator is selected (except <mode>=4). The selected operator name format applies to further read commands +COPS? as well.

The read command +COPS? returns the current mode and the currently selected operator. If no operator is selected, <format> and <oper> are omitted.

The test command +COPS=? returns a list of operators currently within reach. The operators are written in either capital or lower-case letters.

To select a GSM network operator with +COPS, the IMEI number has to be allowed in the network and the name of the network operator must be typed according to the list of operators. If the module has an illegal IMEI number for a specific network, when selecting that network with +COPS the response that the operation is not allowed is given. In this situation the only way to continue is to switch the module off, and then switch it on again and select another network with +COPS.

Defined values

<mode>

0	Automatic (<oper> and <format> fields are ignored). Default.
1	Manual (<oper> and <format> fields are required).
3	Sets <format> for <oper> for the read command +COPS?.
4	Manual/automatic (<oper> field is required). If manual selection fails, automatic mode (<mode>=0) is entered.

<format>

0	Long format alphanumeric <oper>. Default.
1	Short format alphanumeric <oper>.
2	Numeric <oper>.

<oper>

String type	Network operator as defined by <format> shall be enclosed in quotation marks: • long alphanumeric format can be up to 16 characters • short alphanumeric format can be up to 8 characters Characters are according to GSM MoU SE.13. Numeric format is the GSM Location Area Identification number according to GSM 04.08, which consists of a three BCD digit country code coded as in ITU-T E.212, plus a two BCD digit network code, which is administration-specific. Returned <oper> shall be in IRA characters converted from BCD. The number has the number structure: <country code digit 3><country code digit 2> <country code digit 1><network code digit 2> <network code digit 1>

<stat>

0	Unknown.
1	Available.
2	Current.
3	Forbidden.

AT+CLIP (Calling Line Identification Presentation)

Description	*Syntax*	*Possible responses*
Enables or disables the presentation of CLI	+CLIP=[<n>]	
Reads the current CLIP status	+CLIP?	• +CLIP: <n>,<m>
Shows supported parameters	+CLIP=?	• +CLIP: (list of supported <n>s)

This command refers to the GSM supplementary service Calling Line Identification Presentation (CLIP). See GSM 02.81.

The command enables or disables the presentation of the CLI. When the presentation is enabled, a calling subscriber's number will be indicated when a mobile terminated call is received.

When the presentation of the CLI is enabled (if the calling subscriber allows), an unsolicited result code +CLIP: <number>,<type> is sent to the TE (the host) after every result code RING.

Observe that the support of this command may vary depending on your subscription, and the semantics of the command may differ between service providers (how the service is implemented in the network).

Defined values

<n>

Sets or shows the result code presentation status in the TA.

0	Result code presentation is disabled. Default.
1	Result code presentation is enabled.

<m>

Shows the subscriber CLIP service status in the network.

0	CLIP is not provisioned.
1	CLIP is provisioned.
2	Unknown (that is no network, etc).

<number>

String type	The phone number of the format specified by <type> enclosed in quotation marks.

<type>

Integer	A Type-of-Address octet in integer format according to GSM 04.08. Default is 145, if the dialling string includes the international access code character '+', otherwise 129.

AT+CLIR (Calling Line Identification Restriction)

Description	*Syntax*	*Possible responses*
Enables or disables the presentation of CLI for an originating call	+CLIR=[<n>]	
Reads the current CLIR status	+CLIR?	• +CLIR: <n>,<m>
Shows supported parameters	+CLIR=?	• +CLIR: (list of supported <n>s)

This command refers to the GSM supplementary service Calling Line Identification Restriction (CLIR), which allows the calling module to enable or disable the presentation of the CLI to the called party while originating a call (dialling). See GSM 02.81.

The command overrides the CLIR subscription (default is restricted or allowed) when the temporary mode is provisioned as a default adjustment for all the subsequent outgoing calls. This adjustment can be revoked by using the opposite command. If this command is used by a subscriber without CLIR being provisioned in permanent mode the network will act according to GSM 02.81.

Observe that the support of this command may vary depending on your subscription, and the semantics of the command may differ between service providers (how the service is implemented in the network).

Defined values

<n>

Sets the adjustment for outgoing calls.

0	Presentation indicator is used according to the subscription of the CLIR service. Default.
1	CLIR invocation.
2	CLIR suppression.

<m>

Shows the subscriber CLIR service status in the network.

0	CLIR is not provisioned.
1	CLIR is provisioned in permanent mode.
2	Unknown (that is no network, etc).
3	CLIR temporary mode presentation is restricted.
4	CLIR temporary mode presentation is allowed.

AT+CCFC (Call Forwarding number and conditions)

Description	*Syntax*	*Possible responses*
Activates, deactivates or queries the Call Forwarding	+CCFC= <reason>, <mode> [,<number> [,<type> [,<subaddr> [,<satype> [,<class> [,<time>]]]]]]	When <mode>=2 and the command was successful: • +CCFC: <status>,<class1> [,<number>,<type>[,<time>]] [<CR><LF>+CCFC: <status>,<class2> [,<number>,<type>[,<time>]] [...]]
Shows supported parameters	+CCFC=?	• +CCFC: (list of supported <reason>s)

This command refers to the GSM supplementary service Call Forwarding, which permits the called module to have the network send incoming calls to a desired phone number. Registration, erasure, activation, deactivation, and status query are supported. See GSM 02.82.

Observe that the support of this command may vary depending on your subscription, and the semantics of the command may differ between service providers (how the service is implemented in the network).

Defined values

<reason>

0	Unconditional.
1	Mobile busy.
2	No reply.
3	Not reachable.
4	All call forwarding according to GSM 02.30.
5	All conditional call forwarding according to GSM 02.30.

<mode>

0	Disable.
1	Enable.
2	Query status.
3	Registration.
4	Erasure.

<number>

String	A string type phone number of forwarding address in format specified by <type> enclosed in quotation marks.

