Technical Information

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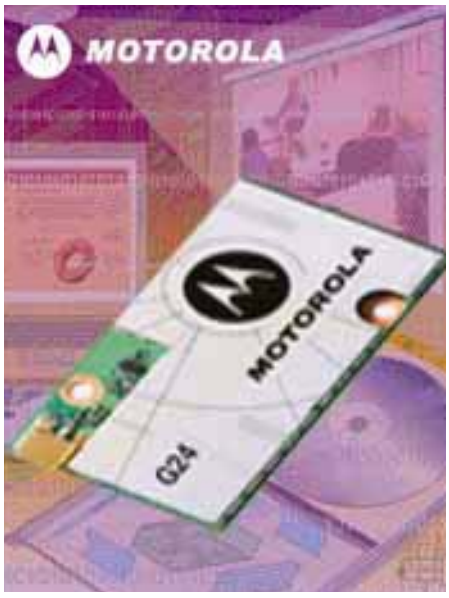
MOTOROLA G24 DEVELOPER'S GUIDE

AT COMMANDS REFERENCE MANUAL



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Preface

Manual Scope

This manual introduces the G24 AT commands, and describes how software developers can use these commands to communicate with the G24 device, and to create software applications that communicate with the G24 using these commands.

Target Audience

This manual is intended for software developers who communicate with the G24 device using the AT commands, and create applications to communicate with the G24 device using the AT commands.

Manual Organization

This manual contains the following chapters:

- "Preface" provides a scope for this manual, document convention, safety instructions and a liability notification.
- "Chapter 1: Product Features" introduces the new product features and provides a list of the AT commands.
- "Chapter 2: Introduction to AT Commands" provides an introduction to the AT commands, and includes a general explanation of the command's format and usage. It also describes supported character sets and error handling.
- "Chapter 3: AT Commands Reference" provides a reference to all available AT commands, including examples, where relevant.
- "Chapter 4: Using the Commands" provides scenarios and examples for implementing various G24 functionality, including G24 setup and connectivity, SMS, call control, data calls, GPRS, Sleep mode, audio, TCP/IP and MUX user integration.
- "Chapter 5: Tools" describes the PC Driver and PC Loader tools provided by the application.
- "Appendix A: Reference Tables" provides conversions between different character sets. It also provides an alphabetical list of all the AT commands.
- "Appendix B: MUX" describes the MUX's PREMUX and MUX states.

Applicable Documents

- G24 Cellular Engine Module Description – 6889192V27-A
- G24 Developer's Kit – 6889192V26-A

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The following special paragraphs are used in this guide to point out information that must be read. This information may be set-off from the surrounding text, but is always preceded by a bold title in capital letters:

Note

Note: Presents additional, helpful, noncritical information that you can use.

Warning

Warning: Presents information to warn you of a potentially hazardous situation in which there is a possibility of personal injury.

Important

Important: Presents information to help you avoid an undesirable situation or provides additional information to help you understand a topic or concept.

Caution

Caution: Presents information to identify a situation in which damage to software, stored data, or equipment could occur, thus avoiding the damage.

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Ground the instrument

To minimize shock hazard, the equipment chassis and enclosure must be connected to an electrical ground. If the equipment is supplied with a three-conductor AC power cable, the power cable must be either plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter. The three-contact to two-contact adapter must have the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable must meet International Electrotechnical Commission (IEC) safety standards.

Note: Refer to *"Grounding Guideline for Cellular Radio Installations"*–Motorola part no. *68P081150E62*.

Do not operate in an explosive atmosphere

Do not operate the equipment in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

Do not service or adjust alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid is present.

Keep away from live circuits

Operating personnel must:

- not remove equipment covers. Only Factory Authorized Service Personnel or other qualified maintenance personnel may remove equipment covers for internal subassembly, or component replacement, or any internal adjustment
- not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed
- always disconnect power and discharge circuits before touching them

Do not substitute parts or modify equipment

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Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed. You should also employ all other safety precautions that you deem necessary for the operation of the equipment in your operating environment.

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3. Defects or damage from improper testing, operation, maintenance, installation, adjustment, unauthorized software applications or any alteration or modification of any kind.
4. Breakage or damage to antennas unless caused directly by defects in material or workmanship.

5. Products disassembled or repaired other than by Motorola in such a manner as to adversely affect performance or prevent adequate inspection and testing to verify any warranty claim.
6. Defects or damage due to range, coverage, availability, grade of service, or operation of the cellular system by the cellular operator.
7. Defects or damage due to moist, liquid or spills of food.
8. Control unit coil cords in the Product that are stretched or have the modular tab broken.
9. All plastic surfaces and all other externally exposed parts that are scratched or damaged due to customer normal use.

Depending on operating conditions and your usage habits, wear and tear might take place of components including mechanical problems related to Product housing, paint, assembly, sub-assemblies, displays and keyboards and any accessories which are not part of the Product's in-box configuration. The rectification of faults generated through wear and tear and the use of consumable items like batteries beyond their Optimum Performance Time as indicated in the product manual is considered to be your responsibility and therefore Motorola will not provide the free Warranty repair service for these items.

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Please make and retain a note of all data you have inserted into your product. For example names, addresses, phone numbers, user and access codes, notes etc. before submitting your product for a warranty service as such data may be deleted or erased as part of the repair or service process.

Please note if you have downloaded material onto your product, for example ring tones, ring tunes, screensavers, wallpaper, games, etc. These may be deleted or erased as part of the repair process or testing process. Motorola shall not be responsible for such matters. The repair or testing process should not affect any such material that was installed by Motorola on your product as a standard feature.

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Revision History

Manual Number

6889192V28-A

Manual Title

G24 Developer’s Guide: AT Commands Reference Manual

Version Information

The following table lists the manual version, date of version, and remarks about the version.

Revision History

Version	Date Issue	Remarks
A	January 10, 2006	Initial Release

Chapter 1: Product Features

Connectivity Interface

The user can establish two types of connections in order to establish an AT command session with the G24:

- RS232 connection
- USB connection

The user can use either RS232 or USB connections, but not both simultaneously.

Improved OEM Features

G24 contains the following new and improved features:

- TCP/IP support
- Audio (digital and analog) - path, gain and algorithm
- User-defined profiles

For a full list of G24 features, refer to the G24 Cellular Engine Module Description manual.

TCP/UDP IP Connection

Overview

The network capabilities are achieved by using different layers of connections. Every layer of connections provides basic connections to the layer above it. The higher the layer is, the more capabilities it can provide.

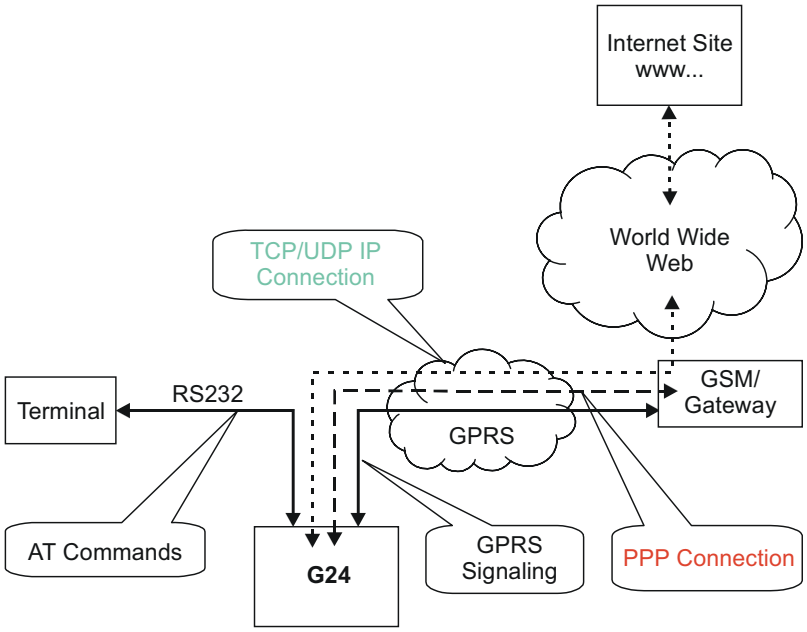


Figure 1-1: System Overview

The three layers of connections are:

- Physical links
- Point-to-point links
- TCP/UDP links

TCP/IP

When establishing the TCP/IP connection the G24 can only be the "initiator". The TCP/IP feature enables the G24 to be a wireless end point for a TCP/IP socket.

Note: The TCP protocol use the value TTL (Time to live) = 64.

Creating TCP/IP Connections

Connection from the G24 to the Web

The following occurs when creating a TCP/IP connection from the G24 to the Web:

1. The G24 connects to the GPRS network and receives an IP address (using the +MIPCALL command).

2. The G24 opens a TCP/IP stack as one of its "sockets" (it must know the target's IP address and port number).
3. Once the connection is established, data is transferred freely in both directions (upload and download).

Connection with another G24 using the "GPRS Manager"

The following occurs when creating a TCP/IP connection with another G24 using the "GPRS Manager":

1. The OEM on the target side (server) uses the "GPRS Manager" application. When using this application the TCP/IP is external to the OEM. (External TCP stack is used).
2. The target side activates the "server application" (The term "server application" means an application that has the ability to listen on a given IP address and port number).
3. After connecting to the GPRS network, the "server" sends its IP address to the G24 using an alternative connection (for example, CSD, SMS and so on).
4. The server application listens on a known port, waiting for G24 to connect.
5. The G24 connects to the same GPRS network as the server, and receives an IP address (using the +MIPCALL command).
6. The G24 initiates a TCP/IP connection with the listening "server". (It knows the IP address and port number of the server).
7. Once the server is connected, the TCP/IP connection is created and data can be transferred freely in both directions (upload and download).

UDP/IP

The set of AT commands created for the TCP/IP connection is used for the UDP/IP connection as well. Therefore, UDP/IP must open a UDP stack using the MIPOPEN AT command. The connection created does not change any concept regarding the
UDP/IP known protocol (which is connectionless), this is just an easy way for the terminal to specify to the G24 which of the four possible stacks should be used.

When establishing the UDP/IP connection, the G24 is both the "initiator" and the "listener".

Creating UDP/IP Connections

Connection with another G24

The following occurs during a UDP/IP connection with another G24:

1. Side A:
   – The G24 connects to the GPRS network and receives an IP address (using the +MIPCALL command).
   – The G24 opens a UDP/IP stack as one of its "sockets" (using the +MIPOPEN and selecting the protocol UDP).
2. Side B:
   – The G24 connects to the GPRS network and receives an IP address (using the +MIPCALL command).
   – The G24 opens a UDP/IP stack as one of its "sockets" (using the +MIPOPEN and selecting the protocol UDP).
3. Side A and B previously agree on a port number, and exchange their given IP addresses via other means of connection (SMS, CSD, Voice, DB and so on).
4. The G24 sends and receives data to and from the targeted site as it knows the IP address and port number of the target.
5. Sending (accumulating) data is done using the +MIPSEND command.
6. Actual send is done using the +MIPPUSH command, by specifying the IP address and port number of the destination.

Note: Every +MIPPUSH sets the destination IP address and destination port number for the current and future transactions. These values are used for the next push if not explicitly overwritten.

Connection from the G24 (client/server) to WEB (client/server)

The following occurs when creating a UDP/IP connection from the G24 (client/server) to WEB (client/server):

1. Client side:
   – The G24 client connects to the GPRS network and receives an IP address (using the +MIPCALL command).
   – The G24 opens a UDP/IP stack as one of its "sockets" (using the +MIPOPEN and selecting the protocol UDP).
2. The G24 sends data to the Website, as the Web site’s IP address is known and is public, and the port number is previously agreed upon.
3. Sending (accumulating) data is done by the +MIPSEND command.
4. Actual send is done by the +MIPPUSH command by specifying the Website IP address and Website port number.

5. Server side:
   – After receiving the first packet from the client, the server knows the IP address and port number of the G24.
   – The IP address and port number for the specific mobile G24 should be saved in the DB.

Note: Every +MIPPUSH sets the destination IP address and destination port number for the current and future transactions. These values are used for the next push if not explicitly overwritten.

Features and Benefits

The TCP/UDP IP feature provides the terminal with the following benefits:

- Up to four simultaneous protocol connections.
- Ability to pass data via the protocol stack using AT commands (command mode). This relieves the terminal from switching the RS232 to "binary mode" and back to "command mode".
- Ability to use UDP and TCP simultaneously.
- No need for protocol support from the terminal - only data sending and receiving.
- Reduced memory utilization. The G24 manages the protocol stack and therefore saves terminal memory.

Technical Description

Figure 1-1, “System Overview,” on page 1-2 displays the system overview which comprises the following links and layers:

Physical layer links:

- The terminal is connected to the G24 using a physical RS-232 connection.
- The G24 is connected to the GGSN using a GPRS link.
- The GGSN is connected to the Internet via some sort of physical connection (usually telephone or cable).

Point-to-point layer links:

- AT command protocol is used to transfer data between the terminal and the G24.
- After authentication, the G24 is linked to the GGSN using PPP protocol.
- The GGSN is connected to its Internet service provider using some protocol.

TCP / UDP layer:

- The G24 can transfer data with the WEB using either TCP/IP or UDP/IP protocols.
- The protocol stacks in the terminal or in the OEM must be managed when using TCP/IP or UDP/IP protocols. The G24 software can manage these stacks internally. This enables the G24 to relieve the terminal from the job of managing these protocols.

Note: Currently, the embedded TCP/IP feature may be used only for mobile-initiated connections. The embedded. TCP/IP feature cannot listen on a port for incoming connections.

Audio

Overview

The audio (digital and analog) feature in the G24 module involves three main issues: path (routes the current input and output devices), gain (volume management) and algorithm. For more information, refer to “Audio” on page 3-147.

Features and Benefits

The following algorithm related features are provided:

Sidetone

Sidetone reduces the microphone audio input that is routed to the selected speaker so that the person speaking can hear himself or herself talking. This creates a slight echo because the speaker sound then gets picked up again by the microphone and is again routed to the speaker, and so on. Echo suppress is designed to take care of this echo.

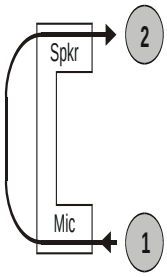


Figure 1-2: Sidetone

Echo Cancel

Echo Cancel suppresses a large amount of the output sound picked up by the input device (cancels all echoes).

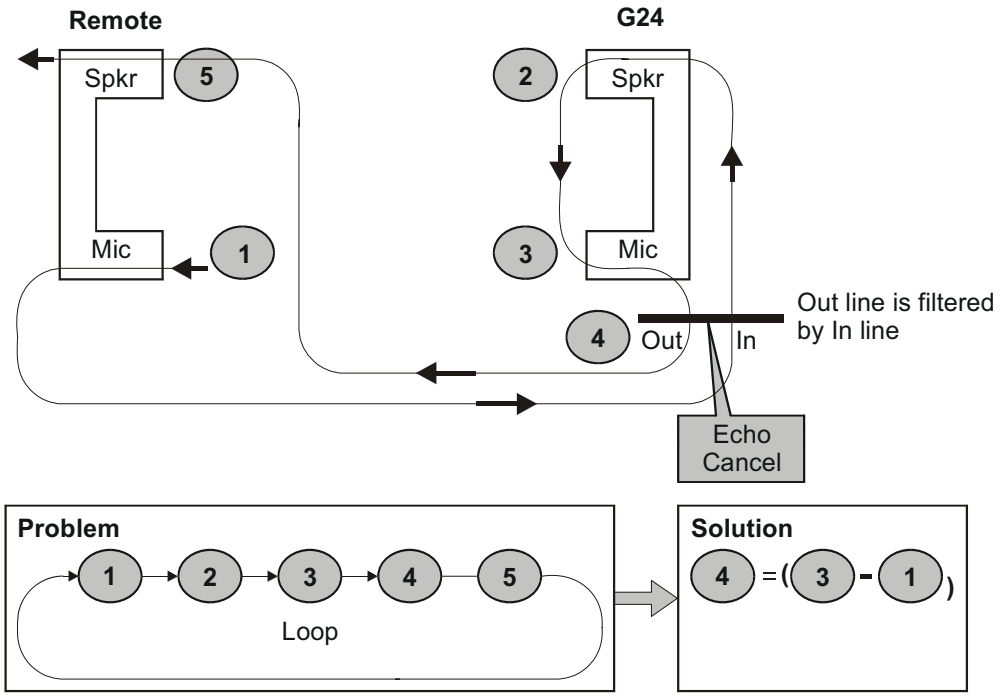


Figure 1-3: Echo Cancel

Noise Suppress

Noise suppression improves audio quality in all modes by suppressing environment noise from being picked up by the input device.

Technical Description

The path features provide full control over the navigation of the audio in the product.

The gain features provide full control over the volume levels of the different output accessories and tones.

The algorithm provides full control over activation/deactivation of audio quality features such as echo canceling and noise suppression.

The user can access these features by means of AT commands. These are described later in this document.

User-defined Profiles

Overview

The G24 enables the user to define two profiles. You can switch between profiles and display the currently used profile.

Benefits

When the G24 is used, the application/user can switch between the two predefined profiles. Setup time is reduced by the use of these profiles.

GPRS Operation

Overview

The GPRS allows the service subscriber to send and receive data in an end-to-end packet-transfer mode, without utilizing network resources in circuit-switched mode.

Features and Benefits

GPRS enables the cost-effective and efficient use of network resources for packet mode data applications:

- Always connected.
- No setup time before data transmission.
- Cost change based on current data communication (not time based).

Technical Description (GPRS – Class B Operation)

The G24 is attached to both GPRS and other GSM services, but can only operate one set of services at a time (GPRS or CSD).

The G24 can activate a GPRS context and at the same time be alerted for an incoming CSD call.

This functionality is available on the G24 single serial line by either of two procedure options:

Option 1:

1. While in GPRS, listen to the RI signal (RS232) for an incoming CSD call ring.
2. Upon being interrupted by the RI signal, drop the DTR line to switch to command mode (depending on the previous DTR configuration: AT&D).
3. Answer the call (suspending the GPRS session).
4. At the end of the call, pull the DTR to resume the GPRS session.

Option 2:

- Use the MUX protocol for virtual channels support, with a unique channel for the GPRS session (Data) and a unique channel for answering the voice call (command)

CSD Operation

Overview

GSM CSD bearer service, the most widely used data service, provides both a transparent and non-transparent (error correction and flow control) data rate of 9.6 kbit/s.

Data transfer over Circuit Switched Data (CSD) is possible. Once the connection is established, data can be transferred to and from the remote side.

The user should take the CSD call setup time into account.

Network operators charge the user for the call time regardless of data usage.

Features and Benefits

CSD operation enables the terminal to perform a data transfer over a circuit switched link.

It enables the user to:

- Connect to a remote modem without any Internet network involvement.
- Own a real IP address and enable its access by connecting to an external ISP.

The following are examples of standard CSD call uses:

- Connecting an Internet Service Provider (ISP).
- Remotely accessing corporate Intranet via Remote Access Server (RAS).
- User specific protocol, where the user defines both the remote and local sides.

Technical Description

GSM network operators typically support the non-transparent CSD bearer service through a modem interworking function. This means that a G24 initiates a data call and the network routes the call to the modem interworking function, which is located at the Mobile Switching Center (MSC) of the GSM network. The modem interworking function then dials the number supplied by the mobile station.

This is different from voice calls, where the GSM network itself routes the call, often to another mobile station on the same network. The GSM network does not route data calls - it dials the requested number on behalf of the mobile station and leaves the routing to the external wireline telephone network. The main reason for this is that the GSM network has information about what the user wants to do with the data call. For example, the user may be contacting his or her Internet Service Provider (ISP) to send email or dialing the corporate Intranet to set up a virtual private network (VPN) connection to retrieve confidential customer information from a company database.

MUX Integration

Overview

The G24 is supplied with an internal GSM 7.10 protocol stack, also referred to as a multiplexer or MUX.

The G24 with multiplexer support utility provides the following capabilities:

- Provides the terminal with up to five virtual channels on one physical RS-232 connection.
- Provides simultaneous data (CSD/GPRS) and command (AT command set) services. In this way, many applications can use a single RS232 line via virtual channels. This enables a user to make network and phone service inquiries and maintain data communication at the same time.

These capabilities are illustrated in the following figure:

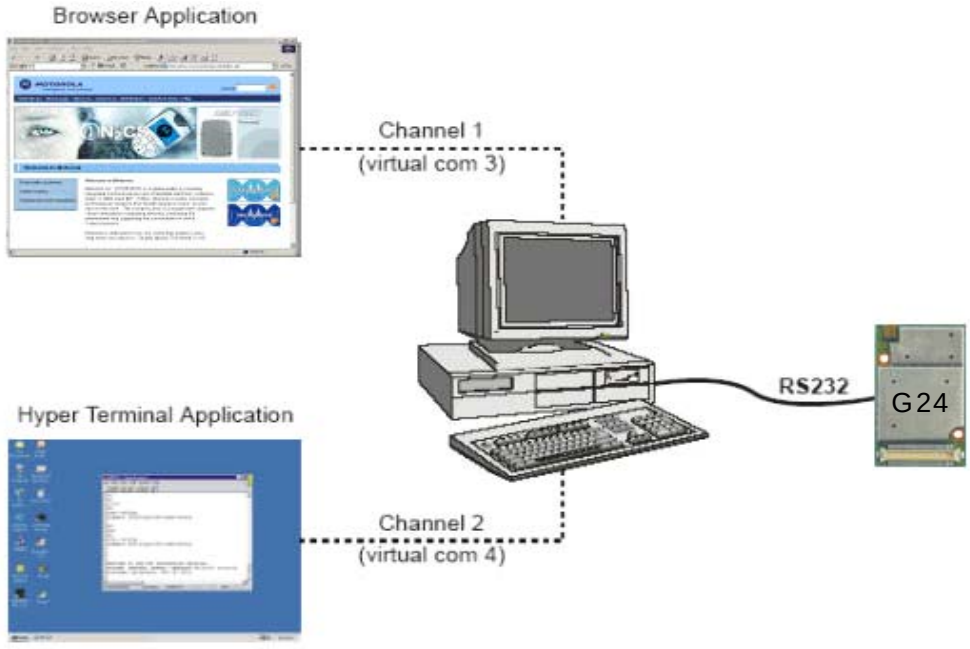


Figure 1-4: G24 with Multiplexer Support Capabilities

Features and Benefits

The G24 with the MUX feature ENABLES multiple channel operation and simultaneous data and control operation. For example, it allows a user to be connected to an Internet website (GPRS session connected), receive a file via CSD Call, and query the G24 phone book all at the same time.

The following actions are enabled during a data session:

- Incoming call alert string RING (while G24 is in GPRS session)
- Answering to incoming call via the ATA command (while G24 is in GPRS session)

- Receive Incoming SMS indication
- Inquiry GSM coverage indication
- Setup a voice call (while G24 is in GPRS session)
- Send & Receive SMS
- Read/write to/from Phone Book
- Local modem operation
- Network interrogation and settings

Technical Description

The MUX feature adds five virtual channels on a single physical RS232 line:

- Channel #0 - DLC0 for MUX Control
- Channels #1 through #4 are used for Data/Fax, GPRS, Voice call and control, and Logger/External modem applications

Short Message Service (SMS)

Overview

The SMS feature provides means for SMS messages handling and the reporting of SMS reception events.

G24 SMS implementation is based on the GSM 07.05 specification.

Features and Benefits

The SMS, as defined within the GSM 900/1800/1900 digital mobile phone standard, has several unique features:

- A single short message can be up to 160 characters of ASCII text in length (7-bit coded). Message text can comprise words, numbers or an alphanumeric combination.
- Short messages can be written and displayed in various coding schemes, including ASCII and UCS2.
- Reception of an incoming message can invoke an indication to the terminal. This feature is configurable using the command AT+CNMI. Short messages received during data calls are not indicated.
- Short messages can be sent and received simultaneously with GSM voice, data and fax calls.
- Cell broadcast messages can also be selected and received on the G24. The G24 enables registration to specific broadcast channels.

Technical Description

The G24 memory for incoming short messages is SIM-dependent. A new incoming message is saved in the first free memory location, from index 1, according to the SIM card.

The G24 memory can contain up to 73 outgoing and CB messages. A new outgoing message is saved in the next free memory location, from index 101 up to index 352.

SMS Type	SMS Index	Max Number of SMS
Incoming messages	1	SIM-dependent
	2	
	...	
	30	
Future use	31	N/A
	...	
	100	
Outgoing and CB messages	101	73
	102	
	...	
	352	

Fax

Overview

A Service Class 1 facsimile G24 provides a basic level of services necessary to support Group 3 facsimile operation. This requires support from the facsimile terminal to implement the recommended T.30 procedures for document facsimile transmission and recommended T.4 for representing facsimile images.

Features and Benefits

Sending and receiving Fax services.

Technical Description

Service Class 1 includes the following services, as required or optional in Group 3 facsimile:

- Connection
- Waiting and silence detection
- Data transmission and reception
- HDLC data framing, transparency and error detection
- Message generation

Character Sets

The following includes the references to various tables that provide conversions between the different character sets.

- CS1 - GSM to UCS2.
- CS2 - ASCII to/from UTF8.
- CS3 - UCS2 to/from UTF8.

For the full content of a specific conversion table, refer to Appendix A, Character Set Tables.

ASCII Character Set Management

The ASCII character set is a standard seven-bit code that was proposed by ANSI in 1963, and finalized in 1968. ASCII was established to achieve compatibility between various types of data processing equipment.

GSM Character Set Management

In G24, the GSM character set is defined as octant stream. This means that text is displayed not as GSM characters but in the hex values of these characters.

UCS2 Character Set Management

UCS2 is the first officially standardized coded character set, eventually to include the characters of all the written languages in the world, as well as all mathematical and other symbols.

Unicode can be characterized as the (restricted) 2-octet form of UCS2 on (the most general) implementation level 3, with the addition of a more precise specification of the bi-directional behavior of characters, as used in the Arabic and Hebrew scripts.

The 65,536 positions in the 2-octet form of UCS2 are divided into 256 rows with 256 cells in each. The first octet of a character representation denotes the row number, the second the cell number. The first row (row 0) contains exactly the same characters as ISO/IEC 8859-1. The first 128 characters are thus the ASCII characters. The octet representing an ISO/IEC 8859-1 character is easily transformed to the representation in UCS2 by placing a 0 octet in front of it. UCS2 includes the same control characters as ISO/IEC 8859 (also in row 0).

UTF-8 Character Set Management

UTF-8 provides compact, efficient Unicode encoding. The encoding distributes a Unicode code value's bit pattern across one, two, three, or even four bytes. This encoding is a multi-byte encoding.

UTF-8 encodes ASCII in a single byte, meaning that languages using Latin-based scripts can be represented with only 1.1 bytes per character on average.

UTF-8 is useful for legacy systems that want Unicode support because developers do not have to drastically modify text processing code. Code that assumes single-byte code units typically does not fail completely when provided UTF-8 text instead of ASCII or even Latin-1.

Unlike some legacy encoding, UTF-8 is easy to parse. So-called lead and trail bytes are easily distinguished. Moving forwards or backwards in a text string is easier in UTF-8 than in many other multi-byte encoding.

The codes in the first half of the first row in Character Set Table CS2 (UTF-8 <-> ASCII) are replaced in this transformation format by their ASCII codes, which are octets in the range between 00h and 7F. The other UCS2 codes are transformed to between two and six octets in the range between 80h and FF. Text containing only characters in Character Set Table CS3 (UTF-8 <-> UCS-2) is transformed to the same octet sequence, irrespective of whether it was coded with UCS-2.

8859-1 Character Set Management

ISO-8859-1 is an 8 bit character set - a major improvement over the plain 7 bit US-ASCII.

Characters 0 to 127 are always identical with US-ASCII and the positions 128 to 159 hold some less used control characters. Positions 160 to 255 hold language-specific characters.

ISO-8859-1 covers most West European languages, such as French (fr), Spanish (es), Catalan (ca), Basque (eu), Portuguese (pt), Italian (it), Albanian (sq), Rhaeto-Romanic (rm), Dutch (nl), German (de), Danish (da), Swedish (sv), Norwegian (no), Finnish (fi), Faroese (fo), Icelandic (is), Irish (ga), Scottish (gd) and English (en). Afrikaans (af) and Swahili (sw) are also included, extending coverage to much of Africa.

AT Commands Summary

The following list contains a summary of all the G24 AT commands sorted by functionality.

Table 1-1: AT Commands

AT Command	Description	Page
Modem ID		
Subscriber Unit Identity		
+CGMI	This command displays manufacturer identification.	Page 3-1
+GMI	This command displays manufacturer identification.	Page 3-1
+FMI	This command displays manufacturer identification.	Page 3-1
+CGMM	This command displays the model identification.	Page 3-2
+GMM	This command displays the model identification.	Page 3-2
+FMM	This command displays the model identification.	Page 3-2
+CGMR	This command displays the revision identification.	Page 3-3
+GMR	This command displays the revision identification.	Page 3-3
+FMR	This command displays the revision identification.	Page 3-3
+CGSN	This command displays the product serial number identification.	Page 3-3
+GSN	This command requests the product serial number identification.	Page 3-3
+CSCS	This command selects the G24 character set.	Page 3-4
+CIMI	This command displays the International Mobile Subscriber Identity number.	Page 3-6
I	This command displays various G24 information items.	Page 3-6
+CNUM	This command displays up to five strings of text information that identify the G24.	Page 3-7
$	This command displays a list of all the AT commands supported by the G24.	Page 3-8
CLAC	This command displays a list of all the AT commands supported by the G24.	Page 3-8
Call Control		
Call Control Commands		
D	This command places a voice call on the current network, when issued from an accessory device.	Page 3-11
D>	This command places a voice/fax/data call on the current network by dialing directly from the G24 phone book.	Page 3-13
DL	This command places a voice call to the last number dialed.	Page 3-15
H	This command hangs up, or terminates a particular call.	Page 3-16

Table 1-1: AT Commands (Cont.)