<type>	
Integer	A Type-of-Address octet in integer format according to GSM 04.08. Default is 145, if the dialling string includes the international access code character '+', otherwise 129.
<subaddr>	
String	This subaddress of format specified by <satype> is not supported. An empty string will be returned. GSM 04.08.
<satype>	
Integer	This subaddress type octet in integer format is not supported. An empty string will be returned. GSM 04.08.
<class***x***>	
Integer	A sum of integers each representing a class of information. Default 135 equals to all classes.
1	Speech L1.
2	Data.
4	Fax.
128	Speech L2. Not supported.
<time>	
1...30	When "no reply" is enabled or queried, this gives the time in seconds, that must pass before the call is forwarded. Default is 20.
<status>	
0	Not active.
1	Active.

AT+CCWA (Call Waiting)

Description	*Syntax*	*Possible responses*
Activates, deactivates or queries the Call Waiting	+CCWA=[<n> [,<mode> [,<class>]]]	When <mode>=2 and the command was successful: • +CCWA: <status>,<class1> [<CR><LF>+CCWA: <status>,<class2>[...]]
Reads the status for presentation of unsolicited result codes	+CCWA?	• +CCWA: <n>
Shows supported parameters	+CCWA=?	• +CCWA: (list of supported <n>s)

This command refers to the GSM supplementary service Call Waiting, which permits the module to be notified of an incoming call, for example, if the module is engaged in an active call or a call on hold. The module can either accept, reject or ignore the incoming call. See GSM 02.83.

Activation, deactivation and status query are supported. The parameter <n> is used to disable or enable the presentation of an unsolicited result code +CCWA: <number>,<type>,<class>.

Observe that the support of this command may vary depending on your subscription, and the semantics of the command may differ between service providers (how the service is implemented in the network).

Defined values

<n>

Sets and shows the result code presentation status in the TA.

0	Result code presentation status is disabled. Default.
1	Result code presentation status is enabled.

<mode>

When <mode> parameter is not given, network is not interrogated.

0	Disable.
1	Enable.
2	Query status.

<class***x***>

A sum of integers each representing a class of information. Default 135 equals to all classes.

1	Speech L1.
2	Data.

4	Fax.
128	Speech L2. Not supported.

<status>

0	Not active.
1	Active.

<number>

String type	The phone number of calling address in format specified by <type> enclosed in quotation marks.

<type>

Integer	A Type-of-Address octet in integer format according to GSM 04.08. Default is 145, if the dialling string includes the international access code character '+', otherwise 129.

AT+CHLD (Call Holding and Multiparty)

Description	*Syntax*	*Possible responses*
Specifies actions for waiting calls, active calls and/or calls on hold	+CHLD[=]<n>	
Shows supported parameters	+CHLD=?	• +CHLD: (list of supported <n>s)

This command refers to the GSM supplementary services Call Holding and Multiparty. See GSM 02.83 and 02.84.

- Call Holding allows the module to interrupt communication on an active call and, if desired, re-establish the communication.
- Multiparty permits the module to maintain simultaneous communication with more than one party.

Calls can be put on hold, recovered, released, or added to conversation. Call Holding and Multiparty are only applicable to speech calls.

Observe that the support of this command may vary depending on your subscription, and the semantics of the command may differ between service providers (how the service is implemented in the network).

Defined values

<n>

Integer	<n> equals to numbers entered before SEND button in GSM 02.30.
0	Releases all calls on hold or sets User Determined User Busy (UDUB) for a waiting call.
1	Releases all active calls (if any) and accepts the call on hold or the waiting call.
1X	Releases the active call with call ID X.
2	Places all active calls (if any) on hold and accepts the call on hold or waiting call.
2X	Places all active calls on hold except multiparty member with call ID X (go one-to-one).
3	Joins a call on hold to the active call (Multiparty).
4	Connects a call on hold with an active call and disconnects the subscriber from both calls (explicit call transfer).

Note!

- If there is a call on hold and a waiting call present at the same time, the command will apply to the waiting call in conflicting situations.
- X is the call ID (starting with 1) given by the sequence of setting up and receiving calls (active calls, waiting calls, or calls on hold) as seen by the served subscriber. Calls hold their number until they are released. New calls get the lowest available number.
- The “directory number” case shall be handled with the dial command D, and the END case with hang-up command H, according to GSM 02.83 and 02.84.

AT+CSSN (supplementary service notifications)

Description	*Syntax*	*Possible responses*
Enables or disables the presentation of notification result codes	+CSSN=[<n> [,<m>]]	
Shows the current settings	+CSSN?	• +CSSN: <n>,<m>
Shows supported parameters	+CSSN=?	• +CSSN: (list of supported <n>s),(list of supported <m>s)

This command refers to supplementary service-related network-initiated notifications. The command enables or disables the presentation of notification result codes from the TA to TE.

When <n>=1 and a supplementary service notification are received after a mobile originated call setup, an intermediate result code +CSSI: <code1> is sent to the TE before any other mobile originated call setup result codes are presented in GSM 07.07 or in ITU-T V.25ter.

When several different <code1>s are received from the network, each of them will have its own +CSSI result code.

When <m>=1 and a supplementary service notification is received during a mobile terminated call setup or during a call, or when a forward check supplementary service notification is received, an unsolicited result code +CSSU: <code2> is sent to the TE.

In case of mobile terminated call setup, a result code is sent after every result code +CLIP and when several different <code2>s are received from the network, each of them will have its own +CSSU result code. See the command +CLIP.

Observe that the support of this command may vary depending on your subscription, and the semantics of the command may differ between service providers (how the service is implemented in the network).

The result codes, +CSSI and +CSSU, might not be returned if the calling and the called party have different service providers (non-compatible).

Defined values

<n>

Sets or shows the +CSSI result code presentation status in the TA.

0	+CSSI result code presentation is disabled. Default.
1	+CSSI result code presentation is enabled.

<m>

Sets or shows the +CSSU result code presentation status in the TA.

0	+CSSU result code presentation is disabled. Default.
1	+CSSU result code presentation is enabled.

<code1>

0	Unconditional call forwarding is active.
1	Some of the conditional call forwardings are active.
2	A call has been forwarded.
3	A call is waiting.
5	Outgoing calls are barred.
6	Incoming calls are barred.
7	CLIR suppression is rejected.