AT Command	Description	Page
A	This command answers an incoming call, placing the G24 into the appropriate mode, as indicated by the RING message.	Page 3-18
+CRC	This command controls whether to present the extended format of the incoming call indication.	Page 3-18
RING	This unsolicited event is received when an incoming call (voice, data or fax) is indicated by the cellular network.	Page 3-18
+CRING	This unsolicited event indicates the type of incoming call.	Page 3-18
+CLIP	This command controls the Calling Line Identity (CLI) presentation to the terminal when there is an incoming call.	Page 3-20
+CCWA	This command controls the Call Waiting supplementary service, including settings and querying of the network by the G24.	Page 3-22
+CHLD	This command controls the Call Hold and Multiparty Conversation supplementary services.	Page 3-24
+CCFC	This command controls the call-forwarding supplementary service.	Page 3-28
+CLIR	This command enables/disables the sending of caller ID information to the called party, for an outgoing call.	Page 3-30
+CBST	This command handles the selection of the bearer service and the connection element to be used when data calls are originated.	Page 3-32
O	This command returns a phone to the Online Data mode and issues a CONNECT or CONNECT <text> result code.	Page 3-34
+CHUP	This command causes the G24 to hang up the current GSM call.	Page 3-35
+CSNS	This command handles the selection of the bearer or teleservice to be used when a mobile terminated single numbering scheme call is established.	Page 3-35
+MDC	This command enables you to select the desired messages to be displayed upon connection of a voice call with a remote party.	Page 3-37
+CTFR1	This command terminates an incoming call and diverts the caller to the number previously defined in CCFC, or to a voice mail if one exists for the subscriber.	Page 3-38
+MCST	This command displays the current state of the call processing, and also enables/disables the unsolicited indication of any change in the call processing state.	Page 3-42
Call Status Messages		
+CPAS	This command displays the current activity status of the G24, for example, call in progress, or ringing.	Page 3-39
+CLCC	This command displays a list of all current G24 calls and their statuses, and also enables/disables the unsolicited indication of the call list.	Page 3-40
Call Advice of Charge Messages		
+CAOC	This command displays information about the cost of calls.	Page 3-44

Table 1-1: AT Commands (Cont.)

AT Command	Description	Page
+CACM	This command resets the Advice of Charge accumulated call meter value in the SIM file, EFACM.	Page 3-46
+CAMM	This command sets the Advice of Charge accumulated call meter maximum value in the SIM file, EFACMmax.	Page 3-47
+CPUC	This command sets the parameters of the Advice of Charge-related price per unit and currency table found in the SIM file, EFPUCT.	Page 3-48
+CR	This command controls whether or not the extended format of an outgoing call is displayed or not.	Page 3-49
Supplementary Services		
+CSSN	This command handles the enabling and disabling of supplementary service-related, network-initiated, notifications.	Page 3-51
+CUSD	This command allows control of Unstructured Supplementary Service Data (USSD), according to GSM 02.90.	Page 3-54
+COLP	This command refers to the GSM supplementary service COLP, Connected Line Identification Presentation, which enables a calling subscriber to get the connected line identity (COL) of the called party after setting up a mobile-originated call.	Page 3-57
Phone and Date Books **Directory Access Commands**		
+CPBS	This command handles the selection of the memory to be used for reading and writing entries in G24s that contain more than one phone book memory.	Page 3-59
+CPBR	This command recalls phone book entries from a specific entry number, or from a range of entries.	Page 3-60
+MCSN	This command sets EFmsisdn in the SIM.	Page 3-68
+MDSI	This command enables unsolicited reporting of indications of SIM deactivation and invalidation.	Page 3-66
+MFS	This command is used to determine how long the G24 waits before attempting to re-register after a registration attempt has failed and the G24 is not registered.	Page 3-129
+CPBF	This command searches the currently active phone book for a particular entry, by name.	Page 3-62
+CPBW	This command stores a new entry in the phone book, or deletes an existing entry from the phone book.	Page 3-63
+CSVM	This command handles the selection of the number to the voice mail server.	Page 3-65
+MPDPM	This command returns the collective percentage of memory used by the phonebook and datebook in their shared dynamic memory storage.	Page 3-71
System Date and Time Access Commands		
+CCLK	This command reads/sets the G24's current date and time settings.	Page 3-73

Table 1-1: AT Commands (Cont.)

AT Command	Description	Page
SMS		
SMS Commands		
+CSMS	This command handles the selection of the SMS message service type.	Page 3-75
+CPMS	This command handles the selection of the preferred storage area for messages.	Page 3-76
+CMGF	This command handles the selection of message formats.	Page 3-78
+CSCA	This command handles the selection of the SCA and the TOSCA.	Page 3-78
+CSMP	This command sets the Text Module parameters.	Page 3-80
+CSDH	This command shows the Text Mode parameters.	Page 3-82
+CNMI	This command sends an unsolicited indication when a new SMS message is received by the G24.	Page 3-83
+CNMA	This command acknowledges the receipt of a +CMT response.	Page 3-85
+CMTI	This unsolicited message, including the SMS message index, is sent upon the arrival of an SMS message.	Page 3-87
+CMGL	This command displays a list of SMS messages stored in the G24 memory.	Page 3-91
+MMGL	This command displays a list of SMS messages stored in the G24 memory.	Page 3-91
+CMGR	This command reads selected SMS messages from the G24 memory.	Page 3-95
+MMGR	This command reads selected SMS messages from the G24 memory.	Page 3-95
+MMAR	This command changes the status of an SMS message in the G24 memory from "REC UNREAD" to "REC READ".	Page 3-102
+CMSS	This command selects and sends pre-stored messages from the message storage.	Page 3-102
+CMGW	This command writes and saves messages in the G24 memory.	Page 3-104
+CMGD	This command deletes messages from the G24 memory.	Page 3-109
+CGSMS	This command handles the selection of the service or service preference used by the G24 to send mobile-originated SMS messages.	Page 3-110
+CMGS	This command sends an SM from the G24 to the network.	Page 3-111
+CSCB	This command handles the selection of cell broadcast message types and data coding schemes received by the G24.	Page 3-112
+CMT	This unsolicited message forwards the SMS upon its arrival.	Page 3-85
+CBM	This unsolicited message forwards the SMS upon its arrival.	Page 3-85
+MCSAT	This command enables/disables/exercises SMS alert tone for an arriving SMS.	Page 3-113

Table 1-1: AT Commands (Cont.)

AT Command	Description	Page
+MEGA	This command updates the Email Gateway Address.	Page 3-114
Network **Network Commands**		
+CSQ	This command displays the signal strength received by the G24.	Page 3-119
+CRLP	This command displays the Radio Link Protocol parameters.	Page 3-120
+CREG	This command enables/disables the network status registration unsolicited result code.	Page 3-121
+CGREG	This command enables/disables the GPRS network status registration unsolicited result code.	Page 3-123
+COPS	This command enables accessing the network registration information, as well as select and register the GSM network operator.	Page 3-124
+CPOL	This command is used to edit the list of preferred operators located in the SIM card.	Page 3-127
Hardware Information **Hardware Information Commands**		
+CBC	This command queries the battery charger connection.	Page 3-133
+CBAUD	This command sets the baud rate.	Page 3-134
+IPR	This command is responsible for setting and saving the request baud rate.	Page 3-135
+GCAP	This command displays the overall capabilities of the G24.	Page 3-137
+CBAND	This command is supported for backward compatibility only, and has no effect.	Page 3-184
+MTDTR	This command checks and displays the physical current status of the DTR pin of the RS232.	Page 3-137
+MTCTS	This command sets the CTS pin of the RS232 to not active (high), waits one second and then sets the CTS to active (low).	Page 3-138
&K	This command configures the RTS/CTS flow control.	Page 3-138
&C	This command determines how the state of the DCD line relates to the detection of the received line signal from the distant end.	Page 3-139
&D	This command determines how the G24 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state.	Page 3-140
+MCWAKE	This command displays reports on the status of the GPRS coverage.	Page 3-141
+CFUN	This command shuts down the phone functionality of smart phones and PDAs with phone capabilities.	Page 3-143

Table 1-1: AT Commands (Cont.)

AT Command	Description	Page
+ICF	This command determines the local serial port start/stop (asynchronous) character framing used by the DCE when accepting DTE commands and transmitting information text and result codes.	Page 3-144
ATS97	This command indicates whether an antenna is physically connected to the G24 RF connector.	Page 3-145
+MRST	This command enables customer software to perform a hard reset to the G24 unit.	Page 3-145
Audio **General Audio Setup Commands**		
+CRTT	This command plays one cycle of a ring tone, stops the cycle in the middle, and sets the ring tone to be used.	Page 3-165
+VTD	This command handles the selection of tone duration.	Page 3-166
+VTS	This command transmits a string of DTMF tones when a voice call is active.	Page 3-167
+CALM	This command handles the selection of the G24's alert sound mode.	Page 3-163
+MMICG	This command handles the selection of microphone gain values.	Page 3-164
+MADIGITAL	This command switches between analog and digital audio modes.	Page 3-162
Basic Audio Specific Commands		
S94	This S-parameter represents the Boolean status, On/Off, of the sidetone feature.	Page 3-153
S96	This S-parameter represents the Boolean status, On/Off, of the echo cancelling feature in the handsfree.	Page 3-154
+CRSL	This command handles the selection of the incoming call ringer and alert tone (SMS) sound level on the alert speaker of the G24.	Page 3-150
+CLVL	This command sets the volume of the internal loudspeaker (which also affects the key feedback tone) of the G24.	Page 3-151
+CMUT	This command mutes/unmutes the currently active microphone path by overriding the current mute state.	Page 3-152
Advanced Audio Setup Commands		
+MAPATH	This command sets/requests the active input accessory, and the output accessory for each feature.	Page 3-155
+MAVOL	This command determines a volume setting for a particular feature in a particular accessory.	Page 3-158
+MAFEAT	This command controls the various algorithm features, such as sidetone, echo cancel and noise suppress.	Page 3-161
+MAMUT	This command controls the muting/unmuting of all input paths (MIC, HDST_MIC, DIGITAL_RX).	Page 3-160

Table 1-1: AT Commands (Cont.)

AT Command	Description	Page
Access		
Access Control Commands		
A/	This command repeats the last command entered on the terminal.	Page 3-168
AT	This command checks the AT communication and only returns OK.	Page 3-168
+CPIN	This command is only relevant for phones that use SIM cards. It unlocks the SIM card when the proper SIM PIN is provided, and unblocks the SIM card when the proper SIM PUK is provided.	Page 3-169
+CPWD	This command sets a new password for the facility lock.	Page 3-171
+CLCK	This command locks, unlocks or interrogates a G24 or a network facility <fac>.	Page 3-173
Modem Configuration and Profile		
Modem Register Commands		
V	This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses.	Page 3-177
Q	This command determines whether to output/suppress the result codes.	Page 3-178
E	This command defines whether the G24 echoes the characters received from the user, (whether input characters are echoed to output).	Page 3-179
X	This command defines the data adaptor response set, and the CONNECT result code format.	Page 3-180
Sn	This command reads/writes values of the S-registers, and includes registers 1-49, 94, 96 (Audio) and 102 (Sleep mode).	Page 3-181
\S	This command displays the status of selected commands and S-registers.	Page 3-184
\G	This command sets the use of the software flow control.	Page 3-184
\J	This command adjusts the terminal auto rate.	Page 3-184
\N	This command displays the type of link.	Page 3-184
?	This command displays the most recently updated value stored in the S-register.	Page 3-185
&F	This command restores the factory default configuration profile.	Page 3-185
Z	This command resets the default configuration.	Page 3-186
Sleep Mode Commands		
S24	This S-parameter activates/disables the Sleep mode. If the parameter value is greater than 0, it represent the number of seconds till the G24 enters sleep mode.	Page 3-189

Table 1-1: AT Commands (Cont.)

AT Command	Description	Page
S102	This S-register sets the value of the delay before sending the data to the terminal.	Page 3-190
+MSCTS	This command defines the behavior of the CTS line when the G24 is in Sleep mode.	Page 3-192
Error Handling Commands		
+CMEE	This command enables/disables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the G24.	Page 3-193
+CEER	This command returns an extended error report containing one or more lines of information text, determined by the manufacturer, providing the reasons for the call-clearing errors.	Page 3-198
RS232 Multiplexer Commands		
+CMUX	This command is used to enable/disable the GSM MUX multiplexing protocol stack.	Page 3-257
User Interface		
+CRSM	This command enables you to read IMSI, GID1, GID2 and ICC ID data from the SIM card.	Page 3-201
&V	This command displays the current active configuration and stored user profiles.	Page 3-202
&W	This command stores the user profile.	Page 3-203
&Y	This command displays the default user profile.	Page 3-205
+CKPD	This command emulates key presses, or virtual keycodes, as if entered from the G24 keypad or from a remote handset.	Page 3-205
+MKPD	This command enables accessories to control the press and release of key presses.	Page 3-208
+CMER	This command enables an external accessory to receive key press information from the G24's internal keypad.	Page 3-209
Unsolicited UI Status Messages		
+CKEV	This command causes the G24 to send an unsolicited message when a key is pressed on the G24 keypad, and local key press echo is enabled.	Page 3-210
+MUPB	This command causes the G24 to send an event when a phone book entry is accessed or modified by the user.	Page 3-212
+CDEV	An unsolicited indication regarding display changes that is sent to the DTE when the <disp> parameter of the +CMER command is set to 1.	Page 3-211
+CIEV	An unsolicited indication regarding various phone indications that is sent to the DTE when the <ind> parameter of the +CMER command is set to 1.	Page 3-211

Table 1-1: AT Commands (Cont.)

AT Command	Description	Page
GPRS		
GPRS Commands		
+CGCLASS	This command sets the GPRS mobile station class.	Page 3-215
+CGDCONT	This command specifies the PDP (Packet Data Protocol) context.	Page 3-216
+CGQMIN	This command sets the minimum acceptable quality of service profile.	Page 3-218
+CGQREQ	This command displays the requested quality of service profile.	Page 3-220
+CGACT	This command activates/deactivates the PDP Context.	Page 3-221
+CGATT	This command attaches the G24 to the GPRS network.	Page 3-221
D*99	This command enables the ME to perform the actions necessary for establishing communication between the terminal and the external PDN.	Page 3-223
+CGPRS	This command indicates whether there is GPRS coverage.	Page 3-225
TCP/IP Commands		
+MIPCALL	This command creates a wireless PPP connection with the GGSN, and returns a valid dynamic IP for the G24.	Page 3-228
+MIPOPEN	This command causes the G24 module to initialize a new socket and open a connection with a remote side.	Page 3-229
+MIPCLOSE	This command causes the G24 module to free the socket accumulating buffer and disconnect the G24 from a remote side.	Page 3-231
+MIPSETS	This command causes the G24 to set a watermark in the accumulating buffer. When the watermark is reached, data is pushed from the accumulating buffer into the protocol stack.	Page 3-232
+MIPSEND	This command causes the G24 to transmit the data that the terminal provides, using an existing protocol stack.	Page 3-233
+MIPPUSH	This command causes the G24 module to push the data accumulated in its accumulating buffers into the protocol stack.	Page 3-234
+MIPFLUSH	This command causes the G24 module to flush (delete) data accumulated in its accumulating buffers.	Page 3-235
+MIPRUDP	This unsolicited event is sent to the terminal when data is received from the UDP protocol stack.	Page 3-236
+MIPRTCP	This unsolicited event is sent to the terminal when data is received from the TCP protocol stack.	Page 3-236
+MIPSTAT	This unsolicited event is sent to the terminal indicating a change in link status.	Page 3-237
+MIPXOFF	This unsolicited event is sent to the terminal to stop sending data.	Page 3-237
+MIPXON	This unsolicited event is sent to the terminal when the G24 has free memory in the accumulating buffer.	Page 3-238

Table 1-1: AT Commands (Cont.)

AT Command	Description	Page
NOP Compatible		
Ignored (Compatible Only) Commands		
%C	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&G	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&J	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&L	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&M	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&P	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&Q	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&R	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&S	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&T	This command is supported for backward compatibility only, and has no effect.	Page 3-241
\B	This command is supported for backward compatibility only, and has no effect.	Page 3-241
\A	This command is supported for backward compatibility only, and has no effect.	Page 3-241
\K	This command is supported for backward compatibility only, and has no effect.	Page 3-241
F	This command is supported for backward compatibility only, and has no effect.	Page 3-241
L	This command is supported for backward compatibility only, and has no effect.	Page 3-241
M	This command is supported for backward compatibility only, and has no effect.	Page 3-241
N	This command is supported for backward compatibility only, and has no effect.	Page 3-241
P	This command is supported for backward compatibility only, and has no effect.	Page 3-241
T	This command is supported for backward compatibility only, and has no effect.	Page 3-241

Table 1-1: AT Commands (Cont.)

AT Command	Description	Page
Y	This command is supported for backward compatibility only, and has no effect.	Page 3-241
+FAR	This command is supported for backward compatibility only, and has no effect.	Page 3-242
+FCL	This command is supported for backward compatibility only, and has no effect.	Page 3-242
+FDD	This command is supported for backward compatibility only, and has no effect.	Page 3-242
+FIT	This command is supported for backward compatibility only, and has no effect.	Page 3-242
Fax Class 1 **Fax Commands**		
+FCLASS	This command places the terminal in particular mode of operation (data, fax, voice).	Page 3-243
+FTS	This command causes the G24 to stop any transmission.	Page 3-244
+FRS	This command causes the G24 to listen and to report back an OK result code when the line has been silent for the specified amount of time.	Page 3-244
+FTM	This command causes the G24 to transmit data.	Page 3-245
+FRM	This command causes the G24 to enter the receive mode.	Page 3-247
+FTH	This command causes the G24 to transmit data framed in the HDLC protocol.	Page 3-247
+FRH	This command causes the G24 to receive HDLC framed data and deliver the next received frame to the terminal.	Page 3-249
+IFC	This command controls the operation of the local flow control between the terminal and the G24.	Page 3-249
+FPR	This command sets the request baud rate.	Page 3-251

Chapter 2: Introduction to AT Commands

AT Commands Overview

AT commands are sets of commands used for communication with the G24 cellular modem.

AT commands are comprised of assemblies of ASCII characters which start with the "AT" prefix (except the commands A/ and +++). The AT prefix is derived from the word Attention, which asks the modem to pay attention to the current request (command).

AT commands are used to request services from the G24 cellular modem, such as:

- Call services: dial, answer and hang up
- Cellular utilities: send/receive SMS
- Modem profiles: Auto Answer
- Cellular Network queries: GSM signal quality

General Symbols Used in AT Commands Description

The following syntax definitions apply in this chapter:

Syntax	Definition
<CR>	Carriage return character, specified by the value of the S3-register.
<LF>	Line-feed character, specified by the value of the S4-register.
<...>	Name enclosed in angle brackets is a syntax element. The brackets themselves do not appear in the command line.
[...]	Optional sub-parameter of a command or an optional part of terminal information response, enclosed in square brackets. The brackets themselves do not appear in the command line. When the sub-parameter is not provided in the parameter type commands, the new value equals its previous value. In action type commands, the action should be performed on the basis of the recommended default setting of the sub-parameter.
//	Denotes a comment, and should not be included in the command.

General System Abbreviations

The basic system configuration contains a modem and a terminal.

The G24 is the modem and may be referred to as the DCE, the phone, the mobile or the radio.

The terminal may be referred to as the DTE or the TE.

AT Commands Protocol

The figure below shows a general messaging sequence of AT commands protocol between the terminal and the G24.

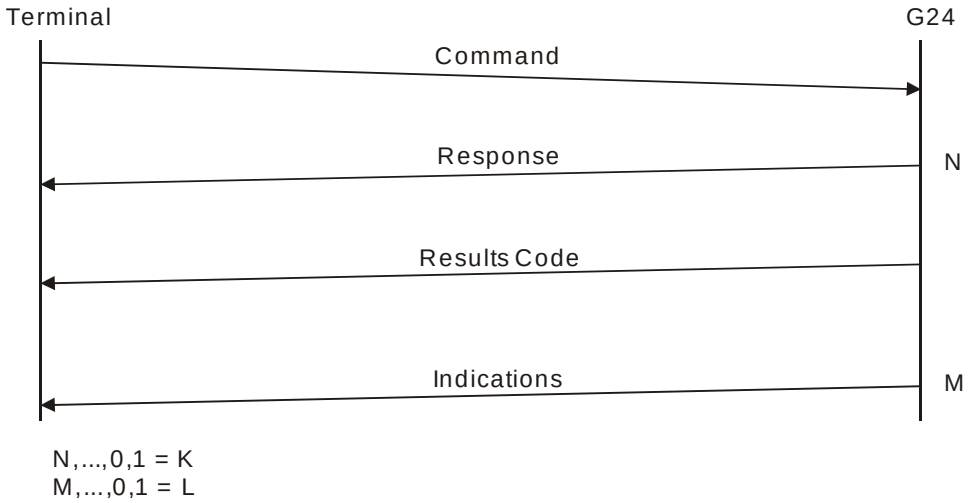


Figure 2-1: AT Commands Protocol

The AT commands interface is basically a Modem Services Upon Request.

Communication (almost) always begins from the terminal side. This means that any service should be requested from the terminal. Thus a request is called a "command".

Each command must be answered by a "results code" from the G24. The results code reports the command status to the terminal.

Some commands may include several "Response" requests (between 0 to K) to send data back to the terminal.

Some commands may initiate a mode in which, when specified events are generated in the G24, "Indicator" messages are sent asynchronously. Indicators can be between 0 to L.

The G24 can echo characters received from the terminal (commands) back to the terminal.

AT Commands Structure

Command Structure

An AT command line may contain one or more commands. Delimiters are used to separate the commands from each other, according to the following structure:

Prefix	Command1	Delimiter	Command2	Delimiter	…	CommandN	Suffix

Each AT command has the "AT" prefix string.

Each AT command has the suffix <CR>.

The delimiter is either a semicolon ";" or none, meaning space (basic commands).

Each AT command has the following structure:

Token	Mode	Arguments

The following figure outlines the basic structure of an AT command line:

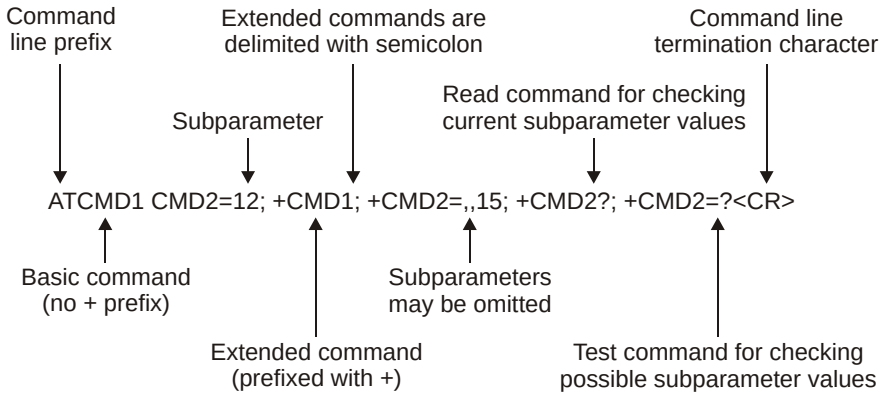


Figure 2-2: Basic Structure of a Command Line

The following rules must be observed when issuing a command line to the modem:

- Every command line must begin with the letters AT.
- Several commands can be concatenated as one line, as long as the total line does not exceed 140 characters with semicolon characters.
- Characters:

Spaces are ignored. You can leave spaces between each command and between characters of a command. You can also include punctuation in telephone numbers, and type commands in either UPPERCASE or lowercase. For example, the following commands are identical:

ATDT8005551234 < Enter > or

atdt (800) 555-1234 < Enter >

Backspace **<S5>** character is allowed.

- To cancel a dialing command in progress, send any ASCII character to the modem.
- To execute the command line, send the <CR> ASCII character.

Results Code Structure

When a command is issued, the G24 responds with a message, called a "Result Code", which tells the terminal the result of the command that was requested. Result codes can indicate, for example, the execution status of the command or the remote modem connection status.

Result codes can be represented either as numerical codes or as verbose responses. By default, the G24 responds with verbose response codes.

The result code has the following structure:.

Prefix	Code	Suffix

where:

The results code prefix is **<CR><LF>**.

The results code suffix is **<CR><LF>**.

Response and Indications Structure

The following is the information response and indications structure:

Token	Separator	Arguments

where:

The separator is ":".

The following is an example of Response and Results code:

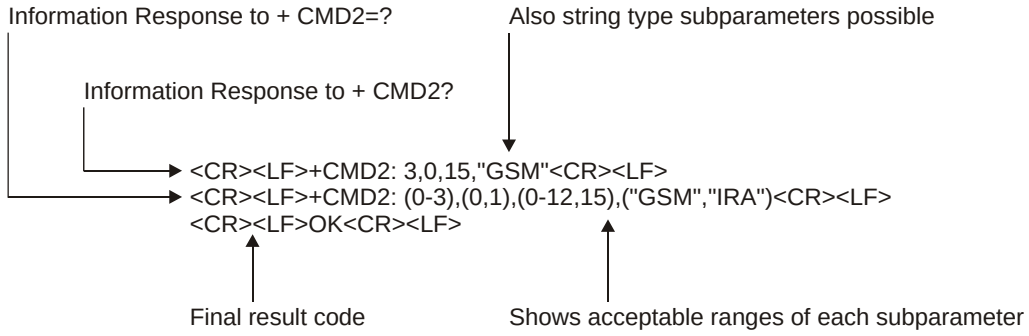


Figure 2-3: Response to a Command Line

If verbose responses are enabled (using the command V1) and all the commands in a command line have been performed successfully, the result code <CR><LF>OK<CR><LF> is sent from the G24 to the terminal. If numeric responses are enabled (using the command V0), the result code 0<CR> is sent instead.

If verbose responses are enabled (using the command V1) and sub-parameter values of a command are not accepted by the G24 (or if the command itself is invalid or cannot be performed for any reason), the result code <CR><LF>ERROR<CR><LF> is sent to the terminal and no subsequent commands in the command line are processed. If the numeric responses are enabled (using the command V0), the result code 4<CR> is sent instead. The ERROR (or 4) response may be replaced by +CME ERROR: <err> when the command was not processed due to an error related to G24 operation.

AT Commands Protocol & Structure Configuration

The AT commands message flow and structure may be configured by the terminal.

The G24 can be configured not to follow a command with an echo and/or results code. It can be configured to transmit the results code in either of two ways: Verbose or Numeric. This (and other) configurations can be set using the following commands:

Command	Description
S3=[<value>]	Command line termination character (default setting 0x13).
S4=[<value>]	Response formatting character (default 0x10).
S5=[<value>]	Command line editing character (default 0x 8).
E[<value>]	Command echo (default 0, meaning the G24 does not echo commands).
Q[<value>]	Result code suppression (default 0, meaning the G24 transmits result codes).
V[<value>]	G24 response format (default 1, meaning verbose format).
X[<value>]	Defines CONNECT result code format.

The figure below shows the flow and structure configuration commands:

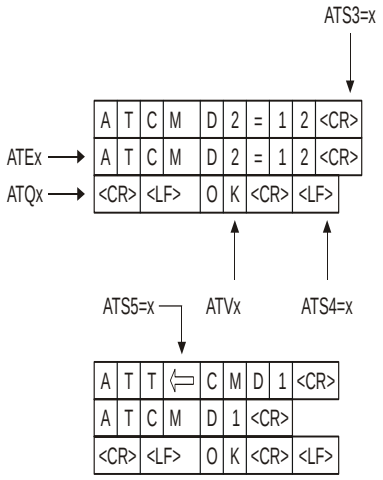


Figure 2-4: Flow and Structure Configuration Commands

Command Token Types

Basic Syntax Command Format

The format of Basic Syntax commands (except for the D and S commands) is:
<command>[<number>]

where:

<command> is either a single character, or the "&" character (IA5 2/6) followed by a single character.
Characters used in **<command>** are taken from the set of alphabetic characters.

<number> may be a string of one or more characters from "0" through "9" representing a decimal integer value.

S-parameters

Commands that begin with the letter S constitute a special group of parameters known as "S-parameters". These differ from other commands in important respects:

- The number following the S indicates the "parameter number" being referenced. If the number is not recognized as a valid parameter number, an ERROR result code is issued.
- Immediately following this number, either a "?" or "=" character (IA5 3/15 or 3/13, respectively) appears:

"?" is used to read the current value of the indicated S-parameter.

"=" is used to set the S-parameter to a new value. "<parameter_number>"
"<parameter_number" =[<value>]

If the "=" is used, the new value to be stored in the S-parameter is specified in decimal form following the "=".

Extended Syntax Command Format

Both actions and parameters have names, which are used in the related commands. Names always begin with the character "+" (IA5 2/11). Following the "+", from one to sixteen (16) additional characters appear in the command name.

All (GSM) cellular commands have the prefix "+C".

All Fax commands have the prefix "+F".

All General modem commands have the prefix "+G".

Most Motorola propriety commands have the prefix "+M".

Command Argument Types

<value> consists of either a numeric constant or a string constant.

<compound_value> consist of several <value> parameters separated by commas.

Example of compound_value: **<value1>,<value2>,…,<valueN>**

Numeric Constants

Numeric constants are expressed in decimal, hexadecimal, or binary form. In the G24, the definition of each command specifies which form is used for values associated with that command.

String Constants

String constants consist of a sequence of characters, bounded at the beginning and end by the double-quote character (").

Command Mode Types

Parameter Set Command Syntax

The terminal may store a value or values in a parameter by using the SET command.

The parameter definition indicates, for each value, whether the specification of that value is mandatory or optional. For optional values, the definition indicates the assumed (default) value if none is specified. The assumed value may be either a previous value (that is, the value of an omitted sub-parameter retains its previous value), or a fixed value (for example, the value of an omitted sub-parameter is assumed to be zero). Generally, the default value for numeric parameters is 0, and the default value for string parameters is "" (empty string).

The following syntax are used for:

- Actions that have no sub-parameters: **+<name>**
- Parameters that accept a single value: **+<name>=<value>**
- Parameters that accept more than one value: **+<name>=<compound_value>**

Parameter Read Command Syntax

The terminal can determine the current value or values stored in a parameter by using the following syntax: **+<name>?**

Parameter Test Command Syntax

The terminal can test whether a parameter is implemented in the G24, and determine the supported values, by using the following syntax: **+<name>=?**

Values

Range of Values

When the action accepts a single numeric sub-parameter, or the parameter accepts only one numeric value, the set of supported values may be presented in the information text as an ordered list of values.

The following are some examples of value range indications:

Value Range	Description
(0)	Only the value 0 is supported.
(1,2,3)	The values 1, 2, and 3 are supported.
(1-3)	The values 1 through 3 are supported.
(0,4,5,6,9,11,12)	The several listed values are supported.
(0,4-6,9,11-12)	An alternative expression of the above list.

Compound Range of Values

When the action accepts more than one sub-parameter, or the parameter accepts more than one value, the set of supported values may be presented as a list of the parenthetically enclosed value range strings (described above), separated by commas.

For example, the information text in response to testing an action that accepts three sub-parameters, and supports various ranges for each of them, could appear as follows:
(0),(1-3),(0,4-6,9,11-12)

Aborting Commands

Some action commands that require time to execute may be aborted while in progress. This is explicitly noted in the description of the command. Aborting a command is accomplished by transmitting any character from the terminal to the G24. A single character is sufficient to abort the command in progress. To ensure that the aborting character is recognized by the G24, it should be sent at the same rate as the preceding command line. The G24 may ignore characters sent at other rates. When an aborting event is recognized by the G24, it terminates the command in progress and returns an appropriate result code to the terminal, as specified for the particular command.

When a command is aborted, this does not mean that its operation is reversed. In the case of some network commands, when the abort signal is detected by the G24, although the command is aborted following G24-network negotiation, the operation might be fully completed, partially completed or not executed at all.

Core AT Commands

The G24 responds to a limited commands set when the SIM card is not functioning, or not present. These commands are referred to as the "Core AT commands".

In previous products, the Core AT commands were called "Basic AT commands". The name "Core" differentiates between the basic AT commands format and the limited service AT commands.

The following table lists the Core AT commands.

Table 2-1: Core AT Commands

AT Command	Description	Page
$	This command displays a list of all the AT commands supported by the G24.	Page 3-8
%C	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&C	This command determines how the state of the DCD line relates to the detection of the received line signal from the distant end.	Page 3-139
&D	This command determines how the G24 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state.	Page 3-140
&F	This command restores the factory default configuration profile.	Page 3-185
&G	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&J	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&K	This command configures the RTS/CTS flow control.	Page 3-138
&L	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&M	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&P	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&Q	This command selects the asynchronous mode, and has no effect.	Page 3-34
&R	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&S	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&T	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&V	This command displays the current active configuration and stored user profiles.	Page 3-202
&W	This command stores the user profile.	Page 3-203

Table 2-1: Core AT Commands (Cont.)

AT Command	Description	Page
&Y	This command displays the default user profile.	Page 3-205
?	This command displays the most recently updated value stored in the S-register.	Page 3-185
\A	This command is supported for backward compatibility only, and has no effect.	Page 3-241
\B	This command is supported for backward compatibility only, and has no effect.	Page 3-241
\G	This command sets the use of the software flow control.	Page 3-184
\J	This command adjusts the terminal auto rate.	Page 3-184
\K	This command is supported for backward compatibility only, and has no effect.	Page 3-241
\N	This command displays the link type.	Page 3-184
\S	This command displays the status of selected commands and S-registers.	Page 3-184
+CBAUD	This command sets the baud rate.	Page 3-134
+CEER	This command returns an extended error report containing one or more lines of information text, determined by the manufacturer, providing the reasons for the call- clearing errors.	Page 3-198
+CFUN	This command shuts down the phone functionality of smart phones and PDAs with phone capabilities.	Page 3-143
+CGMI	This command displays manufacturer identification.	Page 3-1
+CGMM	This command requests the model identification.	Page 3-2
+CGMR	This command requests the revision identification.	Page 3-3
+CGSN	This command requests the product serial number identification.	Page 3-3
+CHUP	This command causes the G24 to hang up the current GSM call.	page 3-35
+CKPD	This command emulates key presses, or virtual keycodes, as if entered from the G24 keypad or from a remote handset.	Page 3-205
+CLAC	This command displays a list of all the AT commands supported by the G24.	Page 3-8
+CLCC	This command displays a list of all current G24 calls and their statuses, and also enables/disables the unsolicited indication of the call list.	Page 3-40
+CLVL	This command sets the volume of the internal loudspeaker of the G24.	Page 3-151
+CMEE	This command enables/disables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the G24.	Page 3-193
+CMER	This command enables an external accessory to receive key press information from the G24's internal keypad.	Page 3-209

Table 2-1: Core AT Commands (Cont.)

AT Command	Description	Page
+CMGF	This command handles the selection of message formats.	Page 3-78
+CMUX	This command is used to enable/disable the GSM MUX multiplexing protocol stack.	Page 3-257
+CPAS	This command displays the current activity status of the G24, for example, call in progress, or ringing.	Page 3-39
+CPIN	This command is only relevant for phones that use SIM cards. It unlocks the SIM card when the proper SIM PIN is provided, and unblocks the SIM card when the proper SIM PUK is provided.	Page 3-169
+CRC	This command controls whether to present the extended format of the incoming call indication.	Page 3-18
+CRSM	This command enables you to read IMSI, GID1, GID2 and ICC ID data from the SIM card.	Page 3-201
+CRTT	This command plays one cycle of a ring tone, stops the cycle in the middle, and sets the ring tone to be used.	Page 3-165
+CSDH	This command controls whether detailed header information is shown in text mode result codes.	Page 3-82
+CSMP	This command sets the Text Module parameters.	Page 3-80
+CSQ	This command returns the signal strength received by the G24.	Page 3-119
+FMI	This command displays manufacturer identification.	Page 3-1
+FMM	This command displays the model identification.	Page 3-2
+FMR	This command displays the revision identification.	Page 3-3
+FPR	This command sets the request baud rate.	Page 3-251
+GCAP	This command requests the overall capabilities of the G24.	Page 3-137
+GMI	This command requests manufacturer identification. The command is not supported when the SIM is missing.	Page 3-1
+GMM	This command requests the model identification.	Page 3-2
+GMR	This command requests the revision identification.	Page 3-3
+GSN	This command requests the product serial number identification.	Page 3-3
+IFC	This command controls the operation of the local flow control between the terminal and the G24.	Page 3-249
+IPR	This command is responsible for setting and saving the request baud rate.	Page 3-135
+MADIGITAL	This command switches between analog and digital audio modes.	Page 3-162
+MAFEAT	This command controls the various algorithm features, such as sidetone, echo cancel and noise suppress.	Page 3-161
+MAMUT	This command controls the muting/unmuting of all input paths (MIC, HDST_MIC, DIGITAL_RX).	Page 3-160

Table 2-1: Core AT Commands (Cont.)

AT Command	Description	Page
+MAPATH	This command sets/requests the active input accessory, and the output accessory for each feature.	Page 3-155
+MAVOL	This command enables you to determine a volume setting for a particular feature in a particular accessory.	Page 3-158
+MCWAKE	This command displays reports on the status of the GPRS coverage.	Page 3-141
+MSCTS	This command defines the behavior of the CTS line when the G24 is in Sleep mode.	Page 3-192
+MCST	This command displays the current state of the call processing, and also enables/disables the unsolicited indication of any change in the call processing state.	Page 3-42
+MDC	This command enables you to select the desired messages to be displayed upon connection of a voice call with a remote party.	Page 3-37
+MDSI	This command enables unsolicited reporting of indications of SIM deactivation and invalidation.	Page 3-66
+MIPCONF	This command allows to configure TCP stack parameters, such as retransmissions number, upper and bottom limits of retransmission timeout, close delay.	Page 3-238
+MRST	This command enables customer software to perform a hard reset to the G24 unit.	Page 3-145
+MTCTS	This command sets the CTS pin of the RS232 to not active (high), waits one second and then sets the CTS to active (low).	Page 3-138
+MTDTR	This command checks and displays the physical current status of the DTR pin of the RS232.	Page 3-137
A	This command answers an incoming call, placing the G24 into the appropriate mode, as indicated by the RING message.	Page 3-18
D	This command places a voice call on the current network, when issued from an accessory device.	Page 3-11
E	This command defines whether the G24 echoes the characters received from the user, (whether input characters are echoed to output).	Page 3-179
F	This command is supported for backward compatibility only, and has no effect.	Page 3-241
H	This command hangs up, or terminates a particular call.	Page 3-16
I	This command requests various G24 information items.	Page 3-6
L	This command is supported for backward compatibility only, and has no effect.	Page 3-241
M	This command is supported for backward compatibility only, and has no effect.	Page 3-241
N	This command is supported for backward compatibility only, and has no effect.	Page 3-241

Table 2-1: Core AT Commands (Cont.)

AT Command	Description	Page
O	This command returns a phone to the Online Data mode and issues a CONNECT or CONNECT <text> result code.	Page 3-34
P	This command is supported for backward compatibility only, and has no effect.	Page 3-241
Q	This command determines whether to output/suppress the result codes.	Page 3-178
Sn	This command reads/writes values of the S-registers, and includes registers 1-49, 94, 96 (Audio) and 102 (Sleep mode).	Page 3-181
T	This command is supported for backward compatibility only, and has no effect.	Page 3-241
V	This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses.	Page 3-177
X	This command defines the data adaptor response set, and the CONNECT result code format.	Page 3-180
Y	This command is supported for backward compatibility only, and has no effect.	Page 3-241
Z	This command resets the default configuration.	Page 3-186

Chapter 3: AT Commands Reference

Modem ID

Subscriber Unit Identity

These commands allow the user to query the type of device that is attached, the technology used in the device, as well as basic operating information about the device.

+CGMI, +GMI, +FMI, Request Manufacturer ID

These commands display manufacturer identification. The G24 outputs a string containing manufacturer identification information, indicating that this is a Motorola device.

Command	Response/Action
AT+CGMI **AT+CGMI?**	**+CGMI: "Motorola"**
AT+GMI **AT+GMI?**	**+CGMI: "Motorola"**
AT+FMI **AT+FMI?**	**+CGMI: "Motorola"**

Example

AT+CGMI
+CGMI: "Motorola"
OK
AT+GMI
+CGMI: "Motorola"
OK
AT+FMI
+CGMI: "Motorola"

+CGMM, +GMM, +FMM, Request Model ID

These commands request the model identification. The G24 outputs a string containing information about the specific model, including a list of the supported technology used, and the particular model number.

Command	Response/Action
AT+CGMM **AT+CGMM?**	**+CGMM**: <list of supported technologies>,<model>
AT+GMM **AT+GMM?**	**+GMM**: <list of supported technologies>,<model>
AT+FMM **AT+FMM?**	**+FMM**: <list of supported technologies>,<model>

Example

AT+CGMM?
+CGMM: "GSM900","GSM1800","GSM1900","GSM850","MODEL=G24"
OK

The following table shows the+CGMM string parameters.

String	Description
"GSM900"	GSM at 900 MHz
"GSM1800"	GSM at 1800 MHz
"GSM1900"	GSM at 1900 MHz (North American PCS)
"GSM850"	GSM at 850 MHz

+CGMR, +GMR, +FMR, Request Revision

These commands request the revision identification. The G24 outputs a string containing the revision identification information of the software version contained within the device. Typically, the version is a quoted string with less than 255 characters.

Command	Response/Action
AT+CGMR **AT+CGMR?**	**+CGMR: <revision>**
AT+GMR **AT+GMR?**	**+GMR: <revision>**
AT+FMR **AT+FMR?**	**+FMR: <revision>**

Example

AT+CGMR
+CGMR: "G24_G_0C.11.44R"
AT+GMR
+GMR: "G24_G_0C.11.44R"
AT+FMR
+FMR: "G24_G_0C.11.44R"

+CGSN, +GSN, Request Product Serial Number Identification

This command displays the product serial number identification IMEI (International Mobile Equipment Identification). It can be used even when the SIM card is not inserted.

Command	Response/Action
AT+CGSN **AT+CGSN?**	**+CGSN: <sn>**
+GSN **+GSN?**	**+GSN: <sn>**

The following table shows the +CGSN, +GSN parameters.

Table 3-1: +CGSN, +GSN Parameters

<Parameter>	Description
<sn>	The IMEI (International Mobile Station Equipment Identity) number is comprised of 15 digits, as specified by GSM 03.03 [3]. IMEI numbers are composed of the following elements, all in decimal digits: Type Approval Code (TAC) - 6 digits Serial Number (SNR) - 6 digits Spare digit - 1 digit The TAC and SNR are protected against unauthorized changes.

Example

AT+CGSN?
+CGSN: "004400013805666"
OK
AT+GSN
+GSN: "004400013805666"
OK

+CSCS, Select Terminal Character Set

This command selects the G24 character set. The G24 supports the following character sets: GSM, UCS2, UTF8, 8859-1 and ASCII.

The default value, set upon system initialization or when omitting <chest> in set command, is ASCII.

Command Type	Syntax	Response/Action
Set	**+CSCS=[<chset>]**	**OK** **or:** **+CMS ERROR: <err>**
Read	**AT+CSCS?**	**+CSCS: <selected character set>**
Test	**AT+CSCS=?**	**+CSCS: (<supported character sets>)**

The following table shows the +CSCS parameter optional values.

Table 3-2: +CSCS Parameters

<chset>	Character Set	Input/Output Format
“ASCII”	ASCII (0x00 - 0x7F)	Quoted string. (For example, "AB" equals two 8-bit characters with decimal values 65, 66.)
“GSM”	GSM default alphabet (GSM 03.38 subclause 6.2.1)	HEX representation.
"UCS2"	Unicode (ISO/IEC 10646 [32])	HEX representation. (For example, 00410042 equals two 16-bit characters with decimal values 65, 66.)
"UTF8"	8-bit Unicode (ISO 10646 transformation format)	HEX representation.
"8859-1"	LATIN (ISO 8859-1)	Quoted string.

Example

```
AT+CSCS=?
+CSCS: ("8859-1","ASCII","GSM","UCS2","UTF8")
OK
AT+CSCS?
+CSCS: "ASCII"
OK
AT+CPBS = "ME"
AT+CPBW=1,"8475763000",129,"Lin Zhao"
OK
AT+CSCS="UCS2"
OK
AT+CPBR=1
+CPBR: 1,"8475763000",129,004C006E006E0020005A00680061006F
OK
AT+CSCS="ASCII"
OK
AT+CPBR=1
+CPBR: 1,"8475763000",129,"Lin Zhao"
OK
```

+CIMI, Request IMSI

This command displays the International Mobile Subscriber Identity number.

Command	Response/Action
AT+CIMI **AT+CIMI?**	**+CIMI: <imsi>** **or:** **+CME ERROR: <err>**

Example

AT+CIMI
+CIMI: 314566320021400

I, Request Identification Information

This command displays various G24 information items.

Command	Response/Action
ATIn	<information item n> or: +CMS ERROR: <err>

The following table shows the information items that are supported by the G24.

ATIn	Description	Output
3	Reports Product Title	Motorola Mobile Phone
5	Reports Software Architecture	P2K
8	Reports Software Version	<current software revision>
9	Reports Flex Version	<current flex version>

Example

ATI8
G24_G_0C.11.44R
OK
ATI9
GCEG24x000AA016
OK

+CNUM, Request MSISDN(s)

This command displays up to five strings of text information that identify the G24. The output string contains double quotes.

On platforms supporting MSISDN numbers, the string(s) returned are the MSISDN numbers and their associated data.

On platforms not supporting MSISDN numbers, this command returns the current phone number of the G24.

Read Command

Command	Response/Action
+CNUM (MSISDN supported)	**+CNUM: [<MSISDN1 string>],<MSISDN1>,<MSISDN1 type> [+CNUM: [<MSISDN2 string>],<MSISDN2>,<MSISDN2 type>] [...]**
+CNUM (MSISDN not supported)	**+CNUM: <phone_number>**

The following table shows the +CNUM parameters.

Table 3-3: +CNUM Parameters

<Parameter>	Description
<MSISDN type>	Phone number type 129 Use for local call 145 Use "+" for international access code 128 Unknown

Example

```
at+cnum?
+CNUM: "David","035558278",129
AT+CNUM //MSISDNs supported
+CNUM: "PHONENUM1","2173848500",129
+CNUM: "PHONENUM2","2173848501",129
+CNUM: "PHONENUM3","2173848502",129
+CNUM:"","",0
+CNUM:"","",0
AT+CNUM //MSISDNs not supported
+CNUM:  "Motomix","2233445",129
+CNUM:"","",0
+CNUM:"","",0
+CNUM:"","",0
```

$, List of All Available AT Commands

This command displays a list of all the AT commands supported by the G24.

Command	Response/Action
AT$	List of available AT commands

+CLAC, List of All Available AT Commands

Command	Syntax	Response/Action	Remarks
Execute	**+CLAC**	List of available AT commands	The Execute command displays a list of all the AT commands supported by the G24.

Example

AT+CLAC
$
%C
&C
&D
&F
&G
&K
&L
&M
&P
&R
&S
&T
***D**
+CACM
+CALC
+CALM
+CAMM
+CAOC
+CBAND
+CBAUD
+CBC
+CBST
+CCFC
+CCLK
+CCWA
+CEER
:
:

:
:
?
A
D
DL
E
F
H
I
L
M
N
O
P
Q
S
T
V
X
Y
Z
\A
\S
OK

Capability Reporting

This set of commands enables a user to determine G24's protocol level. It also enables other support provided by the G24, such as information about the currently implemented protocol version (used to detect older G24s that may not support all commands), as well as determining which optional commands are implemented in a particular G24 software load.

Call Control

Managing a CSD (Data) Call

The G24 working modes can be divided into two modes of operation.

- Data Mode: In this mode, once the G24 has established a link with the remote modem, it does not respond to any data passing through it (except for the Escape Sequence search). The G24 becomes a transparent link, connecting the terminal with the remote side.
- Command Mode: In this mode, the G24 responds to the AT commands issued by the terminal. This is the default working mode.

Note: It is possible to switch between the operating modes.

The operating modes can operate simultaneously using the Mux.

The Terminal mode allows you to instruct the modem to dial a remote modem by issuing the Dial command followed by the phone number. You can also include dial string modifiers in your

command line to give the modem additional instructions. The following dial modifiers are available on most modems:

- ","- Pause
- ";" - Return to the Command mode after dialing - used for a voice call.

Simple Dialing

In order to instruct the modem to dial a remote modem from an ordinary tone-dialing telephone line, enter the Dial command followed by the phone number. For example, type the following command:

ATD 876-5555 <Enter>

Note: If you receive characters which were sent, you can disable this with using the Echo command (ATE0 <Enter>).

After issuing the Dial command, and if the remote modem answers the call, the two modems send high-pitched carrier tones to one another which establish the transmission speed and other parameters for the data connection. This process is called negotiation.

After the negotiation process, the message, "OK" followed by the connection speed, is received.

If the other phone line is busy, the message "NO CARRIER" is received.

If the other modem does not answer, the message "NO CARRIER" is received.

Once a connection has been established, the modem is ready to immediately begin transmitting and receiving data. This may vary from sending messages to each other, sending or receiving files, logging on to an information service, or any other data communication task you wish to perform.

Switching From Data Mode to Command Mode

To switch the connection from Data mode to Command mode, send the Escape Sequence command (+++).

If the modem responds with "OK" to the Escape command, the modem is in Command mode and the dial connection is still active, and you can use the AT command set.

Note: The character '+' in the Escape Sequence pattern can be changed using the S2 S-register. Refer to “S, Bit Map Registers”, page 3-181.

Escape is detected only by the G24 and not by the remote side. The remote side stays in the Data mode.

Hanging Up

If you are using a communications program, use the "Hang up" or "Disconnect" AT command in the program to disconnect the call.

When using computers in the "Dumb Terminal mode", return to the Command mode by typing the Escape Sequence, +++, and then hang up by typing the Hang up command as follows:

ATH <Enter>

If the G24 responds with "OK", the dial connection is closed.

Dialing to an Electronic Telephone Service

When you dial to an electronic telephone service such as telephone banking, you must typically instruct the modem to dial a number, then to wait for call establishment, and then send the password for entering the banking account. A typical command line might look like this:

ATD876-5555,123456; <Enter>

The modem dials the number, then pauses to wait for the call connection (the comma in the command line causes the pause).

You can also create a longer pause by including several commas in a row in the command line, and then send the password to the service.

Receiving a Data Call

ATA <Enter>

This command instructs the modem to be the "answering modem". Either party may be the answering or the originating modem, but both parties cannot be the same modem at the same time.

You hear the modem handshake and see the result code "CONNECT".

Note: Outgoing Voice Call during CSD Call, when switching to Command mode.

If using Dial Command to make Outgoing Voice Call, currently active CSD Call is dropped and the new Voice Call is generated.

Call Control AT Commands

D, Dial Command

This command places a FAX/DATA/VOICE call on the current network.

The default call type is a data call (CSD). If the +FCLASS command was used to set the call type to be FAX, then the outgoing call is a fax call.

There must be an explicit request in order to make a VOICE call. This request bypasses the +FCLASS setting.

If a DATA/FAX call was originated and answered by the remote side, a "OK" notification is sent to the terminal from the G24, and it moves to the online Data/Fax state (respectively).

For more information about call failure, use the AT+CEER command, described in "+CEER, Extended Error Report" on page 3-198.

Note: If there is an active voice call and the terminal sends another ATD voice call command to the G24, the active call is put on hold and the new number is called.

Command	Response/Action
ATD<number>[;]	VOICE CALL: 1st response - Voice call place begins **OK** 2nd response - Voice call connected: **OK** DATA/FAX: 2nd response only - Data/Fax call connected **CONNECT** When MO call fails: 1. Connection Failure - NO CARRIER or BUSY or NO ANSWER 2. General Failure - ERROR 3. Security reason (such as SIM not present) - OPERATION NOT ALLOWED 4. Unknown reason - UNKNOWN CALLING ERROR

The following table shows the D parameters.

Table 3-4: D Parameters

<Parameter>	Description
<number>	Valid phone digits are: 0 1 2 3 4 5 6 7 8 9 * # + and , The following characters are ignored: A B C D - () / and <space>. The comma <,> digit: When dialing a voice call, digits until the comma are considered addressing information (phone number). Any digits after the comma are sent as DTMF tones after the voice call is connected. More than one comma causes a pause in sending the tones. When dialing a data/fax call, the comma digit is ignored, and all other digits before and after the comma are considered addressing information (phone number). The plus <+> digit: Indicates that the international access code exists in the number.
semicolon (;)	When given after <number string>, a voice call is originated to the given address, otherwise a data call is originated.

Note: ATDP, ATDT, AT*D, <T>, <P> and <*> are ignored. The command is handled as ATD.

The control of supplementary services through the Dial command is not supported as these are controlled through the specific supplementary service commands (CCFC, CLCK, and so on.)

Initiating a GPRS connection is done through ATD*99#, as described in "D*99, Request GPRS Service "D"" on page 3-223.

Example

atd44345678;//VOICE call (with semicolon)
OK
OK
atd44345678 //DATA/ FAX call (without semicolon)
...
CONNECT //Move to online Data state

D>, Direct Dialing from Phone Books

This command places a FAX/DATA/VOICE call on the current network by dialing directly from the G24 phone book.

Notes:
- "+CME ERROR: not found" is returned when no match is found in an existing phone book.
- FD phone book supports the (?) wild card character. Telephone numbers containing this character cannot be dialed directly from the phone book.
- "+CME ERROR: Invalid index" is returned when entry <n> is out of the requested Phonebook range.
- When SM phonebook is searched and the given entry value is of the ME phonebook, ME phonebook will be searched as well (result code would be the same as if MT phonebook was searched).

The following table shows a detailed description for the D> commands.

Command	Detailed Description
D><alpha>[;]	Originates a call to a phone number with the corresponding alphanumeric field <alpha>. The Current Phone Book (Set by +CPBS) is searched for the entry that begins with the alphanumeric pattern <alpha>.
D>mem<n>[;]	Originates a call to a phone number in memory (phone book) mem and stored in entry location <n>. Available memories may be queried with Select Phone Book Storage Test command +CPBS=?, described on page 3-59. **Note:** This command does not change the used memory set.
D><n>[;]	Originates a call to a phone number from entry location <n> in the Current Phone Book (Set by +CPBS).

Note: Current used memory (phone book) set/read is done through the memory command **+CPBS=/+CPBS?** respectively.

If the G24 powers up, and no default used memory is set, then, if ATD><alpha> or ATD><n> is sent from the terminal, a +CME ERROR: **"NOT FOUND"** is returned.

The following table shows the D> parameters.

Table 3-5: D> Parameters

<Parameter>	Description
<"alpha">	String type value, which should be equal to an alphanumeric field in a phone book entry. The used character set should be the one selected with Select Terminal Character Set +CSCS. <alpha> is case-sensitive, and should be placed in quotes ("alpha").
<n>	This parameter is also called "speed dial location". It is an integer type memory location. <n> should be in the range of locations available in the memory used.
<"mem">	This parameter is not case-sensitive, and should be placed in quotes ("mem").

Example

at+cpbs="me"//Phone flash memory
OK
at+cscs="ASCII"//ASCII characters
OK
at+cpbw=1,"035659090",129,"VoiceMail"
OK
at+cpbr=1
+CPBR: 001,"035659090",129,"VoiceMail"
OK
atd>"VoiceMail";//Phonebook by name
OK
OK
ath
NO CARRIER
OK
atd>1;//Speed dial from phonebook
OK
OK
ath
NO CARRIER
OK
atd>1//Speed dial from phonebook
+CME ERROR://Invalid characters in dial string
atd>"Motorola Internal"
+CME ERROR://Invalid characters in dial string

For more examples, refer to “Call Control” on page 4-14 and “Data Call” on page 4-17.

DL, Dial Last Number

The DL command places a data/voice call to the last number dialed. The call progress information (success/failure) is reported in the same way as for the Dial command. (Refer to “D, Dial Command”, page 3-11).

Command	Detailed Description
ATDL[;]	Initial Response - Last Number retrieved: ATDL: "DIAL DIGITS" 2nd response - Data/Fax call connected CONNECT 1st response - Voice call placement begins OK 2nd response - Voice call connected OK

The following table shows the DL parameters.

Table 3-6: DL Parameters

<Parameter>	Description
semicolon (;)	If the semicolon (;) is given, a voice call is originated to the last dialed number. If the semicolon (;) is not given, a Fax/Data call is originated. **Note:** The last dialed call type is irrelevant to the DL command.

Note: When ATDL is issued after a dialed number with comma digit:

- ATDL; (Voice) dials the exact number that was last dialed, including the DTMF tones sent.
- ATDL (Data/Fax) dials the addressing information only (comma and tones are discarded).
- If ATDL is sent before any Dial command was issued (mainly after Power On, when the last number is an empty field), the G24 will return NO CARRIER, as mentioned in the ITU V.25-ter standard.

Example

atdl //Last called number is "035658278"
ATDL: "035658278"
OK //DATA call
atdl;
ATDL: "035658278"
OK
OK //VOICE call
atdl //Last called number is "035658278,123,78;"
ATDL: "035658278"
CONNECT //DATA call
atdl;//Last called number is "035658278,123,78"
ATDL: "035658278p123p78"
OK
OK //VOICE call
1 2 3 //Sent as DTMF tones
... //Pause
7 8//Sent as DTMF tones

H, Hang-up Call

This command hangs up a call. The G24 terminates the call whether it is a data or voice call, and whether it is an incoming, originating, waiting, or connected call.

A NO CARRIER message is returned to the terminal before the regular OK approval.

Note: To terminate (hang-up) a MO data/fax call while call is placed: Any character sent from the terminal to the G24 causes the Data/Fax call termination, and NO CARRIER is sent from the G24 to the terminal.

To terminate a held Voice call or to terminate a call out of a MTPY call, refer to "+CHLD, Call Related Supplementary Services Command" on page 3-24.

The following table shows the call states of the H command.