<code2>

0	This is a forwarded call (mobile terminated call setup).
2	A call has been put on hold (during a speech call).
3	A call has been retrieved (during a speech call).
4	Multiparty call entered (during a speech call).
5	A call on hold has been released (this is not a supplementary service notification during a speech call).
6	Forward check supplementary service received (can be received at any time).

AT+CUSD (Unstructured Supplementary Service Data)

Description	*Syntax*	*Possible responses*
Controls USSD	+CUSD=[<n> [,<str>[,<dcs>]]]	• +CUSD: <m>[,<str>,<dcs>]
Shows current status	+CUSD?	• +CUSD: <n>
Shows supported parameters	+CUSD=?	• +CUSD: (list of supported <n>s)

This command refers to the GSM supplementary service Unstructured Supplementary Service Data (USSD). See GSM 02.90.

Both network- and mobile-initiated operations are supported. The parameter <n> is used to disable or enable the presentation of an unsolicited result code (network-initiated operation) +CUSD: <m>,<str>,<dcs>.

When <str> is given, a mobile-initiated USSD-string or a USSD-string response to a network-initiated operation is sent to the network. If the mobile-initiated operation is successful, the USSD-string response from the network is returned before the final result code.

The interaction of this command with other commands based on other GSM supplementary services is described in the GSM standard.

Observe that the support of this command may vary depending on your subscription, and the semantics of the command may differ between service providers (how the service is implemented in the network).

Defined values

<n>

Sets or shows the result code presentation status in the TA.

0	Result code presentation is disabled. Default.

1	Result code presentation is enabled.
2	Terminate (abort) USSD dialogue. This value is not applicable in the response to the read command.

<str>

String	USSD-string (when <str> parameter is not given, the network will not be interrogated): • ME/TA converts the GSM alphabet into current character set (see the command +CSCS) according to rules in GSM 07.05. • Maximum length of <str> is 160 characters.

<dcs>

Integer	Cell Broadcast data coding scheme in integer format according to GSM 03.38. Default is zero (0). 8-bit data coding scheme is not supported.

<m>

0	No further user action is required (network-initiated USSD-Notify, or no further information needed after mobile-initiated operation).
1	Further user action required (network-initiated USSD-Request, or further information needed after mobile-initiated operation).
2	USSD dialogue terminated (due to network supplementary service release request). This result code is not generated if the dialogue terminates with a result code where <m> is equal to zero (0).
3	Other I/O client has responded. This parameter value is not applicable to GM 12. This result code is received if the network initiates a USSD dialogue and some other I/O client responds. The client that responds first receives the dialogue. Clients that try to respond after this notification has been generated, will get a result code ERROR.

AT+CLCK (facility lock command)

Description	*Syntax*	*Possible responses*
Locks or unlocks ME or network facility	+CLCK=<fac>, <mode> [,<passwd> [,<class>]]	When <mode>=2 and the command was successful: • +CLCK: <status>[,<class1> [<CR><LF>+CLCK: <status>,<class2>[...]]
Shows supported parameters	+CLCK=?	• +CLCK: (list of supported <fac>s)

This command refers to the GSM supplementary service Call Barring, which allows the module bar certain categories of outgoing or incoming calls. See GSM 02.88.

This command locks or unlocks an ME or network facility. Each operation requires a password.

Observe that the support of this command may vary depending on your subscription, and the semantics of the command may differ between service providers (how the service is implemented in the network).

Defined values

<fac>	
“PS”	PH-SIM (lock Phone to SIM card).
“SC”	SIM (lock SIM card, SIM asks for password in ME at power-up and when this lock command is issued).
“P2”	PIN2.
“AO”	BAOC (Bar All Outgoing Calls, see GSM 02.88).
“OI”	BOIC (Bar Outgoing International Calls, see GSM 02.88).
“OX”	BOIC-exHC (Bar Outgoing International Calls except to Home Country, see GSM 02.88).
“AI”	BAIC (Bar All Incoming Calls, see GSM 02.88).
“IR”	BIC-Roam (Bar Incoming Calls when Roaming outside the home country, see GSM 02.88).
“FD”	SIM fixed dialling memory feature (if PIN2 authentication has not been done during the current session, PIN2 is required as <passwd>).
“AB”	All Barring services (see GSM 02.30).
“AG”	All outGoing barring services (see GSM 02.30).
“AC”	All inComing barring services (see GSM 02.30).

<mode>

0	Unlock.
1	Lock. For fac="PS", ask for password when SIM card is changed after power-on.
2	Query status.
10	Full lock. Always ask for password after power-on. This is only valid for fac="PS".

<status>

0	Not active.
1	Active.

<passwd>

String	Must be the same as the password specified for the facility by using the command +CPWD.

<class***x***>

A sum of integers each representing a class of information. Default 135 equals to all classes.

1	Speech L1.
2	Data.
4	Fax.
128	Speech L2. Not supported.

AT+CPWD (change password command)

Description	*Syntax*	*Possible responses*
Changes password	+CPWD=<fac>, <oldpwd>, <newpwd>	
Shows supported parameters	+CPWD=?	• +CPWD: list of supported (<fac>, <pwdlength>)s

This command sets a new password for the facility lock function defined by the command +CLCK.

The test command +CPWD=? returns a list of pairs that present the available facilities and the maximum length of their passwords.

Observe that the support of this command may vary depending on your subscription, and the semantics of the command may differ between service providers (how the service is implemented in the network).

Defined values

<fac>	See the command +CLCK.

<oldpwd>, <newpwd>

String	<oldpwd> must be the same as the password specified for the facility. <newpwd> is the new password.

<pwdlength>

Integer	The maximum length of the password for the facility.