Call State	Response/Action
IDLE	Error 3 ("operation not allowed")
Single Active	Call released
MTPY Active	Call released (all calls)
Incoming call (RING)	Call released

Call State	Response/Action
Single Active and Waiting Call	Single Active released (waiting not affected)
MTPY Active and Waiting Call	MTPY Active released (waiting not affected)
Single Held or MTPY Held	Error 3
Single (or MTPY) Active and Single (or MTPY) Held	Single (or MTPY) Active released
Held (Single or MTPY) and Waiting Call	Waiting call released
Single (or MTPY) Active and Single (or MTPY) Held & Waiting call	Single (or MTPY) Active released

Example

RING//Incoming call
RING //Incoming call
ath//Hang-up incoming call
NO CARRIER
OK //Incoming call has been terminated - user determined user busy
RING
ata
OK//Voice call connected
ath//Hang-up connected call
NO CARRIER
OK //Active call has been hung-up - terminated
(... Active multi party call, with 3 numbers …)
ath
NO CARRIER
NO CARRIER
NO CARRIER
OK
atd035659260;
OK
ath//Terminate MO voice call while placed
NO CARRIER
OK
Example - Hanging up a data call:
atd035659260
CONNECT//Data call connected - Online Data mode
…
+++ //ESC Sequence is sent from the terminal to the G24
OK//The G24 is in Command mode
ath//Terminate Data call
NO CARRIER
OK

A, Answer Incoming Call

This command answers an incoming VOICE/DATA/FAX call after a RING/+CRING indication is sent to the terminal.

If the incoming call is answered (connected), the G24 sends a CONNECT notification to the terminal.

If the MT call fails, the possible notifications are:

- NO CARRIER - Connection Failure
- ERROR - General Failure

Note: A waiting call (an incoming call while a call is in progress) is announced by +CCWA rather than RING. A waiting call can be answered only if it is a voice call. The waiting voice call should be answered using the ATA command, which will put the active call on hold and will connect the waiting call, making it the active call. This ATA action is the same action as AT+CHLD=2.

Using ATA command is the standard way to accept a waiting call while an active call is in progress.

Example

Example - Answering a voice call:
AT+CRC=1
+CRING: VOICE
+CRING: VOICE
ata
OK //VOICE call connected - G24 is in Command mode
ath
NO CARRIER
OK
Example - Answering a data call:
+CRING: REL ASYNC
+CRING: REL ASYNC
ata
...//Connecting (dots are not displayed)
OK //DATA call connected - G24 is in Online Data mode

Note: In a CSD call, call release is not valid during the phase of call negotiation (from OK until connect call).

+CRC, Cellular Result Codes and RING, +CRING - Incoming Call Indication

This command controls whether or not to present the extended format of an incoming call indication. The RING/+CRING indication is sent from the G24 to the terminal when the G24 is alerted by an incoming call from the network. Once this indication is sent, information is

available on the calling line via +CLIP. When +CRC is disabled, the indication is RING, and when +CRC is enabled, the indication is +CRING..

Command Type	Syntax	Response/Action	Remarks
Set	**+CRC=[<n>]**	**OK**	The Set command enables/disables the extended format of an incoming call indication. When enabled, an incoming call is indicated to the terminal with an unsolicited result code +CRING:<type> instead of the normal RING.
Read	**+CRC?**	**+CRC: <n>** **OK**	The Read command queries the current settings for the cellular result code.
Test	**+CRC=?**	**+CRC: (list of supported <n>s)**	The Test command returns the possible <n> values.

RING/+CRING Indication

+CRING: <type>
or:
RING

The following table shows the +CRC parameters.

Table 3-7: +CRC Parameters

<Parameter>	Description
<n>	0 Extended format disabled 1 Extended format enabled The default value is 0.
<type>	Type of incoming call: ASYNCCSD asynchronous transparent REL ASYNCCSD asynchronous non-transparent FAX Fax class 1 VOICENormal voice ALT Fax/voice

Example

at+crc?
+CRC: 0
OK
at+crc=?
+CRC: (0-1)
OK
Example - RING/+CRING indication
(..Incoming Data Call..)
RING
RING

RING
at+crc=1//Enable extended ring format
OK
+CRING: REL ASYNC
+CRING: REL ASYNC
ath
at+CRC=1
OK//Mobile fax call terminated (multi-numbered scheme) from PSTN fax machine
+CRING: ALT Voice/Fax
NO CARRIER
OK

+CLIP, Calling Line Identification

This command controls the Calling Line Identity (CLI) presentation indication to the terminal when an incoming call is detected by the G24.

This command allows the user to query the provisioning status of the CLI by the network and by the G24. The command also allows the user to enable/disable the CLI presentation by the G24 to the terminal.

The +CLIP indication information varies depending on what is provided by the network and what information is stored in the G24 phone book.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CLIP=<n>**	**OK** **+CME ERROR: <err>**	The Set command enables or disables the presentation of the CLI indication from the G24 to the terminal. **Note:** The Set command does not address the network.
Read	**AT+CLIP?**	**+CLIP: <n>, <m>** **OK**	The Read command returns the +CLIP enable/disable state in the G24 as well as in the network provisioning state of the CLI presentation.
Test			The Test command returns the Set command options (0,1).

+CLIP Indication

When the CLI presentation indication is enabled by the G24 (<n>=1), this unsolicited indication is sent to the terminal after the RING indication.

+CLIP:<number>,<type>[,<subaddr>,<satype>[,[<alpha>][,<CLI validity>]]]

The following table shows the +CLIP parameters.

Table 3-8: +CLIP Parameters

<n>	Enables/disables the CLI presentation indication after the ring indication: 0 Disable CLI presentation 1 Enable CLI presentation The default is 0.
<m>	Shows the subscriber CLIP service status in the network: 0 CLIP not provisioned 1 CLIP provisioned 2 Unknown (for example, no network and so on)
<"number">	Calling line number. The number format is specified by <type>.
<type>	Type of address octet in integer format: 145 Default when the dialing string includes the international access code character "+". 129 Default when making a local call. 128 Type of number is unknown (usually the output when the number itself is unknown).
<subaddr>	NULL, field not used (String type subaddress of format specified by <satype>)
<satype>	Field not used. Value is always 128 (unknown) - type of sub address octet in integer format.
<"alpha">	Name of the calling party (if provided by the network or if the number is found in the G24 phone books).
<CLI validity>	The Validity of the Calling Line Identity presentation: 0 CLI valid. 1 CLI has been withheld by the originator. 2 CLI is not available due to networking problems or limitations of the originating network.

Example

at+clip=?
+CLIP: (000,001)//CLI presentation is disabled by the G24 (0) and is enabled by the network (1)
OK
at+clip=1
OK
Example +CLIP indication:
(…incoming call…)
RING
+CLIP: "2173845400",129,,128,"Doe John",0
Example +CLIP indication with restricted CLI:
at+crc=1
OK
(…incoming call…, caller restricted the CLI presentation (used at+clir)…)
+CRING: VOICE
+CLIP: "",128,,128,"",1

+CCWA, Call Waiting Command

This command controls the Call Waiting supplementary service, including the settings and the queries of the G24 and the network. When the Call Waiting indication is enabled by the G24 and there is a waiting call, a +CCWA: indication is sent from the G24 to the terminal.

Note: The G24 supports only one of the services at a time: Voice, Data or Fax. Multiparty is a voice-only functionality.

A CCWA indication is sent to the terminal only during a voice call-waiting event. A CCWA indication is not sent for a fax/data call during in a voice session.

Action	Syntax	Response	Remarks
Set	**+CCWA=[<n>[, <mode>[,<class>]]]**	**OK** **If <mode>=2 and the command succeeds:** **+CCWA: <status>,<class1>** **[<CR><LF>+CCWA: <status>,<class2>** **[...]]** **OK**	The Set command enables/disables the Call-Waiting indication in the G24 and in the network. Activation, deactivation and status query are supported. **Note:** When the <mode> parameter is set to 2 (network query), the <n> parameter is ignored. This means that no enable/disable action is performed while querying the network.
Read	**+CCWA?**	**+CCWA: <n>** **OK**	The Read command returns the enable/disable status of the call waiting indication in the G24 (<n>).
Test	**+CCWA=?**	**+CCWA: (list of supported <n>s)**	The Test command returns <n> values supported by the G24 as a compound value.

+CCWA Indication

When a call-waiting indication is enabled by the G24 (<n>=1), the following unsolicited indication is sent to the terminal from the G24:

+CCWA:<number>,<type>,<class>,[<alpha>][,<CLI validity>]

The following table shows the +CCWA parameters.

Table 3-9: +CCWA Parameters

<n>	Enables/disables the call waiting indication to the terminal by the G24. 0 - Disable 1 - Enable The default is 0.
<mode>	Call waiting service request to the network. When the <mode> parameter is not given, the network is not interrogated. 0 - Disable 1 - Enable 2 - Query status
<class>	Sum of integers each representing a class of information. 1 - Voice (telephony) 2 - Data (refers to all bearer services) 4 - Fax (facsimile services) The default value is 7.
<"number">	Calling line number. The number format is specified by <type>.
<type>	Type of address octet in integer format: 145 - Default when the dialing string includes the international access code character "+". 129 - Default when making a local call. 128 - Type of number is unknown (usually the output when the number itself is unknown)
<status>	Call waiting support by the network (output for <mode>=2). 0 - Not active 1 - Active
<"alpha">	Name of the calling party (if provided by the network or if the number is found in the G24 phone books).
<CLI validity>	The Validity of the Calling Line Identity presentation: 0 - CLI valid. 1 - CLI has been withheld by the originator. 2 - CLI is not available due to networking problems or limitations of the originating network.

Note: When the parameter <mode> is 2 (Query status), the first parameter is ignored and the third parameter is always treated as class = 7.

Example

at+ccwa=1 //Enable call waiting on G24
OK
at+ccwa=?
+CCWA: (0,1)
OK
at+ccwa?
+CCWA: 1

OK
Examples of +CCWA set command - network interrogation
at+ccwa=1,2//Class parameter is considered as 7
+CCWA: 1,1//Call waiting is active for class 1, voice
+CCWA: 2,0//Call waiting is not active for class 2, data
+CCWA: 4,0//Call waiting is not active for class 4, fax
OK
at+ccwa=1,2,2//Class parameter is 2
+CCWA: 2,0//Call waiting is not active for class 2, data
+CCWA: 4,0//Call waiting is not active for class 4, fax
OK
at+ccwa=1,1
OK //Enable the call waiting feature in the network, and in the G24
Example +CCWA indication
atd9311234567; //Originate a voice call
OK
OK//Voice call connected
(...conversation...)
(… call waiting indication received by the G24 …)
+CCWA: "+358317654321",145,1,"Bob"
+CCWA: "+358317654321",145,1,"Bob"
at+chld=0 //Release the waiting call
OK
NO CARRIER
at+crc=1//RING indication is not relevant to CCWA indication
OK
(…waiting call…, caller restricted to its CLI presentation (used at+clir)…)
+CCWA: "",128,1,"",1//CLI is restricted, but call type recognized as voice
+CCWA: "",128,1,"",1

+CHLD, Call Related Supplementary Services Command

This command controls the Call Hold and Multiparty Conversation services. This command manipulates voice calls only.

Set Command

The Set command allows the control of the following call related services:

- Call HOLD: A call can be temporarily disconnected from the G24, but the connection is retained by the network.
- MTPY (Multi party) Conversation: Conference calls.

The network does not reserve more than one traffic channel for a mobile station, therefore the G24 can have only one call on hold at a time.

Note: Only voice calls can be put on HOLD.

A precondition for the multi-party service is that the G24 is in control of one active call and one call on hold. In this situation, the G24 can request the network to begin the MTPY (Multi Party) service. Once a MTPY call is active, remote parties may be added, disconnected or separated (removed from the MTPY call, but remain connected to the served mobile subscriber).The maximum number of remote parties is 5.

In this command, the term CALL refers to a single or MTPY call.

A single Active call is considered an MTPY call with one call index numbered as 1.

Command	Response/Action
+CHLD=<n>	If the call is terminated: OK (approve request was submitted) NO CARRIER If the call state is changed (link, split, from active to hold, and so on): OK (approve request was done) If the call is terminated and another call is answered: OK (approve request was submitted) NO CARRIER OK (call answered and is now connected)

Command Type	Syntax	Response/Action	Remarks
Test	**+CHLD=?**	**+CHLD: (list of supported <n>s)** **OK**	The Test command returns <n> values supported by the G24 to the terminal

The following table shows the +CHLD parameters.

Table 3-10: +CHLD Parameters

<Parameter>	Description
<n>	Call hold operation: 0 - Releases all held calls OR Sets User Determined User Busy for a waiting call 1 - Releases all active calls and accepts the held or waiting call 1x - Release specific call x, where x is the serial number of a call participating in an active MTPY call. 2 - Places all active calls on hold and accepts the held or waiting call 2x - In the case of an active MTPY call, places all active calls on hold, except for call x. Call x remains active. 3 - Adds a held call to the conversation - MTPY **Note:** "Held calls" or "active calls" means a held or active single or MTPY call. There cannot be two or more different held/active single/MTPY calls.

The following table shows the +CHLD actions according to state and operation:

Table 3-11: +CHLD Actions According to Call State and Operation

Call State	CHLD <operation>					
	0 -Release Held Call	1 - Release Active Call, Accept Held Call	1x - Release Active/Held Call x from MTPY Call	2 - Switch Between Held and Active Call	2x - Active MTPY Call to Hold, Except for Call x	3 - Add Held Call to Active Call
IDLE	Error 3					
Single Active Call	Error 3.	Releases active call.	If x=1, releases active call, otherwise error 22.	Puts active call on hold.	Error 3.	Error 3.
MTPY Active Call	Error 3.	Releases active call.	Releases specific active call x. If x does not exist, then error 22.	Puts active call on hold.	Split. If call x does not exist, then error 22.	Error 3.
Incoming Call (RING)	Error 3.					
Single Active Call and Waiting Call	Releases waiting call.	Releases active call, accepts waiting call.	Releases specific active call x. If x does not exist, then error 22.	Puts active call on hold, accepts waiting call.	Error 3.	Error 3.
MTPY Active Call and Waiting Call	Releases waiting call.	Releases active call, accepts waiting call.	Releases specific active call x. If x does not exist, then error 22.	Puts active call on hold and accepts waiting call.	Split. If x does not exist, then error 22.	Error 3.
Single Held Call	Releases held call.	Accepts held call.	Releases held call.	Accepts held call.	Error 3.	Error 3.
MTPY Held Call	Releases held call.	Accepts held call.	Releases specific call x. If x does not exist, then error 22.	Accepts held call.	Error 3.	Error 3.
Single (or MTPY) Active Call and Single (or MTPY) Held Call	Releases held call.	Releases active call and accepts held call.	Releases specific active call x. If x does not exist, then error 22.	Switches.	Error 3.	Makes a conference call.

Table 3-11: +CHLD Actions According to Call State and Operation (Cont.)

Call State	CHLD <operation>					
	0 -Release Held Call	1 - Release Active Call, Accept Held Call	1x - Release Active/Held Call x from MTPY Call	2 - Switch Between Held and Active Call	2x - Active MTPY Call to Hold, Except for Call x	3 - Add Held Call to Active Call
Held (Single or MTPY) Call and Waiting Call	Releases waiting call.	Accepts waiting call.	Error 3.	Accepts waiting call.	Error 3.	Error 3.
Single (or MTPY) Active Call and Single (or MTPY) Held and Waiting Call	Releases waiting call.	Releases active call, and accepts waiting call.	Releases specific active call x. If x does not exist, then error 22.	Error 3 (too many calls on hold.	Error 3.	Makes a conference call. Waiting call is not touched.
Split: Places the active MTPY call on hold, except for a specific call x. Switch: Places the active call on hold and accepts the Held call Error 3: "Operation not allowed" Error 22: "Not found"						

Example

```
at+chld=?
+CHLD: (0,1,1x,2,2x,3)
OK
at+ccwa=1//Enable call waiting
OK
atd9311234567; //Originate a voice call
OK
OK
(...conversation...)
+CCWA: "+358317654321",145,1,"Bob" //Awaiting call alerts
at+chld=2 //Put first call on hold and answer the second call
OK
(...conversation...)
at+chld=3 //Add the held call to the conversation
OK
(...MTPY conversation...)
at+chld=22 //Split: Place the MO active call on hold, MT call remains active
OK
at+chld=0 //Release the held call
OK
NO CARRIER
ath //Release the active call
NO CARRIER
OK
atd9311234567; //Originate a voice call
OK
```

OK
+CCWA: "055728386",129,1,"",0 //Waiting call alerts
at+chld=1//Release the active call, accept the waiting call
OK
NO CARRIER//Active 9311234567 was released
OK//Waiting 055728386 was answered

+CCFC, Call Forwarding Number and Conditions

This command enables control of the call-forwarding supplementary service. Registration, erasure, activation, deactivation, and status query are supported.

Command Type	Syntax	Response/Action	Remarks
Set	**+CCFC=<reason>,<mode>[,<number>[,<type>[,<class>[,<subaddr>[,<satype>[,<time>]]]]]]**	**If the command succeeds:** **+CCFC: <status>,<class1>[,<number>,<type>[,<subaddr>,<satype>[,<time>]]][<CR><LF>** **+CCFC: <status>,<class2>[,<number>,<type>[,<subaddr>,<satype>[,<time>]]][...]]** **+CCFC: (list of supported <reason>s)**	The Set command instructs the G24 which call forwarding settings to request from network. The Set command, in query mode, interrogates the network about the subscriber current call forwarding status.
Test	**+CCFC=?**	**+CCFC:<reason>** **OK**	The Test command returns <reason> values supported by the G24 to the terminal.

The following table shows the +CCFC parameters.

Table 3-12: +CCFC Parameters

<Parameter>	Description
<reason>	0 - Unconditional 1 - Mobile busy 2 - No reply 3 - Not reachable 4 - All call forwarding 5 - All conditional call forwarding
<mode>	0 - Disable 1 - Enable 2 - Query status 3 - Registration 4 - Erasure
<"number">	Calling line number. The number format is specified by <type>.
<type>	Type of address octet in integer format-. 145 Default when dialing string includes international access code character "+". 129 Default when making a local call.
<subaddr>	NULL, field not used (String type subaddress of format specified by <satype>).
<satype>	Field not used. Value is always 128 (unknown) - type of sub address octet in integer format.
<classx>	The sum of integers each representing a class of information. 1 - Voice 2 - Data - refers to all bearer services. 4 - Fax The default value is 7.
<time>	1-30 - The number of seconds to wait before calls are forwarded, when "no reply" is enabled or queried. The default value is 20. **Note:** The parameter must be a multiple of 5, for example, 5, 10, 15 and so on. If not, the modulo of 5 will be ignored.
<status>	0 - Not active 1 - Active

Note: A forward-to phone <number> (and the optional fields <type>, <subaddr> and <satype>) are tied to a <reason> and a <class>. This means that there can be a different <number> for the same <reason> because of a different <class>. When registering without mentioning a <class>, <class>=7 is selected.

A <number> field is mandatory when registering (<mode>=3) and it is irrelevant (ignored) in all other <mode>s.

Example

```
at+ccfc=?
+CCFC: (0,1,2,3,4,5)
OK
at+ccfc=0,3,"01256316830",129,1
OK
at+ccfc=1,3,"0545658278",129,1//Register UC forward-to of all classes.
OK
at+ccfc=1,1//Activate UC forward-to of all classes.
OK
at+ccfc=1,2 //Interrogate reason not-reachable of all classes.
+CCFC: 1,1,"+97254151200",145
+CCFC: 0,2,"",0
+CCFC: 0,4,"",0
OK //For <reason>=3, forward only voice calls is activated.
at+ccfc=4,2//Interrogate reason all-call-forwarding for all classes.
+CME ERROR: no network service//Interrogation of <reason>=30 is not supported by network.
at+ccfc=2,3,"+972545658278"
OK
at+ccfc=2,0//Disable call-forwarding for reason no-reply of all classes.
OK
at+ccfc=2,2
+CCFC: 0,1,"+972545658278",145,,25
+CCFC: 0,2,"+972545658278",145,,25
+CCFC: 0,4,"+972545658278",145,,25
OK
```

+CLIR, Calling Line Identification Restriction

This command instructs the G24 to query, enable or disable the presentation of the CLI (calling line ID) of a MO call to the called party. The restriction of the CLI (disable presentation) is dependent both on the G24 and on the network.

The network enables three possible provisions of CLIR:

- Not provisioned (CLIR Off - presentation allowed)
- Provisioned permanently
- Provisioned with Temporary mode

The provision is fixed and cannot be changed by an AT command.

Temporary Mode:

Temporary mode can be in one of two states:

- A - Presentation restricted (CLIR On) as default.
- B - Presentation allowed (CLIR Off) as default. A subscriber to Temporary mode always has a default subscription to state A or B. Temporary-mode provisioning means that the terminal can request the G24 to switch the default mode from A to B, and vice versa.

Note: When a service is in state A, and the terminal wants to enable the CLI presentation (turn CLIR off) for a single call, it can do so using the ATD command. This does not change the Temporary mode state. This can also be done when the service is in state B and the terminal wants to disable the CLI presentation (turn CLIR on) for a single call.

When setting the G24 through the handset (or by using +CKPD), the settings are valid only for the next mobile originated call. After the call, the settings return to default.

Command Type	Syntax	Response/Action	Remarks
Set	**+CLIR=<n>**	**OK**	The Set command instructs the G24 to enable/disable CLI restriction for all MO calls.
Read	**+CLIR?**	**+CLIR:<n>,<m>** **OK**	The Read command returns the current setting of CLIR on the network <m> and on the G24 <n>.
Test	**+CLIR=?**	**+CLIR: (list of supported <n>s)**	The Test command returns <n> values supported by the G24.

Table 3-13: +CLIR Parameters

<Parameter>	Description
<n>	Adjustment for outgoing calls 0 - Presentation indicator is used according to the subscription of the CLIR service 1 - CLIR invocation 2 - CLIR suppression The default is 2.
<m>	Subscriber CLIR service status in the network 0 - CLIR not provisioned 1 - CLIR provisioned in permanent mode 2 - Unknown (for example, no network and so on) 3 - CLIR Temporary mode presentation restricted (can be the default) 4 - CLIR Temporary mode presentation allowed (can be the default)

The following table shows the +CLIR parameters.

Example

at+clir=?
+CLIR: (0,1,2)
OK
at+clir?
+CLIR: 1,4
at+clir=2
OK
atd054565195;//MO voice call
OK
(… calling …)
(… a G24 that has 054565195 SIM and is CLIP enabled will receive the following on the terminal:
RING

+CLIP: "",128,,128,"",1
RING
+CLIP: "",128,,128,"",1)
ath
NO CARRIER
OK
at+clir=0
OK
atd054565195;//MO voice call
OK
(… calling …)
(… a G24 that has 054565195 SIM and is CLIP enabled will receive the following on the terminal:
RING
+CLIP: "054565006",129,,128,"",0
RING
+CLIP: "054565006",129,,128,"",0 …)
ath
NO CARRIER
OK

+CBST, Select Bearer Service Type

This command sets the GSM bearer service (data circuit duplex asynchronous and synchronous). It chooses one of the bearer services, the data rate of the service (actually the modulation when modem IWFs are used), and enables or disables the Radio Link Protocol.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CBST=[<speed>[,<name>[,<ce>]]]**	**OK** **+CME ERROR: <err>**	The Set command selects the bearer service <name> with data rate <speed> and the connection element <ce> to be used when data calls are originated (refer to GSM 02.02). Values may also be used during mobile terminated data call setup, especially in the case of single numbering scheme calls. **Note:** For incoming calls, the bearer service will be taken automatically from incoming parameters and not according to the CBST Set command. The G24 does not change the output, but for incoming calls, the phone works in automatic mode.

Command Type	Syntax	Response/Action	Remarks
Read	**AT+CBST?**	**+CBST: <speed>,<name>,<ce>** **OK**	
Test	**AT+CBST=?**	**+CBST: (list of supported <speed>s),(list of supported <name>s),(list of supported <ce>s)** **OK**	The Test command returns values supported by the MA as compound values.

The following table shows the +CBST parameters.

Table 3-14: +CBST Parameters

<Parameter>	Description
<speed>	0 - Auto-bauding (automatic selection of the speed; this setting is possible in case of 3.1 kHz modem and non-transparent service) 6 - 4800 bps (V.32) 7 - 9600 bps (V.32) 68 - 2400 bps (V.110 or X.31 flag stuffing) 70 - 4800 bps (V.110 or X.31 flag stuffing) 71 - 9600 bps (V.110 or X.31 flag stuffing) The default value is 7. **Note:** Currently the G24 supports: 2 baud rates: 4800 and 9600 bps 2 protocols: V.110 and V.32
<name>	0 - Data circuit asynchronous (UDI or 3.1 kHz modem) 1 - Data circuit synchronous (UDI or 3.1 kHz modem) The default value is 0.
<ce>	0 - Transparent 1 - Non-transparent (default)

Example

At+cbst=?
+CBST: (000,004,006,007,014,068,070,071,075),(000-001),(000-003)
OK
At+cbst?
+CBST: 007,000,001
OK
at+cbst=6
OK
at+cbst?
+CBST: 006,000,001
OK

O, Return to Online Data State

This command returns the G24 from the Command mode to the Online Data mode and issues a CONNECT or CONNECT <text> result code.

After dialing or answering (atd/ata commands and connect), the phone enters the Online Data mode where it is able to transfer data, but not to enter AT commands.

The ESC command +++, transfers the phone to the Command mode (able to input AT commands, while preserving the Data call). The O command returns the phone to the fully Online Data mode (as it was before using the ESC command).

Note: The escape character '+' can be changed using the S2-register.

The time delay between consecutive escape characters is configured using the S12-register.

Command Type	Syntax	Response/Action
Execute	**ATO**	**CONNECT** **+CME ERROR: <err> If phone is not in Data Call** **NO CARRIER: If connection is not successfully resumed.**

Example

ATD035684072//Calling a remote modem - data call
CONNECT//G24 is in Data mode
//Escaping back to Command mode using the +++ sequence
OK
AT//G24 is in Command mode
OK
ATO//Returning to Data mode
CONNECT

&Q, Asynchronous Mode

This command selects the asynchronous mode, and has no effect.

Qn	Description
Q0	Normal asynchronous operation (no error correction)
Q5	Error corrected operation (default)
Q6	Normal asynchronous operation (no error correction)

+CHUP, Hang Up Call

This command causes the G24 to hang up the current GSM call.

Command Type	Syntax	Response/Action	Remarks
Set	**+CHUP**	**OK** **+CME ERROR <err>**	The Set command hangs up the current GSM call.

+CSNS, Single Numbering Call Scheme

This command handles the selection of the bearer or teleservice to be used when a mobile terminated single numbering scheme call is established. If the calling party specifies the required bearer capability, this capability is used for the call setup attempt. If the calling party does not specify the required bearer capability (for example, because the call originated in the PSTN), the network attempts to determine it, as described below.

Some cellular networks use a multi-numbering scheme, where several mobile station ISDN numbers, or MSISDNs, are associated with one IMSI in order to define the bearer capability by the MSISDN. Each MSISDN is used for a different bearer capability. If the network uses a multi-numbering scheme and the calling party has not specified the required bearer capability, then the network uses the bearer capability associated with the called party MSISDN.

However, some networks omit the bearer capability associated with the called party MSISDN, when this MSISDN is associated with voice service and the calling party has not specified the required bearer capability (for example, because the call originated in the PSTN). In these cases, the +CSNS command is used to select the desired bearer or teleservice for a single-numbering scheme, in which one MSISDN is associated with each IMSI. The +CSNS command has a default mode, so is not mandatory to set it.

If the network uses a single-numbering scheme and the calling party has not specified the required service, then the network omits the bearer capability information.

Command Type	Syntax	Response/Action	Remarks
Set	**+CSNS=<mode>[, <repeated>]**	**OK** **+CME ERROR: <err>**	The Set command selects the bearer or teleservice to be use when a mobile-terminated single numbering scheme call is established.
Read	**+CSNS?**	**+CSNS: <mode>**	The Read command displays the currently active CSNS mode.
Test	**+CSNS =?**	**+CSNS: (list of supported mode>s), <repeated>**	The Test command displays the list of supported CSNS modes.

The following table shows the AT+CSNS parameters.

Table 3-15: +CSNS Parameters

<Parameter>	Description
<mode>	CSNS mode: 0 - Voice (default) 2 - Fax (TS 62) 4 - Data
<repeated>	Defines for how long to save the new setting: 0 One shot (new setting is not saved) 1 CSNS mode is saved until new +CSNS set command is issued or next power cycle, whichever occurs first. 2 CSNS mode is saved until new +CSNS set command is issued. The CSNS mode will be stored in non-volatile memory and will be effective after power cycle.

Note: Any mobile-terminated call lacking bearer capability information is handled according to the current CSNS setting.

When <mode> is set to data service, the parameter values set with the +CBST command are used (Refer to "+CBST, Select Bearer Service Type" on page 3-32). If the +CBST parameter is set to a value that is not applicable to single numbering calls, the G24 maps the value to the matching one, according to the Mapping Table (Table 3-16).

The <mode> selected in conjunction with <repeated> value '2' setting replaces <mode> setting in MS non-volatile memory of the bearer or teleservice to be used when mobile terminated single numbering scheme call is established. Selected <mode> is effective until new CSNS set command is issued. After power cycle, <mode> setting in MS non-volatile memory returns to be effective (<mode> selected in conjunction with <repeated> value '2' or default <mode>).

If CSNS set command is issued in conjunction with <repeated> value '0' (one shot), then selected <mode> is effective until any call indication is received (RING, CRING, CLCC, and so on). Afterwards, <mode> stored in MS non-volatile memory, returns to be effective.

If CSNS set command is issued in conjunction with <repeated> value '1', then selected CSNS <mode> is effective until new CSNS set command is issued or until next power cycle.

If CSNS set command is issued without parameter <repeated>, the value of repeated is assumed to be '0'.

The only +CBST parameter that needs mapping for mobile terminated calls is <speed>, as described in the table below. The V.110 protocol is replaced by the analog protocol regardless of the +CBST setting. All other parameters are set by the +CBST command.

Table 3-16: Mapping Table (V.34)

+CBST setting	Mapped value for mobile terminated call
0	autobauding
4	2400 bps (V.22bis)
6	4800 bps (V.32)
7	9600 bps (V.32)
14	14400 bps (V.34)
68	2400 bps (V.110 or X.31 flag stuffing)
70	4800 bps (V.110 or X.31 flag stuffing)
71	9600 bps (V.110 or X.31 flag stuffing)
75	14400 bps (V.110 or X.31 flag stuffing)

Note: CSNS has read-only access to CBST data.

+MDC, Selection of Desired Message to Be Displayed Upon Connection of a Voice Call

This AT command enables you to select the desired messages to be displayed upon connection of a voice call with a remote party. The OK and CONNECT messages are available.

Command Type	Syntax	Response/Action	Remarks
Set	**+MDC=<mode>**	**OK** **or:** **ERROR**	The Set command selects which of the supported messages will be displayed upon connection of a voice call. <mode> Command Parameters: 0 - Display OK on voice call connection 1 - Display CONNECT on voice call connection Default Values: Power Up - As previously saved in NVM FLEX bit 0 - Before Set command is first used
Read	**+MDC?**	**++MDC: <mode>** **OK**	The Read command should return the current selection of <mode>.
Test	**+MDC=?**	**+MDC: (list of supported <mode>s)** **OK**	The Test command returns the possible <mode> values.

Example

```
AT+MDC=?
+MDC: (0-1)
OK
AT+MDC=1
OK
ATD<number>;
OK
CONNECT
AT+MDC?
+MDC: 1
OK
AT+MDC=0
OK
ATD<number>;
OK
OK
AT+MDC?
+MDC: 0
OK
```

+CTFR1, Divert an Incoming Call When User Busy

This command terminates an incoming call and diverts the caller to the number previously defined in CCFC, or to a voice mail if one exists for the subscriber. This is done by sending a user-defined User Busy message to the network.

Command Type	Syntax	Response/Action	Remarks
Set	+CTFR1	OK and NO CARRIER or: +CME ERROR: <err>	The Set command will hand up (terminate) the incoming call, causing the network to divert the incoming call to the number that was set by the CCFC command for "User Busy", or the voice mail, if one exists for the subscriber

Example

```
RING //Incoming call indication
AT+CTFR1
OK
NO CARRIER
AT+CTFR1 //When an active call exists and another call is waiting
OK
NO CARRIER
AT+CTFR1 //When there is no incoming call or waiting call
+CME ERROR: operation not allowed
```

Call Status Messages

+CPAS, Phone Activity Status

This command displays the current activity status of the G24, for example, call in progress, or ringing.

Command Type	Syntax	Response/Action	Remarks
Execute/Read	**AT+CPAS** **AT+CPAS?**	**+CPAS: <pas>** **OK** **or:** **+CME ERROR: <err>**	The Execute and Read commands return the activity status <pas> of the G24. They can be used to interrogate the G24.
Test	**AT+CPAS=?**	**+CPAS: (list of supported <pas>s)** **OK** **or:** **+CME ERROR: <err>**	

The following table shows the +CPAS parameters.

Table 3-17: +CPAS Parameters

<Parameter>	Description
<pas>	0 - Ready - The G24 allows commands from the terminal 2 - Unknown - The G24 is not guaranteed to respond to instructions 3 - Ringing (MT calls) - The G24 is ready for commands from the terminal, but the ringer is active 4 - Call in progress - The G24 is ready for commands from the terminal, but a call is in progress

Example

at+CPAS
+CPAS: 0
OK
at+CPAS=?
+CPAS: (0,2-4)
OK
at+CPAS?
+CPAS: 4
OK
AT+CPAS//Voice call active state
+CPAS: 4
OK

+CLCC, List Current Calls

This command displays a list of all current G24 calls and their statuses, and also enables/disables the unsolicited indication of the call list. (If no calls are received, no information response is sent to the terminal.)

If the command succeeds but no calls are available, no information response is sent to the terminal.

The maximum number of simultaneous multiparty calls is 5+1 (5 in active group and 1 on hold).

On all platforms besides Telematics-enabled GSM platforms, this command responds with a +CME error indicating that the operation is not supported.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CLCC=<state>**	**OK** **or:** **+CME ERROR: <err>**	The Set command enables/disables unsolicited indications.
Execute	**AT+CLCC**	**+CLCC: <idx>,<dir>,<call state>, <mode>, <mpty>[,<number>,<type>,<alpha>]** **[<CR><LF>+ CLCC: <idx>,<dir>,<call state>, <mode>,<mpty>[,<number>,<type>,<alpha>]** **[…]]** **OK**	The Execute command enables the receiving of data about current calls.
Read	**AT+CLCC?**	**+CLCC: <state>** **OK** **or:** **+CME ERROR <err>**	The Read command returns the call status.
Test	**AT+CLCC=?**	**+CLCC: (List of supported <state>s)** **OK** **or:** **+CME ERROR <err>**	

The following table shows the +CLCC parameters.

Table 3-18: +CLCC Parameters

<Parameter>	Description
<state>	0 Disable CLCC unsolicited indication 1 Enable CLCC unsolicited indication The default value is 0.
<idx>	Integer type, call identification number
<dir>	0 Mobile originated call (MO) 1 Mobile terminated call (MT)
<call state>	The state of the call 0 Active 1 Held 2 Dialing (MO call) 3 Alerting (MO call) 4 Incoming (MT call) 5 Waiting (MT call) 6 Released
<mode>	Bearer/Teleservice 0 Voice Call 1 Data 2 Fax
<mpty>	Multiparty status 0 Call is not part of a multiparty call 1 Call is one of multiparty call parties
<number>	Phone number in the format specified by <type>. Contains a string of up to 32 characters.
<type>	Phone number display format. Type of address octet in integer format (refer to GSM 04.08 [8] subclause 10.5.4.7) 129 Local number 145 International number with access character +
<alpha>	Text representation of the phone book entry. String type alphanumeric representation of <number> corresponding to the entry found in the phone book. Contains a string of up to 20 characters.

Note: When a mobile-originated call is routed to PSTN (PABX), no ALERT indication is prompted.

Example

```
AT+CLCC=?
+CLCC: (0,1)
OK
AT+CLCC
+CLCC: 1,0,0,0,0,"01256316830",129,"Shmuel"
OK
AT+CLCC?
```

+CLCC: 0
OK
AT+CLCC=1//Example with unsolicited indication
OK
ATD055490698;
OK
+CLCC: 1,0,2,0,0,"055490698",129,"Alpha"
+CLCC: 1,0,3,0,0,"055490698",129," Alpha "
OK
+CLCC: 1,0,0,0,0,"055490698",129," Alpha "
ATH
NO CARRIER
OK
+CLCC: 1,0,6,0,0,"055490698",129," Alpha

+MCST, Call Status Messages

This command displays the current state of the call processing, and also enables/disables the unsolicited indication of any change in the call processing state.

Command Type	Syntax	Response/Action	Remarks
Set	**+MCST=<n>**	**OK** **or:** **+CME ERROR: <err>**	The Set command Enables/disables the unsolicited call status messages.
Read	**+MCST?**	**+MCST: <state>** **OK**	The Read command returns the current call processing state.

+MCST Indication

When a change in call state occurs and the +MCST is set to n=1 the G24 will give the following indication:

+MCST: <state>

+MCST Parameters

The following table shows the +MCST parameters.

Table 3-19: +MCST Parameters

<Parameter>	Description
<n>	0 - Disable MCST unsolicited indication 1 - Enable MCST unsolicited indication
<state>	1 - Idle call state 2 - Single incoming call 3 - Single call active 4 - Multi-party call active 5 - Single call held 6 - Multi-party call held 7 - Dual call (fully connected active call and held call) 8 - Dual multi-party call active 9 - Dual multi-party call held 10 - Single active call plus call waiting 11 - Multi-party call active plus call waiting 12 - Single call held plus call waiting 13 - Multi-party call held plus call waiting 14 - Dual calls plus call waiting 15 - Dual multi-party calls active plus call waiting 16 - Dual multi-party calls held plus call waiting 17 - Call control busy 64 - Calling 68 - No Service 69 - No Redial 72 - Security Fail
<type>	Phone number display format. Type of address octet in integer format (refer to GSM 04.08 [8] subclause 10.5.4.7) 129 Local number 145 International number with access character +
<alpha>	Text representation of the phone book entry. String type alphanumeric representation of <number> corresponding to the entry found in the phone book. Contains a string of up to 20 characters.

Example

AT+MCST?
+MCST: 1 // **<idle>**
AT+MCST=1
OK
atd035684423;
+MCST: 17
OK
+MCST: 17
+MCST: 255
OK

+MCST: 3
+MCST: 17
NO CARRIER
+MCST: 1

Call Advice of Charge Commands

This set of commands enables GSM operators to offer Advice of Charge (AoC) services that calculate call charges. These charges are expressed in terms of home units.

+CAOC, Advice of Charge

This command displays information about the cost of calls. If supported, this command also activates/deactivates unsolicited event reporting of the CCM (Current Call Meter) information.

The unsolicited report +CCCM:<ccm> is sent when the CCM value changes, but not more than once every 10 seconds.

Note: The CCM value depends on the network properties (charge for MO or/and MT calls).

There are two states in which the command can be activated:

- In IDLE state - returns the last call cost.
- In a voice/data state - returns the accumulated cost, including the current call.

Command Type	Syntax	Response/Action	Remarks
Set	**+CAOC[=<mode>]**	**OK** **or:** **[+CAOC:<ccm>]** **or:** **+CME ERROR:<err>**	The Set command returns the CCM value from the G24, or activates/deactivates unsolicited reports.
Read	**+CAOC?** **+CAOC**	**+CAOC: <mode>** **OK** **OK** **or:** **[+CAOC: <ccm>]** **or:** **+CME ERROR: <err>**	The Read command returns the current CAOC mode.
Test	**+CAOC=?**	**+CAOC: (list of supported <mode>s)** **OK**	The Test command returns the supported mode values.

The following table shows the +CAOC parameters.

Table 3-20: +CAOC Parameters

<Parameter>		Description
<mode>	0	Queries the CCM value
	1	Deactivates unsolicited reporting of the CCM value
	2	Activates unsolicited reporting of the CCM value

Note: <CCM>: String type value representing three bytes of the current call meter value in hexadecimal format (for example, "00001E" indicates decimal value 30).

Example

Example with prepaid SIM card with 56700.00L prepaid before the test.

at
OK
at+caoc=2
OK
atd+97254565190;
OK
OK
+CCCM: "000000"
+CCCM: "000006"
at+caoc
+CAOC: "000009"
OK
+CCCM: "00000e"
+CCCM: "000016"
at+caoc
+CAOC: "00001d"
OK
+CCCM: "00001e"
+CCCM: "000027"
at+caoc=0
+CAOC: "00002d"
OK
at+caoc=2
OK
+CCCM: "00003d"
at+caoc
+CAOC: "00003f"
OK
+CCCM: "000046"
at
+CCCM: "00004e"
+caoc
+CAOC: "00004f"
OK
+CCCM: "000056"

at+caoc
+CAOC: "00005d"
OK
+CCCM: "00005e"
NO CARRIER
at+caoc
+CAOC: "000066"
OK
//567 (prepaid SIM value) - 102 (price per call unit by provider) x 66 (call units) = 465 left in prepaid SIM
OK

There is now 46500.00L prepaid remaining on the SIM card.

Note: The above example shows first time activation of the AOC feature using the G24. Therefore, the accumulated cost is equal to the current call cost.

+CACM, Accumulated Call Meter

This command resets the Advice of Charge accumulated call meter value in the SIM file, EFACM. ACM contains the total number of home units for both the current call and preceding calls.

Refer to "+CAMM, Accumulated Call Meter Maximum", page 3-47.

Command Type	Syntax	Response/Action	Remarks
Set	**+CACM=<passwd>**	**OK** **+CME ERROR: <err>**	The Set command resets the accumulated call meter value. SIM PIN2 is required.
Read	**+CACM?**	**+CACM: <acm>** **+CME ERROR: <err>**	The Read command displays the current value of ACM.
Test	**+CACM=?**	**OK**	The Test command indicates whether the +CACM command is functioning.

The following table shows the +CACM parameters.

Table 3-21: +CACM Parameters

<Parameter>	Description
<passwd>	SIM PIN2 password Maximum string length is 8 characters. If this value is exceeded, the command terminates in an error. If PIN2 is incorrect, "+CME ERROR: incorrect password" is displayed.
<acm>	Accumulated call meter maximum value (similar to CCM; Refer to "+CAOC, Advice of Charge", page 3-44). The default is 0. <ccm> String type; three bytes of the current call meter value in hexadecimal format (for example, 00001E indicates a decimal value of 30). Value is given in home units; bytes are similarly coded as the ACMmax value in the SIM.

Example

```
AT+CACM=?
OK
AT+CACM?
+CACM:"000000"
OK
AT+CACM="2222"
OK
```

+CAMM, Accumulated Call Meter Maximum

This command sets the Advice of Charge accumulated call meter maximum value in the SIM file, EFACMmax. ACMmax contains the maximum number of home units the subscriber is able to consume. When the ACM (Refer to "+CACM, Accumulated Call Meter", page 3-46) reaches ACMmax, additional calls (mobile-originated and mobile-terminated calls that incur charges) are prohibited, except for emergency calls. Refer to GSM 02.24.

Command Type	Syntax	Response/Action	Remarks
Set	**+CAMM=[<acmmax>,<passwd>]**	**OK** **+CME ERROR: <err>**	The Set command sets the accumulated call meter maximum value. SIM PIN2 is required. The value that is set remains after a power cycle. **Note:** This command is activated if Advice of Charge is supported by the network.
Read	**+CAMM?**	**+CAMM: <acmmax>** **+CME ERROR: <err>**	The Read command displays the current value of ACMmax.
Test	**+CAMM=?**	**OK**	The Test command indicates whether the +CAMM command is functioning.

The following table shows the +CAMM parameters.

Table 3-22: +CAMM Parameters

<Parameter>	Description
<acmmax>	Accumulated call meter maximum value (similar to CCM; Refer to "+CAOC, Advice of Charge", page 3-44) ccm> String type; three bytes of the current call meter value in hexadecimal format (for example, 00001E indicates a decimal value of 30). Value is given in home units; bytes are similarly coded as the ACMmax value in the SIM. Range is from 00001 to FFFFFF. 0 Disables ACMmax (default)
<passwd>	SIM PIN2 password Maximum string length is 8 characters. If this value is exceeded, the command terminates in an error. If PIN2 is incorrect, "+CME ERROR: incorrect password" is displayed.

Example

```
AT+CAMM=?
OK
AT+CAMM="FFFFFF","2222"
OK
AT+CAMM?
+CAMM: "FFFFFF"
OK
```

+CPUC, Price per Unit and Currency Table

This command sets the parameters of the Advice of Charge-related price per unit and currency table found in the SIM file, EFPUCT. PUCT information is used to convert the home units (used in +CAOC, +CACM and +CAMM) into currency units.

Command Type	Syntax	Response/Action	Remarks
Set	**+CPUC=<currency>,<ppu>,<passwd>**	**OK** **+CME ERROR: <err>**	The Set command sets the price per unit and the currency table. SIM PIN2 is required. The new value is retained after a power cycle.
Read	**+CPUC?**	**+CPUC: <currency>,<ppu>** **+CME ERROR: <err>**	The Read command displays the current price per unit and currency table.
Test	**+CPUC=?**	**OK**	The Test command indicates whether the +CPUC command is functioning.

The following table shows the +CPUC parameters.

Table 3-23: +CPUC Parameters

<Parameter>	Description
<currency>	Currency code character set (3 characters) defined by +CSCS command. (Refer to "+CSCS, Select Terminal Character Set", page 3-4.) If the string begins with an alphanumeric character, it may be entered with or without quotation marks, for example, "GBP", "DEM".
<ppu>	Price per unit A dot is used as a decimal separator (precision of 1/1000; 15 digit maximum), for example,"2.667". [See notes below]
<passwd>	SIM PIN2 password Maximum string length is 8 characters. If this value is exceeded, the command terminates in an error. If PIN2 is incorrect, "+CME ERROR: incorrect password" is displayed.

Example

```
AT+CPUC=?
OK
AT+CPUC="GBP","0.125","2222"
OK
AT+CPUC?
+CPUC: "GBP","0.125"
OK
```

Note: If <ppu> contains a dot, a maximum of three digits may appear after the dot, otherwise an error is generated. For example, if <ppu>=0.61, the Read command displays 0.610. <ppu>=1.2345 terminates in an error.

If <ppu> does not contain a dot, the number is divided by 1000. For example, if <ppu>=1, the Read command displays 0.001.

Due to storage constraints, the <ppu> value is limited to a range of 0 to 4095. Values beyond this range may result in rounding errors. For example, if <ppu>=4095, the Read command displays 4.095. However, if <ppu>=4096, the Read command displays 4.090 (the last digit is replaced by 0). If <ppu>=456789, the Read command displays 456.000.

+CR, Service Reporting Control

This command controls whether or not the extended format of an outgoing call is displayed or not. The +CR indication is sent from the G24 to the terminal whenever a data call is initiated by the G24.

Command Type	Syntax	Response/Action	Remarks
Set	**+CR=[<mode>]**	**OK**	The Set command enables/disables the extended format of an outgoing data call. When enabled, the outgoing data call is indicated to the terminal through the unsolicited result code +CR:<serv>. When the command is disabled, no +CR is sent to the terminal.
Read	**+CR?**	**+CR:<mode>**	The Read command displays the current service reporting control setting.
Test	**+CR=?**	**+CR:<mode>**	The Test command displays the list of supported CR modes.

The following table shows the +CR parameters.

Table 3-24: +CR Parameters

<Parameter>	Description	
<mode>	0	Extended format disabled (default)
	1	Extended format enabled
<serv>	Type of outgoing data calls: ASYNC - Asynchronous transparent SYNC - Synchronous transparent REL ASYNC - Asynchronous non-transparent REL SYNC - Synchronous non-transparent	

Example

AT+CR=1//Enable reporting
OK
ATD1234567890
+CR: REL ASYNC

Supplementary Services

This set of commands enables control over supplementary service notifications, including Structured and Unstructured Supplementary Service Data (USSD) data.

+CSSN, Supplementary Service Notifications

This command handles the enabling and disabling of supplementary service-related, network-initiated, notifications.

Command Type	Syntax	Response/Action	Remarks
Set	**+CSSN=[<n>[,<m>]]**	**OK** **+CME ERROR: <err>**	The Set command enables/disables the display of notification result codes to the TE. When <n>=1 and a supplementary service notification is received after a mobile-originated call setup, the +CSSI: notification is sent to the TE before any other mobile-originated call setup result codes. When several different notifications are received from the network, each of them receives 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, the unsolicited result code +CSSU: is sent to the TE. In case of a mobile-terminated call setup, a CSSU is sent after every +CLIP result code ("+CLIP, Calling Line Identification" on page 3-20). When several different events are received from the network, each of them receives its own +CSSU result code. **Note:** The values for <n> and <m> are not saved after power cycle.
Read	**+CSSN?**	**+CSSN: <n>,<m>**	The Read command displays the current supplementary service notification setting.
Test	**+CSSN=?**	**+CSSN: (0-1), (0-1)**	The Test command displays the list of supported CSSN values.

The following table shows the +CSSN parameters.

Table 3-25: +CSSN Parameters

<Parameter>	Description
<n>	Sets/displays the +CSSI result code presentation status. This value must be specified. 0 Disable (default) 1 Enable
<m>	Sets/displays the +CSSU result code presentation status. This value is optional, but cannot be specified without <n>. 0 Disable (default) 1 Enable

Table 3-26: +CSSI Notification Values

Value	Description	G24 Support
0	Unconditional call forwarding is active	Yes
1	Some conditional call forwarding is active	Yes
2	Call has been forwarded	Yes
3	Call is waiting	Yes (GSM only)
4	CUG call (<index> is present)	Yes
5	Outgoing calls are barred	Yes
6	Incoming calls are barred	Yes
7	CLIR suppression rejected	Yes
8	Call has been deflected	No

Table 3-27: +CSSU Notification Values

Value	Description	G24 Support
0	This is a forwarded call (mobile-terminated call setup).	Yes
1	CUG call (<index> is present; mobile-terminated call setup).	Yes
2	Call has been put on hold (during a voice call)	Yes
3	Call has been retrieved (during a voice call)	Yes
4	Multiparty call has been entered (during a voice call)	Yes

Table 3-27: +CSSU Notification Values (Cont.)

Value	Description	G24 Support
5	Call on hold has been released (during a voice call; not a supplementary service notification)	Yes
6	Forward check supplementary service message received (can be received at any time)	Yes
7	Call is being connected with the remote party in an alerted state using an explicit call transfer operation (during a voice call).	Yes
8	Call has been connected with the other remote party using an explicit call transfer operation (during a voice call or during mobile-terminated call setup). Number and subaddress parameters may be present: <number>String type phone number of format defined by <type> <type>Type of address octet in integer format (refer to GSM 04.08 [8], subclause 10.5.4.7) <subaddr>String type subaddress of format defined by <satype> <satype>Type of subaddress octet in integer format (refer to GSM 04.08 [8], subclause 10.5.4.8)	Yes
9	Deflected call (mobile-terminated call setup)	No

Example

AT+cssn=?// test command
+CSSN: (0-1),(0-1)
OK
AT+cssn=0,0// disable both options
OK
AT+cssn=1,0// set n value as enabled, m disabled
OK
AT+cssn?
+CSSN: 1,0// display the current n & m values
OK
+CSSI: 1// displayed after mobile originated call setup of call forward and n enable
+CSSU: 2//displayed when a call has been placed on hold (during the call) using the +CHLD AT command and m enable

+CUSD, Unstructured Supplementary Service Data

This command allows control of Unstructured Supplementary Service Data (USSD), according to GSM 02.90. Mobile-initiated operations are supported.

Command Type	Syntax	Response/Action	Remarks
Set	**+CUSD=<n>[,<str>]**	**OK** **+CME ERROR: <err>**	The Set command enables/disables the display of the following unsolicited result code, +CUSD: <m>[,<str>] (the USSD response from the network), to the TE. The new value is not retained after a power cycle.
Read	**+CUSD?**	**+CUSD: <n>** **+CME ERROR: <err>**	The Read command displays the current value of <n>.
Test	**+CUSD=?**	**+CUSD: (list of supported <n>s)** **+CME ERROR: <err>**	The Test command displays the supported values of <n>.

The following table shows the +CUSD parameters.

Table 3-28: +CUSD Parameters

<Parameter>	Description
<n>	Sets/displays the result code presentation status of the G24. 0 Disable (default) 1 Enable
<str>	A USSD string that, when included, causes a mobile-initiated USSD string or response USSD string to be sent to the network. The response USSD string is returned in a subsequent unsolicited +CUSD result code. <str> starts with either "*" or "#". The maximum length is 200 characters, based on +CSCS. When <str> is not included, the network is not queried.
<m>	Whether further user action is required. 0 No further user action required (either network-initiated USSD-Notify, or no further information needed after a mobile-initiated operation) 1 Further user action required (either network-initiated USSD-Request, or further information needed after a mobile-initiated operation 2 USSD terminated by the network (the reason for the termination is indicated by the index, as described in Table Note:)

Example

```
AT+CUSD=?
+CUSD: (0,1,2)
OK
AT+CUSD=1,"*#100#"OK
+CUSD: 2,26//Response of the command <m>=2, reason = 26 (SIGNALING ERROR)
AT+CUSD?
+CUSD: 1
OK
```

Note: When the mobile-initiated operation is successful, the MS is implemented according to the required version. It waits for the USSD response from the network and then sends it to the TE before the final result code.

Table 3-29: CUSD Termination Cause Table Index

Termination Cause	Index
NO_CAUSE	0
CC_BUSY	1
PARAMETER_ERROR	2
INVALID_NUMBER	3
OUTGOING_CALL_BARRED	4
TOO_MANY_CALLS_ON_HOLD	5
NORMAL	6
DROPPED	10
NETWORK	12
INVALID_CALL_ID	13
NORMAL_CLEARING	14
TOO_MANY_ACTIVE_CALLS	16
UNASSIGNED_NUMBER	17
NO_ROUTE_TO_DEST	18
RESOURCE_UNAVAILABLE	19
CALL_BARRED	20
USER_BUSY	21
NO_ANSWER	22
CALL_REJECTED	23
NUMBER_CHANGED	24
DEST_OUT_OF_ORDER	25
SIGNALING_ERROR	26
NETWORK_ERROR	27

Table 3-29: CUSD Termination Cause Table Index (Cont.)

Termination Cause	Index
NETWORK_BUSY	28
NOT_SUBSCRIBED	29
SERVICE_UNAVAILABLE	31
SERVICE_NOT_SUPPORTED	32
PREPAY_LIMIT_REACHED	33
INCOMPATIBLE_DEST	35
ACCESS_DENIED	43
FEATURE_NOT_AVAILABLE	45
WRONG_CALL_STATE	46
SIGNALING_TIMEOUT	47
MAX_MPTY_PARTICIPANTS_EXCEEDED	48
SYSTEM_FAILURE	49
DATA_MISSING	50
BASIC_SERVICE_NOT_PROVISIONED	51
ILLEGAL_SS_OPERATION	52
SS_INCOMPATIBILITY	53
SS_NOT_AVAILABLE	54
SS_SUBSCRIPTION_VIOLATION	55
INCORRECT_PASSWORD	56
TOO_MANY_PASSWORD_ATTEMPTS	57
PASSWORD_REGISTRATION_FAILURE	58
ILLEGAL_EQUIPMENT	59
UNKNOWN_SUBSCRIBER	60
ILLEGAL_SUBSCRIBER	61
ABSENT_SUBSCRIBER	62
USSD_BUSY	63
CANNOT_TRANSFER_MPTY_CALL	65
BUSY_WITH_UNANSWERED_CALL	66
UNANSWERED_CALL_PENDING	68
USSD_CANCELED	69
PRE_EMPTION	70
OPERATION_NOT_ALLOWED	71
NO_FREE_BEARER_AVAILABLE	72

Table 3-29: CUSD Termination Cause Table Index (Cont.)

Termination Cause	Index
NBR_SN_EXCEEDED	73
NBR_USER_EXCEEDED	74
Call Control by SIM Causes	
NOT_ALLOWED_BY_CC	75
MODIFIED_TO_SS_BY_CC	76
MODIFIED_TO_CALL_BY_CC	77
CALL_MODIFIED_BY_CC	78
App. Cause	
FDN_FAILURE	90

+COLP, Connected Line Identification Presentation

This command relates to the GSM supplementary service called COLP (Connected Line Identification Presentation), which enables a calling subscriber to obtain the connected line identity (COL) of the called party after setting up a mobile-originated call with the G24. For example, after setting up a mobile-originated call to one number that is forwarded to another number, the calling party will see the number of that third party.

When this command is enabled (and the called subscriber permits it), the following intermediate result code is returned:

+COLP: <number>,<type>[,<subaddr>,<satype>[,<alpha>]].

Note: This command is activated when COLP is supported by the network.

Command Type	Syntax	Response/Action	Remarks
Set	**+COLP=<n>**	**OK** **+CME ERROR: <err>**	The Set command enables/disables the display of the COL at the TE on the G24. It has no effect on the execution of the COLR supplementary service on the network. The value set by this command is not retained after a power cycle.
Read	**+COLP?**	**+COLP: <n>,<m>** **+CME ERROR: <err>**	The Read command displays the status of <n>. It also initiates a query of the COLP service provision status and displays <m>.
Test	**+COLP=?**	**+COLP: (list of supported <n>s)** **+CME ERROR: <err>**	The Test command displays the supported values of <n>.

The following table shows the +COLP parameters.

Table 3-30: +COLP Parameters

<Parameter>	Description
<n>	Sets/displays the result code presentation status of the G24. 0 Disable (default) 1 Enable
<m>	Displays the subscriber's COLP service status in the network. 0 COLP not provisioned 1 COLP provisioned 2 Unknown (for example, no network, and so on)
<number>	Sets the phone number, using the format specified by <type>.
<type>	Sets the address octet type in integer format (refer to GSM 04.08 [8] subclause 10.5.4.7). 129 Unknown 145 International (used when dialing string includes "+" international access code character)
<subaddr>	Sets the subaddress, using the format specified by <satype>.
<satype>	Sets the address octet type in integer format (refer to GSM 04.08 [8] subclause 10.5.4.8).
<alpha>	An optional, string-type, alphanumeric representation of <number> corresponding to the entry found in the phonebook. The character set is defined by +CSCS (Refer to "+CSCS, Select Terminal Character Set", page 3-4).

Example

At+colp=0
OK
At+colp=2
+CME ERROR: Numeric parameter out of bounds

Phone Books and Clock

Directory Access Commands

This set of commands enables read/write access to the phone book contained within the G24, including both the numeric and the alpha information contained in the location. The presentation is according to GSM 07.07.