GSM-SMS and CBM-PDU mode

The following parameters are used in the SMS and CBM command description:

<mt>	Mobile terminated messages.
<mo>	Mobile originated messages.
<bm>	Cell Broadcast type messages.
<mem1>	Memory from which messages are read and deleted (commands +CMGL, +CMGR and +CMGD).
<mem2>	Memory to which writing and sending operations are made (commands +CMSS and +CMGW).
<mem3>	Memory to which received SMS messages are preferred for storage (unless forwarded directly to TE, see the command +CNMI).
<pdu>	In the case of SMS: SC address according to GSM 04.11 followed by TPDU in hexa-decimal format according to GSM 03.40. ME/TA converts each octet of TP data unit into 2-character-long IRA hexa-decimal number. Example: an octet with the integer value 42 is presented to TE as characters 2A (IRA 50 and 65). In the case of CBM: TPDU in hexa-decimal format according to GSM 03.41.
<sca>	RP SC Address-Value field in string format according to GSM 04.11: BCD numbers (or GSM default alphabet characters) are converted to characters of the currently selected TE character set (see the command +CSCS in TS 07.07). Type-of-Address is given by <tosca>.
<tosca>	RP SC Type-of-Address octet in integer format according to GSM 04.11 (default, see <toda>).
<mid>	CBM Message Identifier in integer format according to GSM 03.41.

<dcs>	Depending on the command or result code: SMS data coding scheme (default is 0), or Cell Broadcast data coding scheme in integer format according to GSM 03.38.
<mr>	TP Message-Reference in integer format according to GSM 03.40.
<index>	Integer type: value in the range of location numbers supported by the associated memory.
<stat>	Integer type in PDU mode (default is 0), or string type in text mode (default is "REC UNREAD"), indicates the status of message in memory. Defined values: 0 "REC UNREAD" received unread message (that is a new message) 1 "REC READ" received read message 2 "STO UNSENT" stored unsent message (only applicable to SM) 3 "STO SENT" stored sent message (only applicable to SM) 4 "ALL" all messages (only applicable to +CMGL command)
<length>	The length of the actual TP data unit in octets (that is the RP layer SMSC address octets are not counted in the length).

AT+CSMS (select message service)

Description	*Syntax*	*Possible responses*
Sets message service	+CSMS= <service>	• +CSMS: <mt>,<mo>,<bm> • +CMS ERROR: <err>
Shows the current status	+CSMS?	• +CSMS: <service>,<mt>, <mo>,<bm>
Shows supported parameters	+CSMS=?	• +CSMS: (list of supported <service>s)

The set command selects the messaging service <service>. It returns the types of messages supported by the ME for the selected service: <mt> for mobile terminated messages, <mo> for mobile originated messages and <bm> for broadcast type messages.

Defined values

<service>

0	GSM 03.40 and 03.41 specific.

<mt>, <mo>, <bm>

0	Type is not supported.
1	Type is supported.

AT+CPMS (preferred message storage)

Description	*Syntax*	*Possible responses*
Sets the preferred message storage areas	+CPMS=<mem1> [,<mem2> [,<mem3>]]	• +CPMS: <used1>,<total1>, <used2>,<total2>,<used3>, <total3> • +CMS ERROR: <err>
Reads the current settings and status	+CPMS?	• +CPMS: <mem1>,<used1>,<total1>, <mem2>,<used2>,<total2>, <mem3>,<used3>,<total3> • +CMS ERROR: <err>
Shows supported parameters	+CPMS=?	• +CPMS: (list of supported<mem1>s), (list of supported<mem2>s), (list of supported<mem3>s)

The set command selects the preferred memory storages <mem1>, <mem2> and <mem3> to be used for reading, writing, etc. Area <mem1> is the memory from which messages are read and deleted, <mem2> is the memory to which writing and sending operations are made, <mem3> is the memory to which a received SMS is preferred for storage.

Defined values

<mem1>, <mem2>

“ME”	ME message storage.
“SM”	SIM message storage. Default.

<mem3>

“ME”	ME message storage. Default.

<used1>, <used2>, <used3>

Integer	Number of messages currently in <mem***x***>.

<total1>, <total2>, <total3>

Integer	The total number of available storage locations in <mem***x***>.

AT+CMGF (message format)

Description	*Syntax*	*Possible responses*
Sets message format	+CMGF= [<mode>]	• +CMGF ERROR: <err>
Reads the current setting	+CMGF?	• +CMGF: <mode>
Shows supported parameters	+CMGF=?	• +CMGF: (list of supported <mode>s)

The set command defines the message format to use when a SMS is transferred in the TE – TA interface (between the host and the module).

Defined values

<mode>

0	PDU mode. Default.

AT+CSCA (Service Centre Address)

Description	*Syntax*	*Possible responses*
Updates the SMSC address	+CSCA=<sca> [,<tosca>]	
Shows the current setting	+CSCA?	• +CSCA: <sca>, <tosca>
Shows supported parameters	+CSCA=?	• +CSCA: (list of supported <tosca>s)

This command updates the SMSC address, through which mobile originated SMS are transmitted. The SMSC address set by this command is used when the length of the SMSC address coded into the PDU equals zero. See the command +CMGS.

Defined values

<sca>

String	The phone number.

<tosca>

Integer	A Type-of-Address octet according to GSM 04.11.
128	Unknown.
129	ISDN / telephony numbering plan, national / international unknown. Default if no '+' in <sca>.
145	ISDN / telephony numbering plan, national / international unknown. Default if '+' in <sca>.

AT+CSCB (select Cell Broadcast Message types)

Description	*Syntax*	*Possible responses*
Sets Cell Broadcast Message types	+CSCB=[<mode> [,<mids>[,<dcss>]]]	• +CMS ERROR: <err>
Shows current setting	+CSCB?	• +CSCB: <mode>, <mids>,<dcss>
Shows supported mode parameter	+CSCB=?	• +CSCB: (list of supported <mode>s)

This command sets the types of Cell Broadcast Messages (CBM) that are to be received by the ME. All message identifiers included in the <mids> parameter will be accepted. If <dcss> is specified, the accepted data coding schemes can be restricted.

The read command of the <mids> parameter is only valid after it has been initialized with a set command. For example, issue the command AT+CSCB=0,“”.

Defined values

<mode>

0	Message types specified in <mids> are accepted. Default.

<mids>

String	CBM message identifiers: in this example, nine values are shown “0,1,5,320-323,922,31000”. Maximum number of values is 32. Valid range of values is 0 – 65 533.

<dcss>

String	Combinations of CBM data coding schemes: for example “0-3,5”. Default is “0-255”.

AT+CNMI (new message indication)

Description	*Syntax*	*Possible responses*
Selects the procedure for how new incoming messages are indicated	+CNMI=[<mode> [,<mt>[,<bm> [,<ds>]]]]	• +CMS ERROR: <err>
Shows current setting	+CNMI?	• +CNMI: <mode>,<mt>, <bm>,<ds>
Shows supported parameters	+CNMI=?	• +CNMI=(list of supported<mode>s), (list of supported<mt>s), (list of supported<bm>s), (list of supported<ds>s) • +CMS ERROR: <err>

This command selects the procedure, for indicating how new messages from the network to the TE (the host) are received.

The <mode> parameter controls the processing of unsolicited result codes specified by +CNMI, and <bm> sets the result code indication routing for CBMs.

Messages are indicated to the TE by the following unsolicited result codes:

- +CMT: [<alpha>],<length><CR><LF><pdu>
- +CMTI: <mem>,<index>
- +CBM: <length><CR><LF><pdu>

Defined values

<mode>

3	Unsolicited result codes are forwarded directly to the TE.

<mt>

0	No SMS-DELIVER (messages to ME) indications are routed to the TE. Default.
1	SMS-DELIVER is stored in ME. Indication of the memory location is routed to the TE by using the unsolicited result code: +CMTI: <mem>,<index>

2	Class 0, class 1 and class 3 SMS-DELIVERs are routed directly to the TE using unsolicited result code: +CMT: [<alpha>],<length><CR><LF><pdu> (PDU mode enabled). Class 0 messages and messages in the message waiting indication group (discard message), may be copied to TE. In this case, ME shall send the acknowledgement to the network. Class 2 messages and messages in the message waiting indication group (store message) result in indication as defined in <mt>=1.
3	Class 3 SMS-DELIVERs are routed directly to TE by using the unsolicited result code: +CMT: [<alpha>],<length><CR><LF><pdu> Messages of other data coding schemes result in indication as defined in <mt>=1.

<bm>

0	No CBM indications are routed to the TE. Default.
2	CBM is routed directly to the TE by using the unsolicited result code: +CBM: <length><CR><LF><pdu>

<ds>

0	No SMS-STATUS-REPORTs are routed to the TE.

AT+CMSS (send message from storage)

Description	*Syntax*	*Possible responses*
Sends message from storage	+CMSS=<index>	• +CMSS: <mr> • +CMS ERROR: <err>
Shows if the command is supported	+CMSS=?	

This command sends a message with the location value <index> from the message storage <mem2> to the network (SMS-SUBMIT). The message reference value <mr> is returned to the TE (the host) if the message is successfully delivered.

Defined values

<index>

Integer	Memory location.

<mr>

Integer	TP Message-Reference in integer format according to GSM 03.40.

AT+CMGD (delete message)

Description	*Syntax*	*Possible responses*
Deletes message from storage	+CMGD=<index>	• +CMS ERROR: <err>
Shows supported parameters	+CMGD=?	• +CMS ERROR: <err>

This command deletes messages from message storage <mem1> at the <index> location.

Defined values

<index>

Integer	Memory location.

AT+CMGL (list messages)

Description	*Syntax*	*Possible responses*
Lists messages	+CMGL=[<stat>]	• +CMGL: <index>,<stat>, [alpha],<length><CR> <LF><pdu>[<CR><LF> +CMGL: <index>,<stat>, [alpha],<length><CR> <LF><pdu>[...]] • +CMS ERROR: <err>
Shows supported parameters	+CMGL=?	• +CMGL: (list of supported <stat>s)

This command returns messages with the status value <stat> from the message storage <mem1>. Entire data units <pdu> are returned. If status of the message is "received unread", the status in the storage changes to "received read".

Defined values

<stat>

0	Received unread. Default.
1	Received read.
2	Stored unsent.
3	Stored sent.
4	All messages.

<index>

Integer	Memory location.

<alpha>	This parameter is not supported. An empty string will be returned.

<length>

Integer	The length of the actual TP data unit in octets (the RP layer SMSC address octets are not counted in the length).
<pdu>	The message in PDU format.

AT+CMGR (read message)

Description	*Syntax*	*Possible responses*
Reads message from storage	+CMGR=<index>	• +CMGR: <stat>,[alpha], <length><CR><LF><pdu> • +CMS ERROR: <err>
Shows if the command is supported	+CMGR=?	• +CMS ERROR: <err>

This command returns a message with the location value <index> from message storage <mem1>. The status of the message and entire message data unit <pdu> will be returned. If the status of the message is “received unread”, the status in the storage changes to “received read”.

Defined values

<index>

Integer	Memory location.

<stat>

0	Received unread.
1	Received read.
2	Stored unsent.
3	Stored sent.
<alpha>	This parameter is not supported. An empty string will be returned.

<length>

Integer	The length of the actual TP data unit in octets (the RP layer SMSC address octets are not counted in the length).

<pdu>	The message in PDU format.

AT+CMGS (send message)

Description	*Syntax*	*Possible responses*
Sends message	+CMGS=<length> <CR>PDU is given<Ctrl-Z or Esc>	• +CMGS: <mr> • +CMS ERROR: <err>
Shows if the command is supported	+CMGS=?	

This command sends message from TE (the host) to the network (SMS-SUBMIT). The message reference value <mr> is returned to the TE if the message is successfully delivered.

The TA (the module) sends a four character sequence <CR><LF><greater_than><space> (IRA 13, 10, 62, 32) after the command line is terminated with <CR>. After that, the PDU can be given from the TE (the host) in one line.

When the length octet of the SMSC address (given in the <pdu>) equals zero, then the stored SMSC address, which is set with the command +CSCA, is used.

The end of the PDU is indicated by <Ctrl-Z> (IRA 26). Otherwise, sending can be cancelled by using the <Esc> character (IRA 27).

Defined values

<mr>

Integer	TP Message-Reference in integer format according to GSM 03.40.