In some cases, it may be possible to use these commands to access the dialed and received call stacks. However, as these phone books cannot be edited, the +CPBW command does not work on them.

+CPBS, Select Phone Book Memory

This command handles the selection of the memory to be used for reading and writing entries in the G24's phone books' memory. (When there is separate storage on the SIM card and in the G24's internal EEPROM).

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CPBS=<storage>**	**OK** **or:** **+CME ERROR: <err>**	The Set command selects the phone book memory storage which is to be used by other phone book commands.
Read	**+CPBS?**	**+CPBS: <storage>[,<used>,<total>]**	The Read command returns the currently selected phone book memory, number of used entries and total number of entries in the phone book memory.
Test	**+CPBS=?**	**+CPBS: (list of supported <storage>s)** **OK**	Test command returns the supported storages as a compound value.

Note: Read format of +CPBS joins RC and MC, therefore the united list will be prompted.

The following table shows the +CPBS parameters.

Table 3-31: +CPBS Parameters

<Parameter>	Description
<storage>	List of supported phone books and their storage IDs FD SIM Fixed dialing phone book. LD SIM Last dialed phone book (the same as "DC"). MC G24 missed (unanswered received) calls list (+CPBW may not be applicable for this storage). ME G24 phone book. MT Combined G24 and SIM phone book. RC G24 received calls list (+CPBW may not be applicable for this storage). SM SIM phone book. DD Quick Dial phone book.
<used>	Integer type value indicating the number of used locations in the selected memory.
<total>	Integer type value indicating the total number of entries in the selected phone book memory (depended on phone or SIM).

Example

At+cpbs="ME"
OK
At+cpbr=?
+CPBR: (1-500,40,24)
OK
At+cpbr=1
OK
At+cpbr=1,3 //There is nothing written in entry 1,2,3
OK
At+cpbs="MT"
OK
At+cpbr=?
+CPBR: (1-750,40,24)
OK
At+cpbr=1,3
OK
At+cpbr=1,750
+CPBR: 101,"+97252999080", 145,"Voice Mail"
OK

+CPBR, Read Phone Book Entries

This command recalls phone book entries from a specific entry number or from a range of entries. If only one entry is specified, and that entry is empty, OK is returned. If a range of entries is requested, all entries that contain data within that range are returned. If a listing fails in a G24 error, +CME ERROR: <err> is returned.

This command can also be used to obtain information about the number of entries and the maximum size of a phone number and alpha tag fields in the phone book.

This command acts on the currently active phone book, as selected with the +CPBS command (Refer to "+CPBS, Select Phone Book Memory", page 3-59).

Command Type	Syntax	Response/Action	Remarks
Set	**+CPBR=<index1>[,<index2>]**	**[+CPBR: <index1>,<number>,<type>,<text>** **[<CR><LF>** **+CPBR: <index2>,<number>,<type>,<text>]]** **OK** **or:** **+CME ERROR: <err>**	The Set command returns phone book entries.
Test	**+CPBR=?**	**+CPBR: (list of supported <index>s),[<nlength>], [<tlength>]** **OK**	The Test command returns the entry range supported by the current storage as a compound value and the maximum lengths of the <number> and <text> fields.

The following table shows the +CPBR parameters.

Table 3-32: +CPBR Parameters

<Parameter>	Description
<index1> **<index2>**	Index for a given phone book entry
<number>	Phone number of a given entry
<type>	The address type of a phone number 129 Use for local call 145 Use "+" for international access code 128 Unknown "128" is used to represent an email address or a mailing list. In this case, <ph_type> can be used to further differentiate between the two.
<text>	Text identifier for a phone book entry, according to the character set as specified by command +CSCS.
<nlength>	The maximum number of digits in the <number>.
<tlength>	The maximum number of characters in the <text> entry

Note: The MC and RC have the same memory storage area, therefore there are only 10 entries in total. Some of the entries are listed if the MC phone book is selected, and others are listed if the RC phone book is selected. The phone book selection is done using the AT+CPBS command.

Example

```
At+cpbs="ME"
OK
At+cpbr=?
+CPBR: (1-100,40,24)
OK
At+cpbr=1
OK
At+cpbr=1,3 //There is nothing written in entry 1,2,3
OK
At+cpbs="MT"
OK
At+cpbr=?
+CPBR: (1-350,40,24)
OK
At+cpbr=1,3
OK
At+cpbr=1,350
+CPBR: 101,"+97252999080",145,"Voice Mail"
OK
```

+CPBF, Find Phone Book Entries

This execution command enables the user to search for a particular entry, by name, in the currently active phone book. If no matching entry is found, the command returns OK. If multiple matches are found, all are returned.

Command Type	Syntax	Response/Action
Set	+CPBF=<findtext>	[+CPBF: <index1>,<number>,<type>,<text>[[...] <CR><LF> +CBPF: <index2>,<number>,<type>,<text>]] OK or: +CME ERROR: <err>
Test	AT+CPBF=?	+CPBF: [<nlength>],[<tlength>] OK

The following table shows the +CPBF parameters.

Table 3-33: +CPBF Parameters

<Parameter>	Description
<findtext>	Case-sensitive text substring to search for, according to the character set specified by the +CSCS command.
<index1> <index2>	Index for a given phone book entry

Table 3-33: +CPBF Parameters (Cont.)

<Parameter>	Description
<number>	Phone number of a given entry
<type>	The address type of a phone number 129 Use for local call 145 Use “+” for international access code 128 Unknown **Note:** "128" is used to represent an email address or a mailing list. In this case, <ph_type> can be used to further differentiate between the two.
<text>	Text identifier for a phone book entry that starts with the substring <findtext>, according to the character set as specified by command +CSCS.

Example

AT+CPBS="MT" //Selecting phone book
OK
AT+CPBF="k" //Searching for "k" and not finding it
OK
AT+CPBF="Voice" //Searching for string "Voice" and finding Voice Mail
+CPBF: 101,"+97252999080",145,"Voice Mail"
OK
AT+CPBF="" //Searching for everything in phone book, and finding all entries
+CPBF: 2,"8475767800",129,"Moto Voicemail"
+CPBF: 101,"+97252999080",145,"Voice Mail"
OK
AT+CPBF="Moto"
+CPBF: 2,"8475767800",129,"Moto Voicemail"

+CPBW, Write Phone Book Entry

This command enables the user to store a new entry in the phone book, or edit/delete an existing entry from the phone book. A particular entry in the phone book can be stored, or the next available entry is used.

This command writes the entry in the currently active phone book, selected with the +CPBS command (Refer to “+CPBS, Select Phone Book Memory”, page 3-59). The entry is selected by <index>, the phone number is entered into the <number> field and text associated with the number is entered into the <text> field. If these fields are omitted, the phone book entry is deleted. If the <index> field is omitted, but a number is entered in the <number> field, the phone number is entered into the first available entry in the phone book. If the writing fails in a G24 error, +CME ERROR: <err> is returned.

Note: The "FD" phone book supports single wild card characters (?) and prefixes of a number in the telephone number field. In cases of fixed dialing, these entries in the "FD" phone book define a group of permitted numbers.

Call indications related to a fixed dialing entry containing wild cards or only a prefix of a number do not display any <alpha> identifier.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CPBW=[<index>][, <number> [,<type>[,<text>]]]**	**OK** **or:** **+CME ERROR: <err>**	
Test	**AT+CPBW=?**	**+CPBW: (list of supported <index>s),[<nlength>], (list of supported <type>s),[<tlength>]** **OK**	This command queries the allowable command field and sizes.

The following table shows the +CPBW parameters.

Table 3-34: +CPBW Parameters

<Parameter>	Description
<index>	Index for a given phone book entry
<number>	Phone number of a given entry
<type>	The address type of a phone number 129 Use for local call 145 Use “+” for international access code 128 Unknown **Note:** "128" is used to represent an email address or a mailing list. In this case, <ph_type> can be used to further differentiate between the two.
<text>	Text identifier for a phone book entry, according to the character set as specified by command +CSCS.
<nlength>	The maximum size of a phone number, in digits. There is a limited number of PB records that can be stored with this length. The number of "long" PB records depends on the size of the SIM card EXT1 extension file. If the extension file is full, an attempt to store a new record with more than 20 digits returns an error.
<tlength>	The maximum number of characters in the <text> entry. This applies to GSM standard characters only. Non-GSM standard character sets and extended GSM characters require additional space in storage. In some cases, when using such characters the text cannot be stored. In this case, the G24 returns a "text string too long"error.

Example

At+cpbs="MT"
OK
At+cpbw=?
+CPBW: (1-750),40,(129,145),16
OK

+CSVM, Set Voice Mail Server

This command handles the selection of the number to the voice mail server. The new value should also remain after power cycle.

Command Type	Syntax	Response/Action	Remarks
Set	**+CSVM=<mode>[,<number>[,<type>]]**	**OK** **+CME ERROR: <err>**	The Set command sets the number to the voice mail server.
Read	**+CSVM?**	**+CSVM:<mode>,<number>,<type>** **+CME ERROR: <err>**	The Read command displays the currently selected voice mail number and status (enabled or disabled).
Test	**+CSVM=?**	**+CSVM: (list of supported <mode>s), (list of supported <type>s)** **+CME ERROR: <err>**	The Test command displays the list of supported <mode>s and <type>s.

The following table shows the +CSVM parameters.

Table 3-35: +CSVM Parameters

<Parameter>	Description
<mode>	0 Disables the voice mail number (default) 1 Enables the voice mail number
<number>	Voice mail number in string. String can be of up to 32 characters long, starting with a digit, or "+". Other allowed characters are digits only (0..9).
<type>	Address octet type. 129 ISDN/telephony marketing plan; national/international number unknown 145 ISDN/telephony numbering plan; international number When the dialing string includes the international access code character (+), the default is 145. Otherwise, the default <type> is 129.

Note: If <mode> is set to 0, <number> and <type> are ignored. If <mode> is set to 1, <number> is mandatory.

Example

```
AT+CSVM=?
+CSVM: (0,1),(129,145)
OK
AT+CSVM=1,"+972555123456","145"
OK
AT+CSVM?
+CSVM: 1,"972555123456",145
OK
```

+MDSI, Motorola Deactivate SIM Card Indication

This command enables unsolicited reporting of indications of SIM deactivation and invalidation. The indications include the cause for deactivation and invalidation.

This command is a basic command, which means the G24 module should accept the command and act according to received parameters regardless of SIM presence and phone lock state.

In MUX mode, this AT command is allowed on DLC2 only.

Command Type	Syntax	Response/Action	Remarks
Set	**+MDSI=<mode>**	**When mode is 1 and SIM was invalidated or deactivated: [+MDSI: <type>, <cause>, <type text>, <cause text>]** **OK** **+CME ERROR: <err>**	The following is the available mode values for the Set command. <mode> = 1 - Defines that unsolicited +MDSI messages will be sent to the DTE. If the SIM card was invalidated or deactivated, the current status will be sent to the DTE. <mode> = 0 - No unsolicited message is sent to the DTE.
Read	**+MDSI?**	**+MDSI: <mode>** **OK** **+CME ERROR: <err>**	The Read command queries the current settings for <mode>
Test	**+MDSI=?**	**+MDSI: (list of supported <mode>s)** **OK** **+CME ERROR: <err>**	The Test command returns the possible <mode> values.

The following table shows the +MDSI parameters.

Table 3-36: +MDSI Parameters

<Parameter>		Description
<mode>	0	Unsolicited indications off
	1	Unsolicited indications on
<type>, <type text>	0	"DEACTIVATE". SIM deactivate request was sent with <cause>
	1	"GSM". Invalidate SIM for GSM services was sent with <cause>
	2	"GPRS". Invalidate SIM for GPRS services was sent with <cause>
<cause>, <cause text>	<cause> and <cause text> related to <type> = 0 ("DEACTIVATE"):	
	1	"Bad SIM"
	<cause> and <cause text> related to <type> = 1 ("GSM") and <type> = 2 ("GPRS"):	
	0	"No reject cause"
	2	"IMSI unknown in HLR"
	3	"Illegal MS"
	4	"IMSI unknown in VLR"
	6	"Illegal ME"
	7	"GPRS service not allowed"
	8	"GPRS and non-GPRS services not allowed"
	9	"MS identity cannot be derived by the network"
	11	"PLMN not allowed"
	12	"Location area not allowed"
	13	"Roaming not allowed in this location area"
	14	"GPRS services not allowed in this PLMN"
	240	"Location update failure"
	241	"Combined LU failure"
	242	"Authentication and ciphering reject"
	243	"Authentication reject"
	244	"Attach failure"

Example

at+mdsi?
+MDSI: 0
OK
at+mdsi=?
+MDSI: (000,001)
OK
at+mdsi=1
OK
//Until now there was no deactivation or invalidation of SIM card.
at+mdsi?
+MDSI: 1
OK
//SIM card does not support GPRS
+MDSI: 2, 7, "GPRS", "GPRS services not allowed"
//Insert a SIM card that is no longer subscribed
at+cpin="1764"
OK
at+cops=0

OK
//Unsolicited messages
+MDSI: 1, 2, "GSM", "IMSI unknown in HLR"
+MDSI: 0, 1, "DEACTIVATE", "Bad SIM"
// Insert a good SIM card, and roam to a NW that doesn't have a GPRS roaming agreement.
//Unsolicited messages
+MDSI: 2, 14, "GPRS", "GPRS services not allowed in this PLMN"
at+cgatt?
+CGATT: 0
OK

+MCSN, Motorola Change Subscriber Number

This AT command sets EFmsisdn in the SIM. The setting is placed in the given <index>, using <number> and <alpha> as the values to be set.

Additionally, when setting the number in a specific storage space, the <mode> parameter defines whether that <number> and corresponding <alpha>should be presented after entering the correct PIN number.

After entering the correct PIN number, the last <index>, whose <mode> was set to 1, is sent to the DTE. This indication is unsolicited and appears when SIM information is ready.

Note: At any given time, only one <index> or no <index> can have <mode> = 1. Therefore, setting <mode> = 1 for one of the supported <index>es implicitly means that all other <index>es have <mode> = 0.

Set Command

The Set command sets EFmsisdn in the SIM. The setting is placed in the given <index>, using <number> and <alpha> as the values to be set.

If only the <mode> value is given, then the Set command is interpreted as follows:

- <mode> = 0 - Do not show any number on next +CPIN insertion command
- <mode> = 1 - Default <index> (equals 1) is set to <mode> = 1

If only a pair of <mode> and <index> values are given, then the Set command is interpreted as follows:

- <mode> = 0, <index> = any valid indexSet mode for given index to 0
- <mode> = 1, <index> = any valid indexSet mode for given index to 1

If only <mode>, <index> and <number> values are given, then the Set command is interpreted as follows:

- Store in <index> of EFmsisdn in the SIM, the <number>. Since no <alpha> was given, corresponding <alpha> will be identical to the <alpha> already stored in this <index>. Also store the <mode> value for this <index>.

If all parameters are given, then the Set command is interpreted as follows:

- Store in <index> of EFmsisdn in the SIM, the <number> and corresponding <alpha>. In case an empty string was given as the <alpha> parameter, the corresponding <alpha> will be an empty string. Also store the <mode> value for this <index>.

Note: Only the last <index> whose mode was set to 1 will be sent to the DTE.

Command Type	Syntax	Response/Action	Remarks
Set	**+MCSN=<mode>[,<index>[,<number>[,<alpha>]]]**	**OK** **or:** **+CME ERROR: <err>**	See above
Read	**+MCSN?**	**+MCSN: <index>** **OK** **or:** **+CME ERROR: <err>**	The Read command queries the current settings for the <index> of the storage place in which the <mode> is equal to 1. If no index has its <mode> set to 1, then the response <index> will be equal to 0.
Test	**+MCSN=?**	**+MCSN: (list of supported <mode>s),(list of supported <index>es)** **OK** **or:** **+CME ERROR: <err>**	The Test command returns the possible <mode> and <index> values.

The following table shows the +MCSN parameters.

Table 3-37: +MCSN Parameters

<Parameter>	Description
<mode>	This value defines whether <number> and corresponding <alpha> tag are presented after entering a correct PIN number. 0 Do not show <number> and <alpha> in <index> after entering correct PIN number 1 Show <number> and <alpha> in <index> after entering correct PIN number The default value is 0 (before MCSN has been set for the first time.
<index>	An integer value between 1 and 5 representing the storage place in EFmsisdn in the SIM. 1 - 5 Index of the storage place The default value is 1. The number of records in EFmsisdn is SIM-dependent and can be less than 5.

Table 3-37: +MCSN Parameters (Cont.)

<Parameter>	Description
<number>	Phone number to set in the phonebook. The string type representing the phone number is written within double quotes. Valid input characters are: 0-9 and + (at start only) The number of digits the <number> parameter is built of can vary from a minimum of 0 to a maximum of 20 digits.
<alpha>	Text related to <number>. The string type text associated with the phone number is written within double quotes. The character set used for text is the one selected by the command Select TE Character Set (AT+CSCS). The number of characters comprising the <alpha> parameter can vary from a minimum of 0 to a maximum of 14.

Example

```
at+cnum// Reading EFmsisdn from the SIM
+CNUM: "","",0
+CNUM: "","",0
+CNUM: "","",0
+CNUM: "","",0
+CNUM: "","",0
OK
at+mcsn=1,1,"054444444","VOICE"// Setting record 1 in EFmsisdn in the SIM
// Enable unsolicited indication
OK
at+mcsn=0,2,"039999999","OFFICE"// Setting record 2 in EFmsisdn in the SIM
OK
at+mcsn=0,3,"1111","PIN1"// Setting record 3 in EFmsisdn in the SIM
OK
at+mcsn=0,4,"8523","PIN2"// Setting record 4 in EFmsisdn in the SIM
OK
at+cnum// Reading EFmsisdn from the SIM
+CNUM: "VOICE","054444444",129
+CNUM: "OFFICE","039999999",129
+CNUM: "PIN1","1111",129
+CNUM: "PIN2","8523",129
+CNUM: "","",0
OK
at+mcsn?
+MCSN: 1
OK
// Restart Phone
at+cpin="1111"
OK
// Unsolicited information of record 1 in EFmsisdn in the SIM
+MCSN: "VOICE","054444444"
at+mcsn=0// Disable unsolicited indication
OK
```

```
// Restart Phone
at+cpin="1111"
OK
at+mcsn=0,3,,"ada"
ERROR
at+mcsn=0,3,"3456346"// Update the <number> of record 3 same <alpha>
OK
at+cnum// Reading EFmsisdn from the SIM
+CNUM: "VOICE","054444444",129
+CNUM: "OFFICE","039999999",129
+CNUM: "PIN1","3456346",129
+CNUM: "PIN2","8523",129
+CNUM: "","",0
OK
at+mcsn=0,3,"","FAX"// Update the <alpha> of record 3 same <number>
OK
at+cnum// Reading EFmsisdn from the SIM
+CNUM: "VOICE","054444444",129
+CNUM: "OFFICE","039999999",129
+CNUM: "FAX","",0
+CNUM: "PIN2","8523",129
+CNUM: "","",0
OK
at+mcsn=0,3,"","" // Resetting record 3 in EFmsisdn in the SIM
OK
at+cnum// Reading EFmsisdn from the SIM
+CNUM: "VOICE","054444444",129
+CNUM: "OFFICE","039999999",129
+CNUM: "","",0
+CNUM: "PIN2","8523",129
+CNUM: "","",0
OK
```

+MPDPM, Motorola Phonebook Dynamic Percentage Memory

This command returns the collective percentage of memory used by the phonebook and datebook in their shared dynamic memory storage. A single percentage value is returned representing the combined percentage used by both the phonebook and datebook.

Command Type	Syntax	Response/Action	Remarks
Read	**+MPDPM?**	**+MPDPM: <n>** **OK** **or:** **+CME ERROR: <err>**	The Read command queries the current (combined) percentage used by the phonebook and datebook in their shared dynamic memory storage.

The following table shows the +MPDPM parameters.

Table 3-38: +MPDPM Parameters

<Parameter>	Description
<n>	The percentage of memory used together by both the phonebook and datebook in their shared dynamic memory storage.

Example

```
AT+mpdpm?
+MPDPM: 0
OK
at+cpbs="mt"
OK
at+cpbr=?
+CPBR: (001-350),040,016
OK
at+cpbr=1,100
OK
at+cpbw=,"035658020",129,"Phone0"
OK
at+cpbw=,"035658021",129,"Phone1"
OK
at+cpbw=,"035658022",129,"Phone2"
OK
at+cpbw=,"035658023",129,"Phone3"
OK
at+cpbw=,"035658024",129,"Phone4"
OK
at+cpbw=,"035658025",129,"Phone5"
OK
at+cpbw=,"035658026",129,"Phone6"
OK
at+cpbw=,"035658027",129,"Phone7"
OK
at+cpbw=,"035658028",129,"Phone8"
OK
at+cpbw=,"035658029",129,"Phone9"
OK
at+cpbw=,"035658030",129,"Phone10"
OK
AT+mpdpm?
+MPDPM: 2
OK
```

System Date and Time Access Commands

+CCLK, Read/Set System Date and Time

This command reads and sets the G24 current date, time and time zone.

Command Type	Syntax	Response/Action	Remarks
Set	**+CCLK=<time>**	**OK** **or:** **+CME ERROR: <err>**	The Set command sets the date, time and time zone of the system clock. **Note:** Set Command sets user defined system clock values and saves them in the NVM memory. These saved values are kept after power-cycle as well.
Read	**+CCLK?**	**+CCLK: <time>** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the current date, time and time zone setting. By default, <time> will represent the network updated time. If the user has used the Set command once, then <time> will represent the Set command setting. **Note:** If network operator does not support System Clock Update Message, the initial date, time and time zone, displayed by CCLK Read Command could be invalid (user's responsibility to set date, time and time zone by CCLK Set Command). **Note:** See Execute Command for how-to enable back network update time.
Test	**+CCLK=?**	**+CCLK (list of supported <time>s)** **OK** **or:** **+CME ERROR: <err>**	The Test command returns valid parameters for the +CCLK Set command.
Execute	**+CCLK**	**OK** **or:** **+CME ERROR: <err>**	The Execute command causes system clock to be overridden by network System Clock value immediately. **Note:** CCLK Read command will represent the network update time after CCLK Execute command . This value will be represented after power-cycle as well.

The following table shows the +CCLK parameters.

Table 3-39: +CCLK Parameters

<Parameter>	Description
<time>	ASCII string of format: yy/MM/dd,hh:mm:ss±zz or yy/MM/dd,hh:mm:ss yy - 2-digit year [2000-2069] MM - 2-digit month [01-12] dd - 2-digit day of month [00-31] hh - 2-digit hour [00-23] mm - 2-digit minute [00-59] ss - 2-digit seconds [00-59] zz - (optional) time zone offset from GMT, in quarter-hours [-47...+48]. If this value is not specified, the time zone offset will be 0.

Example

AT+CCLK=?
+CCLK: "88/12/31, 23:59:59, (-47-+48)"
OK
AT+CCLK="01/01/01, 01:01:01-08"
OK
AT+CCLK?
+CCLK: "01/01/01, 01:01:01-08"
OK
AT+CCLK="02/02/02, 02:02:02"
OK
Power cycling…
AT+CCLK?
+CCLK: "02/02/02, 02:02:02+00"
OK
AT+CCLK="03/03/03, 03:03:03+50"
+CME ERROR: Numeric parameter out of bounds
AT+CCLK
OK
AT+CCLK?
+CCLK: "05/10/27,16:52:31+08"
Power cycling…
AT+CCLK?
+CCLK: "05/10/27,16:52:50+08"
OK

SMS

SMS Commands

G24 supports SMS PDU and SMS TEXT mode according to ETSI specifications 07.05 & 3.40.

+CSMS, Select Message Service.

This command handles the selection of the messaging service. It returns the types of messages that are supported by the G24.

Command Type	Syntax	Response/Action	Remarks
Set	**+CSMS=<service>**	**+CSMS: <mt>,<mo>,<bm>** **or:** **+CMS ERROR: <err>**	The Set command sets the type of service and returns the types of messages supported by the G24.
Read	**+CSMS?**	**+CSMS: <service>,<mt>,<mo>,<bm>**	The Read command returns the supported message types along with the current service setting.
Test	**+CSMS=?**	**+CSMS: <service>**	The Test command returns a list of all the services supported by the terminal.

The following table shows the +CSMS parameters.

Table 3-40: +CSMS Parameters

<Parameter>	Description
<service>	Integer that defines the type of service 1-127 Not supported 128 Supported (manufacturer-specific)
<mt>	Mobile terminated messages 0 Not supported by the G24 1 Supported by the G24
<mo>	Mobile originated messages 0 Not supported by the G24 1 Supported by the G24
<bm>	Broadcast type messages 0 Not supported by the G24 1 Supported by the G24

Note: Only the 128 (manufacturer-specific) messaging service is supported by the G24. The service is supported for all messaging types (mobile terminated, mobile originated and broadcast).

Example

AT+CSMS=128
+CSMS: 001,001,001
OK
AT+CSMS?
+CSMS: 128,001,001,001
OK
AT+CSMS=?
+CSMS: (128)
OK

+CPMS, Preferred Message Storage

This command handles the selection of the preferred message storage area. The message storage area is divided into three parts, mem1, mem2 and mem3.

Command Type	Syntax	Response/Action	Remarks
Set	**+CPMS=<mem1>[,<mem2>[,<mem3>]]**	**+CPMS: <used1>,<total1>,<used2>,<total2>,<used3>,<total3>** **OK** **or:** **+CMS ERROR: <err>**	The Set command sets the memory storage.
Read	**+CPMS?**	**+CPMS: <mem1>,<used1>,<total1>,<mem2>,<used2>,<total2>,<mem3>,<used3>,<total3>** **OK** **or:** **+CMS ERROR: <err>**	The Read command displays the selected memory storage type for the three memory areas.
Test	**+CPMS=?**	**+CPMS: (list of supported <mem1>s),(list of supported <mem2>s),(list of supported <mem3>s)** **OK** **+CMS ERROR: <err>**	The Test command lists the supported memory storage for <mem1>, <mem2> and <mem3>.

The following table shows the +CPMS parameters.

Table 3-41: +CPMS Parameters

<Parameter>	Description
<mem1>	memory from which messages are read and deleted. Supported values are: "MT","SM","ME","BM". The default value at power-up is "MT".
<mem2>	memory to which writing operation is made. Supported value is: "ME". The default value at power-up is "ME".
<mem3>	memory to which received SMS are stored (unless forwarded directly to TE). Supported value is: "SM". The default value at power-up is "SM".
"BM"	broadcast message storage
"ME"	ME message storage
"MT"	All storages
"SM"	SIM message storage

Note: The value 'Total' is the total number of messages, of maximal size, that can be stored in the corresponding 'mem': Total1 for mem1, Total2 for mem2, and Total3 for mem3.

The 'Total' values are not fixed. They are recalculated after any change in message storage contents. Calculated value is 'size of free storage' divided by 'maximal size of message'.

The maximal message size includes the maximal size of message contents, and the maximal size of all header fields.

For example, if message storage is empty, the output will be as follows:

AT+CPMS?

+CPMS: "MT",0,76,"ME",0,56,"SM",0,20

When writing five new messages, five characters long each, the output will be as follows:

AT+CPMS?

+CPMS: "MT",5,79,"ME",5,59,"SM",0,20.

In the first example, the ’Total2’ value was 56. In the second example, the ’Total2’ value is 59. Because new messages are shorter, more memory is available for additional messages.

Example

```
AT+CPMS="SM"
+CPMS: 5,20,5,59,5,20
OK
AT+CPMS?
+CPMS: "SM",5,20,"ME",5,59,"SM",5,20
OK
AT+CPMS="ME"
+CPMS: 5,59,5,59,5,20
OK
AT+CPMS?
+CPMS: "ME",5,59,"ME",5,59,"SM",5,20
OK
```

+CMGF, Message Format

This command is a basic command. The Set command handles the selection of the message format used with send, list, read and write commands, as well as the format of unsolicited result codes resulting from message receipts. The G24 supports both PDU mode (where entire TP data units are used) and text mode (where the body of the message and its headers are given as separate parameters).

Command Type	Syntax	Response/Action	Remarks
Set	**+CMGF=<mode>**	**OK** **or:** **+CMS ERROR: <err>**	The Set command sets the message format to use.
Read	**+CMGF?**	**+CMGF:<mode>**	The Read command displays the current message format.
Test	**+CMGF=?**	**+CMGF:(list of supported <mode>s)**	The Test command lists all the supported message formats.

The following table shows the +CMGF parameters.

Table 3-42: +CMGF Parameters

<Parameter>	Description
<mode>	Message format: 0 PDU mode (default) 1 Text mode

Example

```
AT+CMGF=1
OK
AT+CMGF?
+CMGF: 1
OK
AT+CMGF=?
+CMGF: (0,1)
OK
```

+CSCA, Service Center Address

This command handles the selection of the SCA and the TOSCA. The SCA is the phone number of the SC (Service Center). The TOSCA can be 129 (local) or 145 (international), where 129 is the default value. The TOSCA parameter of the Set command is optional, and can be omitted. If the SCA parameter of the Set command is prefixed by the "+" character, it indicates that TOSCA is 145.

The following table shows the +CSCA input characters and their hexadecimal values.