<length>

Integer	The length of the actual TP data unit in octets (the RP layer SMSC address octets are not counted in the length).

<pdu>	The message in PDU format.

AT+CMGW (write message to memory)

Description	*Syntax*	*Possible responses*
Writes message to memory	+CMGW=<length> [,<stat>]<CR> PDU is given <Ctrl-Z or Esc>	• +CMGW: <index> • +CMS ERROR: <err>
Shows if the command is supported	+CMGW=?	

This command stores messages (either SMS-DELIVER or SMS-SUBMIT) in the memory storage <mem2>. The memory location <index> of the stored message is returned. By default, the message status will be set to “stored unsent”, but the <stat> parameter also allows other status values to be given. The PDU is given in the same way as the command +CMGS.

The TA (the module) sends a four character sequence <CR><LF><greater_than><space> (IRA 13, 10, 62, 32) after the command line is terminated with <CR>. After that, the PDU can be given from the TE (the host) in one line.

Defined values

<length>

Integer	The length of the actual TP data unit in octets (the RP layer SMSC address octets are not counted in the length).

<stat>

2	Stored unsent.

<index>

Integer	Message location.

+CBM (Cell Broadcast Message result code)

Description	*Syntax*	*When*
Cell Broadcast Message	+CBM:<length> <CR><LF><pdu>	When a new CBM has been received and +CNMI is activated to route it directly to the TE

This result code is enabled by the command AT+CNMI=3,1,2. A received Cell Broadcast Message will be forwarded to the TE (the host) by a +CBM unsolicited result code.

Defined values

<length>

Integer	The length of the actual TP data unit in octets.
<pdu>	The message in PDU format.

+CMT (message received result code)

Description	*Syntax*	*When*
SMS-DELIVER message is received	+CMT: [<alpha>], <length><CR><LF><pdu>	When a new message has been received and +CNMI is activated to send the actual message

This result code is enabled by the command AT+CNMI=3,3. A received SMS-DELIVER message will be forwarded to the TE (the host) by a +CMT unsolicited result code.

Defined values

<alpha>	This parameter is not supported. An empty string will be returned.

<length>

Integer	The length of the actual TP data unit in octets (the RP layer SMSC address octets are not counted in the length).
<pdu>	The message in PDU format.

+CMTI (message received indication result code)

Description	*Syntax*	*When*
Indicates the storage location of a received SMS-DELIVER message	+CMTI: <mem>, <index>	When a new message has been received and +CNMI is activated to send indications for this type of message

This result code is enabled by the command AT+CNMI=3,1. A received SMS-DELIVER message will be stored in the ME and a +CMTI unsolicited result code will indicate the storage location.

Defined values

<mem>

“ME”	ME message storage.
“SM”	SIM message storage.

<index>

Integer	Memory location.

+CMS ERROR (message service failure result code)

If an SMS command fails and the error is related to mobile equipment or to network’s functions, the final result code ERROR will be replaced by +CMS ERROR: <err>.

Defined values

<err>

0...127	GSM 04.11, annex E-2 values
1	Unassigned number
8	Operator determined barring
10	Call barred
21	Short message transfer rejected
27	Destination out of service
28	Unidentified subscriber
29	Facility rejected
30	Unknown subscriber
38	Network out of order
41	Temporary failure
42	Congestion
47	Resources unavailable unspecified
50	Requested facility not subscribed
69	Requested facility not implemented
81	Invalid short message transfer reference value
95	Invalid message unspecified
96	Invalid mandatory information
97	Message type non existent or non implemented
98	Message not compatible with short message protocol state
99	Information element non existent or not implemented
111	Protocol error unspecified
127	Interworking unspecified

128...255	TP Failure-Cause (TP-FCS) values according to GSM 03.40
128	Telematic interworking not supported
129	Short message type 0 not supported
130	Cannot replace short message
143	Unspecified TP-PID error
144	Data coding scheme not supported
145	Message class not supported
159	Unspecified TP-DCS error
160	Command cannot be actioned
161	Command unsupported
175	Unspecified TP command error; either the message type identifier is other than SMS command, or the service center address is corrupt
176	TPDU not supported
192	SC busy
193	No SC subscription
194	SC system failure
195	Invalid SME address
196	Destination SME barred
197	SM rejected duplicate SM
208	SIM SMS storage full
209	No SMS storage capability in SM
210	Error in MS
211	Memory capacity exceeded
255	Unspecified error cause
300	ME failure
301	SMS service of ME reserved; the phone is busy sending a message
302	Operation not allowed
303	Operation not supported
304	Invalid PDU mode parameter
305	Invalid text mode parameter
310	SIM not inserted
311	SIM PIN necessary
312	SIM PIN necessary for PH-SIM
313	SIM failure
314	SIM busy
315	SIM wrong

316	SIM PUK required
317	SIM PIN2 required
318	SIM PUK2 required
320	Memory failure; write of SMS to specified memory failed
321	Invalid memory index
322	Memory full
330	SMSC address unknown
331	No network service
332	Network timeout
500	Unknown error
…511	Other values within the range from 256 to 511 are reserved.

GSM phonebook

AT+CPBS (select phonebook memory storage)

Description	*Syntax*	*Possible responses*
Selects memory for phonebook commands	+CPBS= <storage>	
Returns currently selected memory	+CPBS?	• +CPBS: <storage>
Shows supported parameters	+CPBS=?	• +CPBS: (list of supported <storage>s)

This command selects phonebook memory storage <storage>, which is used by other phonebook commands.

Defined values

<storage>

“ME”	ME phonebook.
“SM”	SIM phonebook.

AT+CPBR (read phonebook entries)

Description	*Syntax*	*Possible responses*
Reads phonebook entries	+CPBR=<index1> [,<index2>]	• +CPBR: <index1>,<number>, <type>,<text>[[...]<CR><LF> +CPBR: <index2>,<number>, <type>,<text>]
Shows supported parameters	+CPBR=?	• +CPBR: (list of supported <index>s),<nlength>, <tlength>

This command returns phonebook entries in location number range <index1>...<index2> from the current phonebook memory storage, that has been previously selected with the command +CPBS. If <index2> is left out, only the location <index1> will be returned.

Defined values

<index1>, <index2>, <index>

Integer	Values in the range of location numbers in the phonebook memory.

<number>

String	The phone number of the format <type> enclosed in quotation marks.

<type>

Integer	A Type-of-Address octet in integer format according to GSM 04.08. Default is 145, if the dialling string includes the international access code character '+', otherwise 129.

<text>

String	Field of maximum length <tlength> enclosed in quotation marks.

<nlength>

Integer	Value indicating the maximum length of the field <number>.

<tlength>

Integer	Value indicating the maximum length of the field <text>.

AT+CPBF (find phonebook entries)

Description	*Syntax*	*Possible responses*
Searches for phonebook entries	+CPBF= <findtext>	• +CPBF: <index1>,<number>, <type>,<text>[[...]<CR><LF> +CBPF: <indexn>,<number>, <type>,<text>]
Shows supported parameters	+CPBF=?	• +CPBF: <nlength>,<tlength>

This command returns all phonebook entries from the current phonebook memory storage, that has been previously selected with the command +CPBS, in which an alphanumeric field is starting with the string <findtext>.

Defined values

<index1>, <index***n***>

Integer	Values in the range of location numbers in the phonebook memory.

<number>

String	The phone number of the format <type> enclosed in quotation marks.

<type>

Integer	A Type-of-Address octet in integer format according to GSM 04.08. Default is 145, if the dialling string includes the international access code character '+', otherwise 129.

<findtext>, <text>

String	Field of maximum length <tlength> enclosed in quotation marks.

<nlength>

Integer	Value indicating the maximum length of the field <number>.

<tlength>

Integer	Value indicating the maximum length of the field <text>.

AT+CPBW (write phonebook entry)

Description	*Syntax*	*Possible responses*
Writes entry into phonebook	+CPBW= [<index>] [,<number> [,<type>[,<text>]]]	
Shows supported parameters	+CPBW=?	• +CPBW: (list of supported <index>s),<nlength>,(list of supported <type>s),<tlength>

This command writes the phonebook entry in the location number <index> in the current phonebook memory storage, that has been previously selected with the command +CPBS. The entry fields written are the phone number <number> (in the format <type>) and text <text> associated with the number. If these fields are omitted, the phonebook entry is deleted. If <index> is left out, but <number> is given, the entry will be written to the first free location into the phonebook.

Defined values

<index>

Integer	Values in the range of location numbers in the phonebook memory.

<number>

String	The phone number of the format <type> enclosed in quotation marks.

<type>

Integer	A Type-of-Address octet in integer format according to GSM 04.08. Default is 145, if the dialling string includes the international access code character '+', otherwise 129.

<text>

String	Field of maximum length <tlength> enclosed in quotation marks.

<nlength>

Integer	Value indicating the maximum length of the field <number>.

<tlength>

Integer	Value indicating the maximum length of the field <text>.

Commands without PIN code control

In general, a PIN code (or PUK) is required for entry before the AT commands are issued, in order to send, for example, SMS messages. The following AT commands can be used even if no PIN code has been entered:

AT+CGMI	AT+CPIN
AT+CGMM	ATE
AT+CGMR	ATS3, ATS4 and ATS5
AT+CGSN	AT*EWEE
ATD112; (emergency call)	AT*ECAM
ATH (hang-up of emergency call)	AT+CSCS
AT+CPAS	AT+CMEE
AT+CFUN	

Result codes

The following list below contains the result codes according to ITU-T V.25ter. These result codes can be set to text or numeric form by using the command ATV (default is text form). Or they can be suppressed by the command ATQ.

To find out how to check and change parameters, see the section with AT command examples.

OK	Acknowledges execution of a command line. For example, if the dial command has been terminated successfully. Numeric response: 0 (zero).
ERROR	The command is not recognised, the maximum length of the command line has been exceeded, a parameter value is invalid, or other problem with processing the command line. Numeric response: 4.
RING	An incoming call signal from the network. Numeric response: 2.
NO CARRIER	No connection to the network. Numeric response: 3.
NO DIALTONE	No dial-tone is detected during connection of a call. Numeric response: 6.
NO ANSWER	Connection timeout. Numeric response: 8.

For further reading

The manual contains many references to the standards that support the technology for the module. Some of these references are listed below, and might be useful if you wish to gain a deeper understanding of GSM networking, AT commands, etc.

This chapter also includes a few references to web sites, if you wish to find more information about, for example, connectors.

Standards

- DCE-DTE interface for Short Message Service (SMS) and Cell Broadcast Service (Phase 2), GSM 07.05, by the European Telecommunication Standards Institute
- AT command set for GSM Mobile Equipment (Phase 2), GSM 07.07, by the European Telecommunication Standards Institute
- Technical realization of the Short Message Service (SMS) and Point to Point (PP) (Phase 2), GSM 03.40, by the European Telecommunication Standards Institute
- Alphabet and Language Specific Information for GSM, GSM 03.38, by the European Telecommunication Standards Institute
- Supplementary services (Phase 2), GSM 02.81 – 02.86, 02.88 and 02.90 by the European Telecommunication Standards Institute
- Mobile radio interface, layer 3 specification (Phase 2), GSM 04.08, by the European Telecommunication Standards Institute
- Serial asynchronous automatic dialling and control, ITU-T V.25ter
- List of definitions from interchange circuits between DTE and DCE, ITU-T V.24
- Electrical characteristics for unbalanced double-current interchange circuits, ITU-T V.28
- International Reference Alphabet (IRA), Information technology – 7-bit coded character set for information interchange, recommendation T.50, by the International Telecommunication Union
- Information technology – 8-bit single-byte coded graphic character sets, Latin alphabet no 1, by the International Organization Standardization and the International Electrotechnical Commission

Web sites

- **http://www.molex.com**
  About Molex Mini-Fit Jr, RJ modular plug connectors, D-SUB connectors, manual press tools, and application tools. On-line catalogue system.
- **http://www.amp.com**
  About RJ modular plug connectors and SMA connectors. On-line catalogue system.
- **http://www.etsi.fr**
  http://www.etsi.org
  About the standardisation activities carried out by the European Telecommunication Standards Institute (ETSI). Here, it is possible to send queries, download publications, etc.
- **http://www.ericsson.se/health/**
  About health and safety issues, published by Ericsson. Here, you can read about, for example, electromagnetic interference.