Table 3-43: +CSCA Input Characters and Hexadecimal Values

Character	Description	Hexadecimal
+	International, allowed at start only	0x2B
0-9	Digits	0x30 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x39
*****	Instructions	0x2A
#		0x23
/	Other characters, allowed and ignored, not saved	0x2F
-		0x2D
(		0x28
)		0x29
blank		0x20
A		0x41
B		0x42
C		0x43
D		0x44
,	Pause control, ignored, not saved	0x2C
;	Allowed at end of number, ignored, not saved	0x3B

Command Type	Syntax	Response/Action	Remarks
Set	**+CSCA=<sca>[,<tosca>]**	**OK** **or:** **+CMS ERROR: <err>**	The Set command sets the service center address.
Read	**+CSCA?**	**+CSCA: <sca>,<tosca>**	
Test			The Test command for +CSCA is not defined by ETSI, and therefore is not supported by the G24. The G24 returns an error.

The following table shows the +CSCA parameters.

Table 3-44: +CSCA Parameters

<Parameter>	Description
<sca>	Service Center Address
<tosca>	Type of Service Center Address is the current address format setting

Example

AT+CSCA="4252833433"
OK
AT+CSCA?
+CSCA: "4252833433",129
OK

+CSMP, Set Text Mode Parameters

This command is a basic command and is used to select values for additional parameters needed when SM is sent to the network or placed in storage when TEXT mode is selected.

Command Type	Syntax	Response/Action	Remarks
Set	**+CSMP=[<fo>[,<vp>[,<pid>[,<dcs>]]]]**	**OK** **or:** **+CMS ERROR: <err>**	The set command selects values for additional parameters needed when SM is sent to the network or placed in storage when text format message mode is selected.

Command Type	Syntax	Response/Action	Remarks
Read	**AT+CSMP?**	**+CSMP: <fo>,<vp>,<pid>,<dcs>** **OK** **or:** **+CMS ERROR: <err>**	The read command returns the current parameters value.
Test	**AT+ CSMP =?**	**OK** **or:** **+CMS ERROR: <err>**	The test command just returns OK.

The following table shows the +CSMP parameters.

Table 3-45: +CSMP Parameters

<Parameter>	Description
<fo>	first octet of GSM 03.40. in integer format. For detailes see +CMGW definitions. The default value at power-up is 17 (Message type is: SMS-SUBMIT and relative VP format).
<vp>	Validity Period. depending on SMS-SUBMIT <fo>, TP-Validity-Period-Format bits setting. Either in integer format (see Table 3-46) or in time-string format ("yy/MM/dd,hh:mm:ss±zz"). If there is no correlation between the VPF and the VP value. an error message will be returned.
<pid>	Protocol-Identifier. The one octet information element by which the SM-TL either refers to the higher layer protocol being used, or indicates interworking with a certain type of telematic device. "0 - no interworking, SME-to-SME protocol (default) "Any value between 0-255 will be accepted. The SC may reject messages with a TP-Protocol-Identifier containing a reserved value or one, which is not supported.
<dcs>	One octet of Data Coding Scheme, indicates the data coding scheme of the DATA, and may indicate a message class. NOTE: For DCS expanded information, see section "DCS handling" on page 3-115. default alphabet: 00xx00xx, 111100xx, 1101xxxx 8 bit data: 00xx01xx, 111101xx UCS2: 00xx10xx, 1110xxxx reserved: 00xx11xx, 0100xxxx-1011xxxx The default value at power-up is 0 - Default alphabet.

Table 3-46: VP Relative Format (In Integer Frmat)

<Parameter>	Description
0 to 143	(TP-VP + 1) x 5 minutes (i.e. 5 minutes intervals up to 12 hours)
144 to 167	12 hours + ((TP-VP - 143) x 30 minutes)

Table 3-46: VP Relative Format (In Integer Frmat) (Cont.)

<Parameter>	Description
168 to 196	(TP-VP - 166) x 1 day
197 to 255	(TP-VP - 192) x 1 week

Example

```
AT+CSMP?
+CSMP: 17,167,0,0 (default values for SMS-SUBMIT)
OK
AT+CSMP= 1,256,0,0
+CMS ERROR: numeric parameter out of bounds
AT+CSMP=29,"04/11/04,09:48:36+08"
OK
AT+CSMP=?
OK
AT+CSDH=1
OK
AT+CMGF=1
OK
AT+CMGW="0544565034"
> ABC (^Z)
+CMGW: 160
OK
AT+CMGR=160
+CMGR: "STO UNSENT","0544565034",,81,29,0,0,"04/11/04,09:48:36+08","+97254120032",145,3
ABC
OK
```

+CSDH, Show Text Mode Parameters

This command controls whether detailed header information is shown in text mode result codes.

Command Type	Syntax	Response/Action	Remarks
Set	**+CSDH=[<show>]**	**OK** **or:** **+CMS ERROR: <err>**	The set command controls whether detailed header information is shown in text mode result codes.
Read	**AT+CSDH?**	**+CSDH: (list of supported <show>s)** **OK** **or:** **+CMS ERROR: <err>**	The read command returns the current <show> parameter value.

The following table shows the +CSDH parameters.

Table 3-47: +CSDH Parameters

<Parameter>	Description
<show>	0 - Means do not show header values defined in commands +CSCA and +CSMP (<sca>, <tosca>, <fo>, <vp>, <pid> and <dcs>) nor <length>, <toda> or <tooa> in +CMT, +CMGL, +CMGR result codes for SMS- DELIVERs and SMS-SUBMITs in text mode; for SMS-COMMANDs in +CMGR result code, do not show <pid>, <mn>, <da>, <toda>, <length> or <cdata> (default). 1 - Means show the values in result codes.

Example

AT+CSDH=?
+CSDH:(0,1)
OK
AT+CSDH?
+CSDH: 0
OK
AT+CMGR=160// SMS-SUBMIT
+CMGR: "STO UNSENT","0544565034",
ABC
OK
AT+CSDH=1
OK
AT+CMGR=160
+CMGR: "STO UNSENT","0544565034",,81,29,0,0,"04/11/04,09:48:36+08","+97254120032",145,3
ABC
OK

+CNMI, New Message Indications to Terminal

This command handles enabling of unsolicited notifications to the terminal when an SM is received by the G24.

After sending an unsolicited response to the TE, the G24 will expect a +CNMA (new message acknowledgement) from the TE within a predefined timeout of 60 seconds. The G24 will not send another unsolicited response to the TE before the previous one is acknowledged. If acknowledged within the timeout, the new SM is not saved in the message storage. If not, the new SM is saved in the message storage and +CNMI parameters are set to 0.

Command Type	Syntax	Response/Action
Set	**+CNMI=[<mode> [,<mt>[,<bm> [,<ds>[,<bfr>]]]]]**	**OK** **or:** **+CMS ERROR: <err>**

Command Type	Syntax	Response/Action
Read	+CNMI?	+CNMI:<mode>,<mt>,<bm>,<ds>,<bfr>
Test	+CNMI=?	+CNMI: (list of supported <mode>s), (list of supported <mt>s), (list of supported <bm>s), (list of supported <ds>s), (list of supported <bfr>s)

The following table shows the +CNMI parameters.

Table 3-48: +CNMI Parameters

<Parameter>		Description
<mode>	0	Buffer unsolicited result codes (default).
	3	Forward unsolicited result codes directly to the terminal
<mt>	0	No SMS-DELIVER indications are routed to the terminal (default)
	1	If SMS-DELIVER is stored in the G24, the memory location indication is routed to the terminal using the unsolicited result code: +CMTI: <mem>,<index>
	2	SMS-DELIVER is routed directly to the terminal
<bm>	0	No CBM indications are routed to the terminal (default)
	2	New CBMs are routed directly to the terminal
	The CBM of multipage "CB" and "QuickView" are not supported.	
<ds>	0	No SMS-STATUS-REPORT indications are routed to the terminal (default)
	1	SMS-STATUS-REPORT is routed directly to the terminal
	2	If SMS-STATUS-REPORT is stored in the G24, the memory location indication is routed to the terminal using the unsolicited result code: +CDSI: <mem>,<index>
<bfr>	0	No SMS-STATUS reports are buffered.

Example

```
AT+CNMI=?
+CNMI: (0,3),(0-2),(0,2),(0-2),(0)
OK
AT+CNMI?
+CNMI: 0,0,0,0
OK
AT+CNMI=3,1
OK
at+cmss=142,"0544565034"// send to myself
+CMSS: 72
OK
+CMTI: "SM",15
at+cnmi=,2
OK
at+csdh=1
OK
at+cmss=142,"054565034"     // send to myself
```

```
+CMSS: 73
OK
+CMT: "+972544565034",,"04/11/04,09:48:36+08",145,4,0,0,"+97254120032",145,3
ABC
AT+CSMP=49 /*Set first octet to status report - see status report parameters in CMGW*/
OK
AT+CSMP?
+CSMP: 49,167,0,0
OK
AT+CNMI=,,,1
OK
AT+CNMI?
+CNMI: 0,0,0,1,0
OK
AT+CNMI=0,0,0,1,0
OK
AT+CMGS="0524680592"
> HELLO
+CMGS: 168
OK
+CDS: 6,168,"+972524680592",145,"05/08/02,15:20:12+08","05/08/02,15:20:14+08",0
AT+CNMI=0,0,0,2
OK
AT+CMSS=296
+CMSS: 185
OK
+CDSI: "SM",6
```

+CNMA, New Message Acknowledgment

This command acknowledges the receipt of a +CMT and +CDS response from the terminal to the G24. A +CMT response receipt confirms the correct reception of a new SMS-DELIVER message, which was routed directly to the terminal. A +CDS response receipt confirms the correct reception of a new SMS-STATUS-REPORT message, which was routed directly to the terminal.

When the G24 sends a +CDS response to the terminal, it waits a predefined timeout of 60 seconds for the +CNMA acknowledgment. The G24 will not send another +CDS result code to the terminal before the previous one is acknowledged, or the timeout expires.

When the G24 sends a +CMT response to the terminal, it waits a predefined timeout of 60 seconds for the +CNMA acknowledgment. The G24 will not send another +CMT result code to the terminal before the previous one is acknowledged, or the timeout expires.

Upon receipt of the +CNMA command, the G24 sends RP-ACK to the network. The acknowledged SM will not be saved in message storage.

If the G24 does not receive acknowledgment within the required time, it sends RP-ERROR to the network. The G24 automatically disables routing to the terminal by setting both <mt> and <ds> values of +CNMI to zero. The unacknowledged SM is saved in message storage.

If the command is executed but no acknowledgment is expected, or some other G24 related error occurs, the final result code +CMS ERROR: <err> is returned.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CNMA**	**OK** **or:** **+CMS ERROR: <err>**	
Read			The Read command for +CNMA is not defined by ETSI, and therefore is not supported by the G24. The G24 returns an error.
Test			The Test command for +CNMA is not defined by ETSI, and therefore is not supported by the G24. The G24 returns an error.

Example

```
AT+CNMI=3,2
OK
at+cmss=142,"054565132"     // send to myself
+CMSS: 74
OK
+CMT: "+97254565132",,"03/04/09,17:14:33+08"
new message text
AT+CNMA
OK
AT+CNMI?
+CNMI: 3,2,0,0
OK
AT+CNMI=0,0,0,1
OK
AT+CSMP=49
OK
AT+CSMP?
+CSMP: 49,167,0,0
OK
AT+CNMI?
+CNMI: 0,0,0,1,0
OK
AT+CMSS=295
+CMSS: 184
OK
+CDS: 6,184,"+972524680592",145,"05/08/02,17:19:23+08","05/08/02,17:19:24+08",0
AT+CNMA
OK
AT+CNMI?
+CNMI: 0,0,0,1,0
OK
```

+CMTI, Unsolicited Response (New SMS-DELIVER Receipt Indication)

The +CMTI unsolicited response is sent to the TE upon receipt of a new SMS-DELIVER SM, if the +CNMI parameter <mt> is set to 1. Refer to "+CNMI, New Message Indications to Terminal" on page 3-83.

This unsolicited message indicates that a new SMS-DELIVER message was received, and is stored in location <index>:

+CMTI: <mem>,<index>

The following table shows the +CMTI parameters.

Table 3-49: +CMTI Parameters

<Parameter>	Description
<mem>	Message memory space. "SM" - SIM memory storage.
<index>	Location of the new message.

Example

AT+CNMI=3,1
OK
at+cmgs=18//send to my self
> 07917952120100951100 0c91795242865029 0004AA0441424344
+CMGS: 69
OK
+CMTI: "SM",4

+CMT, Unsolicited Response (New SMS-DELIVER Receipt)

The +CMT unsolicited response is sent to the TE upon receipt of a new SMS-DELIVER SM if the +CNMI parameter <mt> is set to 2. Refer to "+CNMI, New Message Indications to Terminal" on page 3-83.

This unsolicited message displays the received SMS-DELIVER message:

In text mode: (+CMGF=1):

+CMT: <oa>,<scts>[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>] <CR><LF><data>

(about parameters in italics, refer command Show Text Mode Parameters +CSDH).

In PDU mode: (+CMGF=0):

+CMT: [<alpha>],<length><CR><LF><pdu>

The following table shows the +CMT parameters.

Table 3-50: +CMT Parameters

<Parameter>	Description
<oa>	Message origination address.
<scts>	Service center time stamp.
<toda>	Type of origination address
<fo>	First octet of the SM
<pid>	Protocol Identifier
<dcs>	Data Coding Scheme
<sca>	Service Center Address
<tosca>	Type of Service Center Address
<data>	Message contents.
<alpha>	Alpha ID of message.
<length>	In PDU mode: Size of message, in octets, excluding SMSC data. In TEXT mode: number of characters included in the <data>
<pdu>	Message header and contents in PDU mode format. See description in "+CMGR, +MMGR, Read Message" on page 3-95.

After sending a +CMT unsolicited response to the TE, the G24 will expect a +CNMA (new message acknowledgement) from the TE within a predefined timeout of 60 seconds. The G24 will not send another +CMT unsolicited response to the TE before the previous one is acknowledged. If the +CMT is acknowledged within the timeout, the new SM is not saved in the message storage. If the +CMT is not acknowledged and the timeout has expired, the new SM is saved in the message storage and +CNMI parameter <mt> is set to 0.

Example

```
at+cnmi=,2
OK
at+csdh=1
OK
at+cmss=142,"054565034"     // send to myself
+CMSS: 74
OK
+CMT: "+972544565034",,"04/11/04,09:48:36+08",145,4,0,0,"+97254120032",145,3
ABC
at+cnma
OK
AT+CMGF=0
OK
at+cmgs=18     // send to myself
> 0791795212010095110000c917952446505430004AA0441424344
+CMGS: 70
OK
+CMT: ,23
0791795212010095040C917952446505430004502032115430800441424344
```

+CBM, Unsolicited Response (New CB Message Receipt)

The +CBM unsolicited response is sent to the TE upon receipt of a new cell broadcast message if +CNMI parameter <bm> is set to 2. Refer to "+CNMI, New Message Indications to Terminal" on page 3-83.

This unsolicited message displays the received CB message. The displayed CBM is not saved in message storage.

Unsolicited Response

In text mode: (+CMGF=1):

+CBM: <sn>,<mid>,<dcs>,<page>,<page><CR><LF><data>

In PDU mode: (+CMGF=0):

+CBM: <length><CR><LF><pdu>

The following table shows the +CBM parameters.

Table 3-51: +CBM Parameters

<Parameter>	Description
<sn>	Message serial number.
<mid>	Message ID.
<page>	Current page number.
<pages>	Total number of pages.
<data>	Message contents in text mode.
<length>	Size of message in PDU mode format, in octets.
<pdu>	Message header and contents in PDU mode format. See description in "+CMGR, +MMGR, Read Message" on page 3-95.

+CDSI, Unsolicited Response (New SMS-STATUS-REPORT Indication)

The +CDSI unsolicited response is sent to the TE upon receipt of a new SMS-STATUS-REPORT SM, if the +CNMI parameter <ds> is set to '2'. For further information, refer to "+CNMI, New Message Indications to Terminal" on page 3-83.

This unsolicited message indicates that a new SMS-STATUS-REPORT message was received, and is stored in location <index>.

Unsolicited Response

+CDSI: <mem>,<index>

The following table shows the +CDSI parameters.

Table 3-52: +CDSI Parameters

<Parameter>	Description
<mem>	Message memory space. "SM" - SIM memory storage.
<index>	Location of the new message.

Example

```
at+cmgf=1
OK
at+csmp=49 /*Set Message type to Status Report, see +CMGW*/
OK
at+csmp?
+CSMP: 49,167,0,0
OK
at+cnmi=0,0,0,2
OK
at+cmgs="052468000"
> Hello
+CMGS: 188
OK
+CDSI: "SM",14
```

+CDS, Unsolicited Response (New SMS-STATUS-REPORT Receipt)

The +CDS unsolicited response is sent to the TE upon receipt of a new mobile-terminated SM if the +CNMI parameter <ds> is set to ’1’. For further information, refer to “+CNMI, New Message Indications to Terminal” on page 3-83.

This unsolicited message displays the received SMS-DELIVER message.

Unsolicited Response

In text mode: (+CMGF=1):

+CDS: <fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st><CR><LF>

In PDU mode: (+CMGF=0):

+CDS: <length><CR><LF><pdu>

The following table shows the +CDS parameters.

Table 3-53: +CDS Parameters

<Parameter>	Description
<fo>	First octet of the SM
<mr>	Message Reference

Table 3-53: +CDS Parameters (Cont.)

<Parameter>	Description
<ra>	Message Recipient address
<tora>	Type of Recipient address
<scts>	Service center time stamp
<dt>	Discharge-Time
<st>	Status

After sending a +CDS unsolicited response to the TE, the G24 will expect a +CNMA (new message acknowledgement) from the TE within a predefined timeout of 60 seconds. The G24 will not send another +CDS unsolicited response to the TE before the previous one is acknowledged. If the +CDS is acknowledged within the timeout, the new SM is not saved in the message storage. If the +CDS is not acknowledged and the timeout has expired, the new SM is saved in the message storage and +CNMI parameter <ds> is set to ’0’.

Example

at+cmgf=1
OK
at+csmp=49
OK
at+csmp?
+CSMP: 49,167,0,0
OK
at+cnmi=0,0,0,1
OK
at+cmgs="052468000"
> Hello
+CMGS: 187
OK
+CDS: 6,187,"+97252468000",145,"05/08/03,08:56:34+08","05/08/03,08:56:34+08",70
at+cnma
OK

+CMGL, +MMGL, List Messages

These commands display a list of all SMs with the status value <stat>, from the G24 message storage <mem1> (selected using the +CPMS command). The command returns a series of responses, one per message, each containing the message index, status, and data. If the status of a message is "RECEIVED UNREAD", execution of the +CMGL command changes the status of the message to "RECEIVED READ".

The +MMGL command does not change the message status. In addition, +MMGL includes a <stat> selection that can be used to query the G24 for a list of message headers without attendant message data.

Command Type	Syntax	Response/Action	Remarks
Set	**+CMGL [=<stat>]** **or** **+MMGL [=<stat>]**	If text mode (+CMGF=1) command execution is successful and SMS-SUBMITs and/or SMS-DELIVERs: +CMGL: **<index>,<stat>,<oa/da>,,[<scts>] [,<tooa/toda>,<length>]<CR><LF><data>[<CR><LF>** +CMGL: **<index>,<stat>,<da/oa>,,[<scts>] [,<tooa/toda>,<length>]<CR><LF><data>[...]]** The parameters <tooa/toda>,<length> refer command shows the Text Mode Parameters +CSDH and will be shown according to +CSDH settings. If text mode (+CMGF=1) command execution is successful and SMS-COMMANDs: +CMGL: <index>,<stat>,<fo>,<ct>[<CR><LF>+CMGL: <index>,<stat>,<fo>,<ct>[...]] If text mode (+CMGF=1), command execution is successful and CBM storage: +CMGL: **<index>,<stat>,<sn>,<mid>,<page>,<pages><CR><LF><data>[<CR><LF>** +CMGL: **<index>,<stat>,<sn>,<mid>,<page>,<pages><CR><LF><data>[...]]** If text mode (+CMGF=1) command execution is successful and SMS-STATUS_REPORTs: +CMGL: **<index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st>[<CR><LF>** +CMGL: **<index>,<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st>[...]]** In PDU mode (+CMGF=0): +CMGL: **<index>,<stat>,[<alpha>],<length><CR><LF><pdu>[<CR><LF>** +CMGL: **<index>,<stat>,[<alpha>],<length><CR><LF><pdu>[…]]** Or **+CMS ERROR: <err>**	
Test	**+CMGL=?** **+MMGL=?**	**+CMGL: (list of supported <stat>s)** **+MMGL: (list of supported <stat>s)**	The Test command lists all the supported <stats>

The following table shows the +CGML/+MMGL parameters.

Table 3-54: +CGML/+MMGL Parameters

<Parameter>	Description
<index>	1-352 Index of message in storage.
<stat>	Status of message in memory:

PDU mode	Text mode	Description
0	"REC UNREAD"	Received unread messages (default)
1	"REC READ"	Received read messages
2	"STO UNSENT"	Stored unsent messages
3	"STO SENT"	Stored sent message
4	"ALL"	All messages
5	"HEADER ONLY"	Header only (applies to +MMGL only)

<oa/da>	Original/destination address.
<data>	Message contents in text mode.
<length>	In PDU mode: Size of message, in octets, excluding SMSC data. In TEXT mode: Number of characters included in <data>.
<pdu>	Message header and contents in PDU mode format. See description in "+CMGR, +MMGR, Read Message" on page 3-95.
<toda/toda>	Type of origination address / destination address
<fo>	First octet of the SM
<mr>	Message reference
<ra>	Recipient-Address
<tora>	Type Of Recipient-Address
<scst>	Service center time stamp
<ct>	Command type
<sn>	Message serial number
<mid>	Message ID
<page>	Current page number
<pages>	Total number of pages
<dt>	Discharge-Time
<st>	Status

Example

```
AT+CMGL=?
+CMGL: ("REC UNREAD","REC READ","STO UNSENT","STO SENT","ALL")
OK
AT+MMGL=?
+MMGL: ("REC UNREAD","REC READ","STO UNSENT","STO SENT","ALL","HEADER ONLY")
OK
AT+CPMS="SM"// read messages from SIM.
+CPMS: 2,20,11,61,2,20
OK
AT+MMGL// read "rec-unread" messages without changing message stat
+MMGL: 1,"REC UNREAD","+972544565034",,"05/01/01,09:21:22+08"
message text
OK
AT+CMGL// read "rec-unread" messages with changing message stat
+CMGL: 1,"REC UNREAD","+972544565034",,"05/01/01,09:21:22+08"
message text
OK
AT+CMGL
OK// the message stat was changed. No "rec-unread"  messages.
AT+CPMS="ME"
+CPMS: 11,61,11,61,2,20
OK
AT+CMGL="sto sent"
+CMGL: 142,"STO SENT","054565034",,
message text
OK
AT+CSDH=1
OK
AT+CMGL="STO SENT"
+CMGL: 142,"STO SENT","054565034",,,81,<message length>
message text
OK
at+cmgs=18//send to myself
> 0791795212010095110000c917952446505430004AA0441424344
+CMGS: 68
OK
at+cpms="sm"// change to SIM to read the incoming messages
+CPMS: 2,20,11,61,2,20
OK
at+mmgl
+MMGL: 2,0,,23
0791795212010095040C917952446505430004502032114340800441424344
OK
```

+CMGR, +MMGR, Read Message

These commands handle the reading of SMs. The command displays the message in location <index> of the preferred message storage <mem1> (selected using the +CPMS command). If the status of the message is "RECEIVED UNREAD", the +CMGR command changes the status to "RECEIVED READ". The +MMGR command does not change the message status.

Command Type	Syntax	Response/Action	Remarks
Set	**+CMGR=<index>** or **+MMGR=<index>**	If text mode (+CMGF=1) command execution is successful and SMS-DELIVER: +CMGR: **<stat>,<oa>,[<alpha>],<scts>[,<tooa>,<fo>,<pid>,<dcs>,<sca>,<tosca>,<length>]<CR><LF><data>** If text mode (+CMGF=1) command execution is successful and SMS-SUBMIT: +CMGR: **<stat>,<da>,[<alpha>][,<toda>,<fo>,<pid>,<dcs>,[<vp>],<sca>,<tosca>,<length>]<CR><LF><data>** If text mode (+CMGF=1) command execution is successful and SMS-COMMAND: +CMGR: **<stat>,<fo>,<ct>[,<pid>,[<mn>],[<da>],[<toda>],<length><CR><LF><cdata>]** If text mode (+CMGF=1) command execution is successful and CBM storage: +CMGR: **<stat>,<sn>,<mid>,<dcs>,<page>,<pages><CR><LF><data>** If text mode (+CMGF=1) command execution is successful and SMS-STATUS-REPORT: +CMGR: **<stat>,<fo>,<mr>,[<ra>],[<tora>],<scts>,<dt>,<st>** If PDU mode (+CMGF=0) and command execution is successful: +CMGR: **<stat>,[<alpha>],<length><CR><LF><pdu>** otherwise: **+CMS ERROR: <err>**	The Set command reads the SM located at <index> in the G24 message storage and displays it

The following table shows the +CMGR parameters.

Table 3-55: +CGMR/+MMGR Parameters

<Parameter>	Description
<index>	1-352 Index in storage of the message. to be retrieved.
<stat>	Status of message in memory: **PDU mode** / **Text mode** / **Description** **0** / "REC UNREAD" / Received unread messages (default) **1** / "REC READ" / Received read messages **2** / "STO UNSENT" / Stored unsent messages **3** / "STO SENT" / Stored sent message **4** / "ALL" / All messages
<alpha>	Alpha ID of message (not present).
<length>	In PDU mode: Size of message, in octets, excluding SMSC data. In TEXT mode: Number of characters included in <data>.
<pdu>	Message header and contents in PDU mode format. See description in the tables below.
<oa/da>	Original/destination address.
<data>	Message contents in text mode.
<toda/toda>	Type of origination address / destination address
<fo>	First octet of the SM
<pid>	Protocol Identifier
<dcs>	Data Coding Scheme
<sca>	Service Center Address
<tosca>	Type of Service Center Address
<vp>	Validity Period. Either in integer format (see Table 3-45) or in time-string format ("yy/MM/dd,hh:mm:ss±zz").
<mr>	Message reference
<scst>	Service center time stamp
<ct>	Command type
<sn>	Message serial number
<mn>	Message Number
<cdata>	Command-Data
<mid>	Message ID
<page>	Current page number

Table 3-55: +CGMR/+MMGR Parameters (Cont.)

<Parameter>	Description
<pages>	Total number of pages
<mr>	Message Reference
<ra>	Message Recipient address
<tora>	Type of Recipient address
<scts>	Service center time stamp
<dt>	Discharge-Time
<st>	Status

Table 3-56: Layout of SMS-DELIVER in PDU Mode (according to GSM03.40)

Reference	Description	Length
<sca>	Service Center address: 1 BYTE: length (number of followed octets). Mandatory 1 BYTE: <tosca> - value between 128-255	1, 3-12 BYTES (When length is 1, length BYTE = 0)
<fo>	First Octet. See Table 3-57.	1 BYTE
<TP-OA>	Originating address formatted according to the formatting rules of address fields.	2-12 BYTES
<TP-PID>	Protocol-Identifier. Values between 0-255.	1 BYTE
<TP-DCS>	Data Coding Scheme. Values between 0-255.	1 BYTE
<TP-SCTS>	The TP-Service-Center-Time-Stamp field is given in semi-octet representation, and represents the local time as described in GSM03.40	7 BYTE
<TP-UDL>	User data length	1 BYTE
<TP-UD>	User data	0-140 BYTES

Note: Any unused bits will be set to zero and shall be ignored by the receiving entity.

Table 3-57: <fo> for SMS-DELIVER Message

Bit/s	Reference	Description
0-1	Message-Type-Indicator	Parameter describing the message type. 0 0 SMS-DELIVER (in the direction SC to MS)
2	TP-More-Message-To-Send	Parameter indicating whether or not more messages are waiting to the MS in the SC. 0 More messages are waiting for the MS in this SC 1 No more messages are waiting for the MS in this SC
5	TP-Status-Report-Indication	Parameter indicating if a status report is requested by the MS 0 A status report is not requested 1 A status report is requested
6	TP-User-Data-Header-Indicator	Parameter indicating whether or not a status report will be returned to the SME. 0 A status report will not be returned to the SME 1 A status report will be returned to the SME
7	TP-Reply-Path	Parameter indicating that Reply Path is set or not. 0 TP-Reply-Path parameter is not set 1 TP-Reply-Path parameter is set

Table 3-58: Layout of SMS-STATUS-REPORT in PDU Mode (according to GSM03.40)

Reference	Description	Length
<sca>	Mandatory: Service Center address: 1 BYTE: length (number of followed octets) Mandatory: 1 BYTE: <tosca> - value between 128-255	1, 3-12 BYTES (When length is 1, length BYTE = 0)
<fo>	Mandatory: First Octet. See Table 3-59.	1 BYTE
<mr>	Mandatory: Message Reference number, which identifying the previously submitted SMS-SUBMIT or SMS-COMMAND	1 BYTE

Table 3-58: Layout of SMS-STATUS-REPORT in PDU Mode (according to GSM03.40) (Cont.)