Technical data

Mechanical specifications

Maximum length:	153 mm
Maximum width:	64 mm
Maximum thickness:	23 mm
Weight:	125 grams

Radio specifications

Frequency range:	GSM 900 MHz band (890 – 960 MHz)
Maximum RF output power:	2 W
Antenna impedance:	50 Ω

SIM card

SIM card interface:	5 V

Environmental specifications

Operating temperature range:	–20 to +55 °C
Powerless temperature range:	–40 to +85 °C
Off position temperature range:	–40 to +85 °C (V+ applied)
Maximum relative humidity:	95 percent (+25 to +55 °C)
Vibration:	5 – 500 Hz, 0.01 g²/Hz 10 – 200 Hz, 0.03 g²/Hz (IEC 68-2-36, Fdb)
Shock:	300 m/s², 11 ms 1000 m/s², 6 ms (IEC 68-2-27, Ea)
Bump:	250 m/s², 6 ms (IEC 68-2-29, Eb)
Solar radiation:	The module should be mounted so that direct solar radiation is avoided.
Enclosure:	IP50: the plastic case of the module protects from dust but not from falling water drops (ISO 529).

Power supply voltage, normal operation

Voltage range:	+7 to +32 V DC
Ripple:	1.0 V p-p at 0 – 5 kHz 50 mV p-p at 5 – 150 kHz
Voltage must always stay within normal-operating range, ripple included.	

Power supply voltage, absolute maximum ratings

Reversed polarity:	–30 V DC for 1 hour
Over-voltage:	40 V DC for 1 hour, at +25 °C. The module's functions are not guaranteed.

Transients and surges, power supply interface

ETS 300 342-1 refers to ISO 7637-1 for immunity to transients and surges on DC power inputs for vehicle mounted equipment (EMC approval).

ISO 7637-1 and ISO 7637-2 identifies a number of test pulses, each with four severity levels. The tables below shows the level where full functionality of the module is maintained.

ISO 7637-1 for 12V powered equipment:

Test pulse	*Level*
1, 2, 7	4 (see note)
3a, 3b	3
4, 5	2

ISO 7637-2 for 24V powered equipment:

The module power supply shall have a direct connection to the 24 V main vehicle battery.

Test pulse	*Level*
1a	3 (see note)
2	2 (see note)
3a, 3b	3
4	4

Note! Since there is no backup battery in the module, it will be powerless under part of the test due to the pulse characteristics and the communication link will be lost.

Current consumption

Typical current consumption at +25 °C in different operating modes.

Power supply	*Busy, transmitting: current consumption (maximum RF output power 2 W)*			
V	*Average, typical mA*	*Average, max mA*	*Peak, typical A*	*Peak, max A*
7.0	250	330	1.50	2.00
12.0	150	200	0.75	1.00
24.0	87	115	0.40	0.60
32.0	75	100	0.30	0.50

Power supply	*Idle: current consumption*	*Off: current consumption*	
V	*Long-term average, mA*	*Typical µA*	*Max µA*
7.0	31	30	100
12.0	28	53	100
24.0	16	120	200
32.0	13	163	200

Note!

- The voltages are measured at the power supply terminal of the module. The supply voltage must be measured with an oscilloscope in order to detect the ripple. Consider the voltage drop of the power supply cable. Keep the voltage within operating range.
- The peak current at low supply voltages between 7 – 10 V depends on the output impedance of the power supply and the cable length. Higher cable resistance or inductance will increase the peak current.
- Although the module will normally use the lowest possible RF output power required to maintain the communication link, the power supply for the module must be designed according to the maximum peak current requirement for the given supply voltage.
- The long-term average idle current may depend on the actual GSM network configuration.
- All currents will increase as the power supply voltage decreases, except from the off current. This is because a step-down switched mode voltage regulator is used in the GM 12.

Type approval and CE-mark

The GM 12 has been certified according to the Telecommunications directive 91/263/EEC as a phase 2 Mobile Station, power class 4.

The module also conforms to the EMC directive 89/336/EEC and fulfils the requirements according to ETS 300 342-1 for equipment in fixed, mobile and portable use.

Glossary

The following list clarifies some of the abbreviations and terminology used in this manual.

AT commands	A standardised command set for modems, that has become a GSM standard (by ETSI).
CBM	Cell Broadcast Message.
DCE	Data Circuit terminating Equipment.
DTE	Data Terminal Equipment.
DTMF	Dual-Tone Multi-Frequency tones.
EMC	Electromagnetic Compatibility.
EMI	Electromagnetic Interference.
ESD	Electrostatic Discharge.
ETSI	European Telecommunication Standards Institute. ETSI defines the GSM standard, for example, AT commands.
GSM	Global System for Mobile communications.
IMEI	International Mobile Equipment Identity, which is a phone-unique serial number.
IMSI	International Mobile Subscriber Identity.
ISO	International Standards Organisation.
ITU-T	International Telecommunication Union – Telecommunications Standardization Sector.
LED	Light-Emitting Diode.
MO	Mobile Originated.
ME	Mobile Equipment.
MS	Mobile Station, which in this case is the module GM 12 with a SIM card.
MT	Mobile Terminated.
PDU	Packet Data Unit.

PIN	Personal Identification Number, which is used to protect the SIM card from unauthorized access.
PUK	Personal Unblocking Key, which is used to unblock a blocked SIM card.
PLMN	Public Land Mobile Network.
RF	Radio Frequency.
SIM card	Subscriber Identity Module, which contains the subscriber number and the name of the service provider network.
SMS	Short Message Service.
TA	Terminal Adapter.
TE	Terminal Equipment, which in this case is the controller.
V.24/V.28	An ITU-T standard for serial communication.
VSWR	Voltage Standing-Wave Ratio.

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