Reference	Description	Length
<TP-RA>	Mandatory: Recipient address formatted according to the formatting rules of address fields.	2-12 BYTES
<TP-SCTS>	Mandatory: The TP-Service-Center-Time-Stamp field is given in semi-octet representation, and represents the local time as described in GSM03.40	7 BYTE
<TP-DT>	Mandatory: Discharge-Time of <TP-ST>, is given in semioctet representation, and represents the local time as described in GSM03.40	7 BYTES
<TP-ST>	Mandatory: Status of the MO message	1 BYTE
<TP-PI>	Optional: Parameter indicating the presence of any of the optional parameters which follow. See Table 3-59.	1 BYTE
<TP-PID>	Optional: Protocol-Identifier. Values between 0-255.	1 BYTE
<TP-DCS>	Optional: Data Coding Scheme. Values between 0-255.	1 BYTE
<TP-UDL>	Optional: User data length	1 BYTE
<TP-UD>	Optional: User data	131 BYTES

Notes:

- Any unused bits will be set to zero by the sending entity and will be ignored by the receiving entity.
- The maximum guaranteed length of TP-UD is 131 octets. In order to achieve the maximum octet of 143, the TP-RA field must have a length of two octets and TP-PID and TP-DCS must not be present.
- TP-PI is Mandatory if any of the optional parameters following TP-PI is present, otherwise optional.

Table 3-59: <fo> for SMS-STATUS-REPORT Message

Bit/s	Reference	Description
0-1	Mandatory: Message-Type-Indicator	Parameter describing the message type. 1 0 SMS-STATUS-REPORT (in the direction SC to MS)
2	Mandatory: TP-More-Message-To-Send	Parameter indicating whether or not more messages are waiting to the MS in the SC. 0 More messages are waiting for the MS in this SC 1 No more messages are waiting for the MS in this SC
5	Mandatory: TP-Status-Report-Qualifier	Parameter indicating whether the previously submitted TPDU was an SMS-SUBMIT or an SMS-COMMAND: 0 The SMS-STATUS-REPORT is the result of a SMS-SUBMIT. 1 The SMS-STATUS-REPORT is the result of an SMS-COMMAND
6	Optional: TP-User-Data-Header-Indicator	Parameter indicating whether or not a status report will be returned to the SME. 0 A status report will not be returned to the SME 1 A status report will be returned to the SME

Table 3-60: <TP-PI> for SMS-STATUS-REPORT Message

Bit/s	Description
0	0 TP-PID not presence 1 TP-PID not presence
1	0 TP-DCS not presence 1 TP-DCS presence
2	0 TP-UDL not presence 1 TP-UDL presence
3-7	Reserved

Note: Reserved bits are ignored.

Example

```
AT+CPMS?
+CPMS: "ME",5,59,"ME",5,59,"SM",5,20
OK
AT+CMGR=1
+CMS ERROR: invalid index
AT+CMGR=142
+CMGR: "STO SENT","054565034",
message text
OK
AT+CSDH=1
OK
AT+CMGR=142
+CMGR: "STO SENT","054565034",,129,25,0,0,"05/04/03,21:22:23+08","+ 97254120032",145,<message
length>
message text
OK
at+cmgw=18
> 07917952120100951100 0c91795242865029000 4AA0441424344
+CMGW: 143
OK
at+cmgr=143
+CMGR: 2,,23
07917952120100950 40C91795242865029000450203211020180044 1424344
OK
AT+CPMS="SM"// change to SM to read SMS-DELIVER messages.
+CPMS: 2,20,11,61,2,20
OK
AT+CMGR=1
+CMGR: "REC READ","+972544565034",,"05/02/23,11:20:10+08",145,4,0,4,"+97254120032",145,4
41424344
OK
AT+CMGF=0
OK
at+cmgr=1
+CMGR: 0,,23
0791 07917952140230F2040C91795244650543000450203211020180044 1424344
OK
at+cmgr=14
+CMGR: 0,,25
07917952120100950 6BC0B917952428600F0508030807512805080308075128046 // SMS-STATUS-REPORT
message in PDU mode
OK
at+cmgf=1
OK
at+cmgr=14 // SMS-STATUS-REPORT message in Text mode
+CMGR: "REC READ",6,188,"+97252468000",145,"05/08/03,08:57:21+08","05/08/03,08:5
7:21+08",70
OK
```

+MMAR, Motorola Mark As Read

This command handles changing the <stat> attribute of an SM in the G24 memory location <index>, preferred message storage <mem1>, from "REC UNREAD" to "REC READ". (<mem1> is selected using the +CPMS command.) If the status change fails, +CMS ERROR: <err> is returned.

Command Type	Syntax	Response/Action	Remarks
Set	**+MMAR=<index>**	**OK** **or:** **+CMS ERROR: <err>**	
Read			The Read command for +MMAR is not defined, and therefore is not supported by the G24. The G24 returns an error.
Test			The Test command for +MMAR is not defined, and therefore is not supported by the G24. The G24 returns an error.

The following table shows the +MMAR parameters.

Table 3-61: +MMAR Parameters

<Parameter>	Description
<index>	Index of the message to be marked as read, in the SMS memory.

Example

```
AT+MMGR=1
+MMGR: "REC UNREAD","+972544565034",,"04/11/04,09:48:36+08"
message text
OK
AT+MMAR=1
OK
AT+MMGR=1
+MMGR: "REC READ","+972544565034",,"04/11/04,09:48:36+08"
message text
OK
```

+CMSS, Send Message From Storage

This command sends a pre-stored message, written previously using the +CMGW command. The <da>, <toda> parameters are optional. If a DA is given, the message is sent to that address. Otherwise the message is sent to the DA it was stored with (if any was entered). If no DA is found, an error occurs.

When the given index is an incoming message index the header settings will be as follows:

- <first-octet> will be SMS-SUBMIT and VPF - relative.
- The TP-RP and TP-UDHI settings will be taken from the incoming message's first octet.
- <vp> - will be set to the default value -167 - as defined in 03.40.
- <sca>,<tosca>, <pid> and <dcs> will be set according the incoming message parameters.
- If <da> and/or <toda> are not given by the command, the <oa> and <tooa> will be set instead.

Command Type	Syntax	Response/Action	Remarks
Set	**+CMSS=<index>[,<da>[,<toda>]]**	**+CMSS: <mr>** or: **+CMS ERROR: <err>**	The Set command sends a message from storage to the network.

The following table shows the +CMSS parameters.

Table 3-62: +CMSS Parameters

<Parameter>	Description
<index>	1-352 Index in storage of the message to be sent.
<da>	Destination address in quoted string. This field contains a single phone number.
<toda>	Type of DA. Value between 128-255 (according to GSM 03.40, 9.1.2.5). If this field is not given and first character of <da> is '+' , <toda> will be 145, otherwise 129.
<mr>	Sent message reference number.

Example

AT+CMSS=7
+CMSS: 12
OK
AT+CMSS=7,"054565132",129
+CMSS: 13
OK

Note: Any character sent by TE to G24 before G24 has reported a result of AT+CMSS operation, will abort AT+CMSS command execution. However, if SMS was already sent to NW and sending operation was successful, the result of operation "+CMSS <mr>" will be reported by G24. If after aborting AT+CMSS command execution and before result of operation was reported by G24, a second AT+CMSS command is executed, then the result of the second AT+CMSS operation only will be reported by G24.

+CMGW, Write Message to Memory

This command is used to write and save a message to <mem2>. The message is saved in memory, and the message index is displayed to the user.

By default, messages are saved with the status of "STO UNSENT", but status "STO SENT" can be applied using the <stat> parameter.

In TEXT mode, the header parameters will be set according to CSMP settings.

Command Type	Syntax	Response/Action	Remarks
Set	If text mode (+CMGF=1): **+CMGW[=<da>[,<toda>[,<stat>]]]<CR>text is entered<ctrl-Z/ESC>** if PDU mode (+CMGF=0): **+CMGW=<length>[,<stat>]<CR> PDU is given<ctrl-Z/ESC>**	**+CMGW: <index>** or: **+CMS ERROR: <err>**	The Set command writes a message and stores it.

The following table shows the +CMGW parameters.

Table 3-63: +CMGW Parameters

<Parameter>	Description
<da>	Destination address in quoted string. This field contains a single phone number.
<toda>	Type of DA. Value between 128-255 (according to GSM 03.40, 9.1.2.5). If this field is not given and first character of <da> is '+' , <toda> will be 145, otherwise 129.
<stat>	Status of new message In text mode: “STO UNSENT” (default) or “STO SENT” In PDU mode: 2 (default) or 3
<length>	Size of message in PDU mode fromat, in octects, excluding SMSC data.
<index>	1-352 Index in storage of the stored message.
<PDU>	Message header andcontents in PDU mode format. See description in the tables below.

Table 3-64: Layout of SMS-SUBMIT in PDU Mode: (according to GSM03.40)

Reference	Description	Length
<sca>	Service Center address: 1 BYTE: length (number of followed octets). Mandatory 1 BYTE: <tosca> - value between 128-255	1, 3-12 BYTES (When length is 1, length BYTE = 0)
<fo>	First Octet. See the table below.	1 BYTE
<TP-MR>	Message Reference. An integer representation of a reference number of the SM submitted to the SC by the MS. Values between 0-255.	1 BYTE
<TP-DA>	Destination address formatted according to the formatting rules of address fields.	2-12 BYTES
<TP-PID>	Protocol-Identifier. Values between 0-255.	1 BYTE
<TP-DCS>	Data Coding Scheme. Values between 0-255.	1 BYTE
<TP-VP>	Validity Period. depending on <fo>, TP-Validity-Period-Format bits setting.	0, 1, 7 BYTE
<TP-UDL>	User data length	1 BYTE
<TP-UD>	User data	0-140 BYTES

Table 3-65: Layout of SMS-COMMAND in PDU Mode: (according to GSM03.40)

Reference	Description	Length
<sca>	Service Center address: 1 BYTE: length (number of followed octets). Mandatory 1 BYTE: <tosca> - value between 128-255	1, 3-12 BYTES (When length is 1, length BYTE = 0)
<fo>	First Octet. See Table 3-66.	1 BYTE
<TP-MR>	Message Reference. An integer representation of a reference number of the SM submitted to the SC by the MS. Values between 0-255.	1 BYTE
<TP-PID>	Protocol-Identifier. Values between 0-255.	1 BYTE
<TP-CT>	Command Type	1 BYTE
<TP-MN>	Message Number	1 BYTE
<TP-DA>	Destination address formatted according to the formatting rules of address fields.	2-12 BYTES

Table 3-65: Layout of SMS-COMMAND in PDU Mode: (according to GSM03.40)

Reference	Description	Length
<TP-CDL>	Command data length	1 BYTE
<TP-CD>	Command data	0-156 BYTES

Table 3-66: <fo> for SMS-SUBMIT Message

Bit/s	Reference	Description
0-1	Message-Type-Indicator	Parameter describing the message type. 0 1 SMS-SUBMIT (in the direction MS to SC)
2	TP-Reject-Duplicates	Parameter indicating whether or not the SC shall accept an SMS-SUBMIT for an SM still held in the SC which has the same MR and the same DA as a previously submitted SM from the same OA. 0 Instruct the SC to accept an SMS-SUBMIT as mention above 1 Instruct the SC to reject an SMS-SUBMIT as mention above. In this case an appropriate TP-FCS value will be returned in the SMS-SUBMIT-REPORT.
3-4	TP-Validity-Period-Format	Parameter indicating whether the TP-VP field is present and in which format. 0 0 TP-VP field not present 1 0 TP-VP field present - relative format 0 1 TP-VP field present - enhanced format - valid only in PDU mode 1 1 TP-VP field present - absolute format
5	TP-Status-Report-Request	Parameter indicating if a status report is requested by the MS 0 A status report is not requested 1 A status report is requested
6	TP-User-Data-Header-Indicator	Parameter indicating whether the beginning of the User Data field contains a Header in addition to the short message or contains only the short message 0 The TP-UD field contains only the short message 1 The beginning of the TP-UD field contains a Header in addition to the short message
7	TP-Reply-Path	Parameter indicating that Reply Path is set or not. 0 TP-Reply-Path parameter is not set 1 TP-Reply-Path parameter is set

Table 3-67: <fo> for SMS-COMMAND Message

Bit/s	Reference	Description
0-1	Message-Type-Indicator	Parameter describing the message type. 1 0 SMS-COMMAND (in the direction MS to SC)
5	TP-Status-Report-Request	Parameter indicating if a status report is requested by the MS 0 A status report is not requested 1 A status report is requested
6	TP-User-Data-Header-Indicator	Parameter indicating whether the beginning of the User Data field contains a Header in addition to the short message or contains only the short message 0 The TP-UD field contains only the short message 1 The beginning of the TP-UD field contains a Header in addition to the short message

Note: Any unused bits will be set to 0.

Example

AT+CMGF=1
OK
AT+CMGW="5124335432"
>This is the message body <CTRL+Z>//<CTRL+Z> ends the prompt text mode and returns to regular AT command mode
+CMGW: 126
OK
AT+CMGW
> TEST <CTRL+Z>
+CMGW: 195
OK
AT+CMGF=0
OK
AT+CMGW=24
>07917952120100951 1FF0B917962543940F20008001400410042004300440045 <CTRL+Z>
+CMGW: 128
OK
AT+CMGR=128
+CMGR: 2,,24
07917952120100951 1FF0B917962543940F20008001400410042004300440045
OK
AT+CMGF=1
OK
AT+CSDH=1
OK
AT+CMGR=128
+CMGR: "STO UNSENT", "+97264593042",,145,17,0,8,0,"+972521100059",145,5

```
00410042004300440045
OK
AT+CSMP=25,"05/03/15,21:22:23+08",0,0
OK
AT+CMGW="0544565034"
A<CTRL+Z>
+CMGW: 129
OK
AT+CMGR=129
+CMGR: "STO UNSENT", "0544565034",,129,25,0,0,"05/03/15,21:22:23+08","+972521100059",145,1
A
OK
AT+CMGF=0
OK
AT+CMGR=129
+CMGR: 2,,20
07917952120100951 9FF0A8150446505430000503051122232800141
at+cmgw=18
> 0011000c917952428650290004AA0441424344   // // SCAis not given
+CMGW: 130
OK
at+cmgr=130
+CMGR: 2,,18
07917952120100951 1000C917952428650290004AA0441424344
OK
at+cmgw=19
> 07917952120100951 1000c917952428650290004AA0441424344  //Invalid length (19)
+CMS ERROR: invalid PDU mode parameter
at+cmgw=19
> 07917952120100951 1000c917952428650290004AA044142434477 //UDL is not equal to UD length
+CMS ERROR: invalid PDU mode parameter
at+cmgw=17
> 07917952120100950 1000c9179524286502900040441424344 //No VP in PDU message
+CMGW: 131
OK
at+cmgr=131
+CMGR: 2,,17
07917952120100950 1000C9179524286502900040441424344
OK
at+cmgw=14
> 07917952140230F212000000000c9179524286502900  //SMS Command
+CMGW: 132
OK
at+cmgr=132
+CMGR: 2,,14
07917952140230F212000000000C9179524286502900
OK
at+cmgf=1
OK
at+cmgr=132
+CMGR: "STO UNSENT",18,0,0,0,"+972524680592",145,0
OK
```

+CMGD, Delete Message

This command handles deletion of a single message from memory location <index>, or multiple messages according to <delflag>. If the optional parameter <delflag> is entered, and is greater than 0, the <index> parameter is practically ignored. If deletion fails, result code +CMS ERROR: <err> is returned.

Note: The deletion of multiple commands is a time-consuming process that may require more than 60 seconds to complete.

Command Type	Syntax	Response/Action	Remarks
Set	**+CMGD=<index> [,<delflag>]**	**OK** **or:** **+CMS ERROR: <err>**	
Read			The Read command for +CMGD is not defined by ETSI, and therefore is not supported by the G24. The G24 returns an error.
Test	**+CMGD=?**	**+CMGD: (list of valid <index>s), (list of valid <deflag>s)**	The Test command displays the supported values of <n>.

The following table shows the +CMGD parameters.

Table 3-68: +CMGD Parameters

<Parameter>		Description
<index>	1-352	Index in the SMS memory of the message to be deleted.
<delflag>	0	Deletes the message specified in <index>
	1	Deletes all read messages
	2	Deletes all read messages and sent MO messages
	3	Deletes all read messages, sent and unsent MO messages
	4	Deletes all messages

Example

AT+CMGD=4
OK
AT+CMGD=1,3
OK

+CGSMS, Select Service for MO SMS Messages

This command handles the selection of the service or service preference used by the G24 to send mobile-originated SMS messages.

Note: This command is network dependent, which means that the network must support SMS over GPRS.

Command Type	Syntax	Response/Action	Remarks
Set	**+CGSMS=[<service>]**	**OK** **+CME ERROR: <err>**	The Set command selects the service or service preference used to send SMS messages. The value that is set is not retained after a power cycle.
Read	**+CGSMS?**	**+CGSMS: <service>** **+CME ERROR: <err>**	The Read command displays the current SMS service preference setting.
Test	**+CGSMS=?**	**+CGSMS: (list of currently available <service>s)** **+CME ERROR: <err>**	The Test command displays a list of currently available <service>s on the network.

The following table shows the +CGSMS parameters.

Table 3-69: +CGSMS Parameters

<Parameter>	Description
<service>	Indicates the service or service preference to be used. 0 GPRS 1 Circuit switched (default) 2 GPRS preferred (use circuit switched if GPRS is not available) 3 Circuit switched preferred (use GPRS if circuit switched is not available) Other values are reserved and will result in an ERROR response to the Set command.

Example

AT+CGSMS=?
CGSMS:(0-3)
OK
AT+CGSMS?
CGSMS: 1
OK

+CMGS, Send SM to Network

This command sends an SM from the G24 to the network. The message reference value <mr> is returned to the G24 upon successful delivery of the message.

Valid <toda> will be any value between 128-255.

The header parameters in TEXT mode will be set according to CSMP settings.

Command Type	Syntax	Response/Action	Remarks
Set	If text mode (+CMGF=1): **+CMGS=<da>[,<toda>]<CR>** text is entered<ctrl-Z/ESC> If PDU mode (+CMGF=0): **+CMGS=<length><CR>** **PDU is entered<ctrl-Z/ESC>**	+CMGS: <mr> **+CMS ERROR: <err>**	The Set command validates the input parameters, sends the SM to network and reports the result of the operation to the G24.

The following table shows the +CMGS parameters.

Table 3-70: +CMGS Parameters

<Parameter>	Description
<da>	Destination address in quoted string. This field contains a single MIN number.
<toda>	Type of DA. Value between 128-255 (according to GSM 03.40, 9.1.2.5). If this field is not given and first character of <da> is '+' , <toda> will be 145, otherwise 129.
<length>	Size of message in PDU mode format, in octets, excluding SMSC data.
<mr>	Sent message reference number.
PDU	Message header andcontents in PDU mode format. See description in +CMGW section.

Example

AT+CMGS="064593042",129

>This is the message body <CTRL+Z> //<CTRL+Z> ends the prompt text mode and returns to regular AT command mode

OK
AT+CMGF=0
OK
AT+CMGS=24
>07917952120100951 1FF0B917962543940F20008001400410042004300440045 <CTRL+Z>
+CMGS: 128
OK

Note: Any character sent by TE to G24 before G24 has reported a result of AT+CMGS operation, will abort AT+CMGS command execution. However, if SMS was already sent to NW and sending operation was successful, the result of operation "+CMGS <mr>" will be reported by G24. If after aborting AT+CMGS command execution and before result of operation was reported by G24, a second AT+CMGS command is executed, then the result of the second AT+CMGS operation only will be reported by G24.

+CSCB, Cell Broadcast Messages

This command handles the selection of cell broadcast message types and data coding schemes received by the G24.

Command Type	Syntax	Response/Action	Remarks
Set	**+CSCB=[<mode>[,<mids>[,<dcss>]]]**	The active channel list is updated with new Message IDs (MIDs) and Data Coding Schemes (DCSs).	The Set command sets the cell broadcast message type and data coding scheme.
Read	**+CSCB?**	+CSCB: <mode>,<mids>,<dcss>	The Read command displays the current MID and DCS settings.
Test	**+CSCB=?**	+CSCB: (list of supported <mode>s)	The Test command displays the supported values of <n>.

Note: The Channel and DCS list is saved to the SIM card.

The maximum number of active channels is SIM dependent.

The AT+CSCB set command is not available when the phone is either in "Emergency Only" or "No Service" status.

The following table shows the AT+CSCB parameters.

Table 3-71: +CSCB Parameters

<Parameter>	Description
<mode>	The current broadcast message mode: 0 MIDs and DCSs accepted 1 MIDs and DCSs not accepted
<mids>	Cell broadcast message identifiers 0-65534
<dcss>	Cell broadcast message data coding schemes 0-255

Note: A combination of discrete values or intervals can be entered for <mids> and <dcss>, for example, "0,1,5,320-324,922".

Parameter values must be entered in ascending order.

+MCSAT, Motorola Control SMS Alert Tone

This command enables/disables/exercises the SMS alert tone for an arriving SMS. It does not apply on Cell Broadcast SMS.

Command Type	Syntax	Response/Action	Remarks
Set	**+MCSAT=<mode> [,<dcs_mask>[,....]]**	**OK** **or:** **+CME ERROR: <err>**	The Set command is used to: • Suppress (mute) the voice notification (alert tone) of a specific incoming SMS, identified by the received <dcs_mask>s property • Enable voice notification (alert tone) of all incoming SMS events • Activate the current alert tone for an incoming SMS event
Read	**+MCSAT?**	**+MCSAT: <mode>[,<dcs_mask>[,....]]** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the current <mode> and current <dcs_mask>s.
Test	**+MCSAT=?**	**+MCSAT: (list of supported <mode>s)** **OK** **or:** **+CME ERROR: <err>**	The Test command returns the possible <mode> values.

The following table shows the +MCSAT parameters.

Table 3-72: +MCSAT Parameters

<Parameter>	Description
<mode>	0 Suppress alert tone 1 Enable alert tone 2 Play alert tone The default value at power-up is 1.
<dcs_mask>	SMS data coding-scheme mask. The format is an 8-bit information parameter. Each bit contains 0, 1, or X (ASCII character): 0 Condition is met if the arriving SMS includes dcs with 0 in this position 1 Condition is met if the arriving SMS includes dcs with 1 in this position X or x This bit is ignored from the dcs of the arriving SMS

Example

```
AT+MCSAT=?
+MCSAT:(0-2)
OK
AT+MCSAT?
+MCSAT: 1
OK
AT+MCSAT=2
OK
AT+MCSAT=1,00001000     // UCS2
OK
AT+MCSAT=1,00000100     // UTF8
OK
AT+MCSAT=1,00000000     // GSM
OK
AT+MCSAT=1
OK
AT+MCSAT=0
OK
```

+MEGA, Email Gateway Address

This Motorola-specific command updates the Email Gateway Address.

Command Type	Syntax	Response/Action	Remarks
Set	**+MEGA=<ega>**	**OK** **or:** **CME ERROR: <err>**	The Set command sets the Email gateway address.
Read	**+MEGA?**	**+MEGA: "<ega>"**	

The following table shows the +MEGA parameters.

Table 3-73: +MEGA Parameters

<Parameter>	Description
<ega>	Email Gateway Address, represented by a quoted string. See Table 3-43, on page 3-79, for supported characters. The length of the <ega> should be between 3 to 15 characters.

Example

```
AT+MEGA="4252833433"
OK
AT+MEGA?
+MEGA: "4252833433"
OK
```

DCS handling

Sending or Storing SM

When sending or storing SM in TEXT mode, only the specified <dcs>s in Table 3-45, on page 3-81, +CSMP command definitions, will be supported. Handling will be as shown in Table 3-74.

Table 3-74 shows the conversion between the <dcs> and +CSCS setting when storing SM to memory or sending SM.

Table 3-74: <dcs> field and +CSCS settings conversion when writing SM

CASE	<dcs> field	User-Data-Header	Current TE character set (+CSCS)	Action
A	Default alphabet	Not Set	UTF8 or UCS2	Returns an error since conversion from these character sets to default alphabet is impossible.
			GSM	G24 converts each two IRA characters long hexadecimal number to 7-bit septet.
			ASCII or 8859	G24 converts each character to 7-bit septet.
B	Default alphabet	Set	All	G24 converts each two IRA characters long hexadecimal number to one 8-bit octet.
C	8-bit or UCS2	All	All	G24 converts each two IRA characters long hexadecimal number to one 8-bit octet.

Note: If SMS, requested to be read in TEXT mode, is a GSM ’7’ bit Default alphabetical encoded and contains undefined extended characters in User Data (e.g. hex base 1B07), then two septets will be converted, as two separate characters accordingly, to currently selected (+CSCS setting) character set.

Reading SM

Any <dcs> value is accepted when receiving an SM.

When reading a SM with unsupported <dcs> the message header will be passed as usual. The DATA will be output in "HEX" format.

According to the GSM 03.38, Any reserved codings shall be assumed to be the GSM default alphabet (the same as DCS value 0x00) by a receiving entity. Handling will be as shown in Table 3-75.

Table 3-75 shows the conversion between the <dcs> and +CSCS setting when reading SM.

Table 3-75: <dcs> field and +CSCS settings conversion when reading SM

CASE	<dcs> field	User-Data-Header	Current TE character set	Action
A	Default alphabet	Not Set	All	G24 converts GSM alphabet into current TE character set according to rules of GSM07.05, Annex A
B	Default alphabet	Set	All	G24 converts each 8-bit from TP-UD, encoded in GSM alphabet into two IRA character long hexadecimal number
C	8-bit or UCS2	All	All	G24 converts each 8-bit octet into two IRA character long hexadecimal number

Examples:

Store in TEXT mode SMS encoded in default alphabet with UDHI set.
Character set is ASCII.
at+cmgf=1
OK
at+csmp=81,167,0,0
OK
at+cmgw="0544565803"
> 050003090301123456786543
+CMGW: 222
OK
at+cmgr=222
+CMGR: "STO UNSENT","0544565803",
050003090301123456786543
OK
at+cmgf=0
OK
at+cmgr=222
+CMGR: 2,,25
07917952140230F251000A8150446585300000A70D050003090301123456786543
OK
Store in TEXT mode SMS encoded in UCS2 alphabet with UDHI set.
Character set is ASCII.
at+csmp=81,167,0,10

```
OK
at+cmgf=1
OK
at+cmgw="0544565803"
> 0500030903011234567865 43FE
+CMGW: 223
OK
at+cmgr=223
+CMGR: "STO UNSENT","0544565803",
0500030903011234567865 43FE
OK
at+cmgf=0
OK
at+cmgr=223
+CMGR: 2,,26
07917952140230F251000A815044658530000AA70D0500030903011234567865 43FE
OK
### Store in TEXT mode SMS 8-bit encoded.
### Character set is ASCII.
at+csmp=17,167,0,245
OK
at+cmgf=1
OK
at+cmgw="0544565803"
> 050003090301123456786543
+CMGW: 225
OK
at+cmgr=225
+CMGR: "STO UNSENT","0544565803",
050003090301123456786543
OK
at+cmgf=0
OK
at+cmgr=225
+CMGR: 2,,25
07917952140230F211000A81504465853000F5A70C050003090301123456786543
OK
### Store in TEXT mode SMS encoded in default alphabet.
### Character set is GSM.
at+csmp=17,167,0,0
OK
at+cmgw="0544565803"
> 414441444144414441444144414441444144414441444144414441444144414441444144414441444144
444144414441444144414441444144414441444144414441444144414441444144414441444144414441
444144414441444144414441444144414441444144414441444144414441444144414441444144414441
444144414441444144414441444144414441444144414441444144414441444144414441444144414441
44
+CMGW: 227
OK
at+cmgr=227
+CMGR: "STO UNSENT","0544565803",
414441444144414441444144414441444144414441444144414441444144414441444144414441444144
```

414441444144414441444144414441444144414441444144414441444144414441444144414441444144414441444144
414441444144414441444144414441444144414441444144414441444144414441444144414441444144414441444144
414441444144414441444144414441444144414441444144414441444144414441444144414441444144414441444144
OK
at+cscs="ASCII"
OK
at+cmgr=227
+CMGR: "STO UNSENT","0544565803",
ADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADAD
ADADADADADADADADAD
ADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADADAD
ADADADADADADADADAD
OK
at+cmgf=0
OK
at+cmgr=227
+CMGR: 2,,153
07917952140230F211000A8150446585300000A7A0416290182406894162901824068941629018240
6894162901824068941629018240689416290182406894162901824068941629018240689416290
1824068941629018240689416290182406894162901824068941629018240689416290182406894
1629018240689416290182406894162901824068941629018240689416290182406894162901824
0689416290182406894162901824068941629018240689416290182406
89
OK

Network

Network Commands

+CSQ, Signal Strength

This command displays the received signal strength indication <rssi> and channel bit error rate <ber> from the G24.

Command Type	Syntax	Response/Action
Execute/Read	**AT+CSQ** **AT+CSQ?**	**+CSQ: <rssi>,<ber>** **OK** **or:** **+CME ERROR: <err>**
Test	**AT+CSQ=?**	**+CSQ: (list of supported <rssi>s),(list of supported <ber>s)** **OK** **or:** **+CME ERROR: <err>**

The following table shows the +CSQ parameters.

Table 3-76: +CSQ Parameters

<Parameter>	Description
<rssi>	0 through 31 - covers the range of -113 dbm (or less) to -51dbm (or greater)
<ber>	Channel bit error rate (in percent) 0–7 RXQUAL values in the GSM 05.08 table 99 Unknown or not detectable

Example

at+csq
+CSQ: 031,000
OK
at+csq=?
+CSQ: (000-031,099),(000-007,099)
OK

+CRLP, Radio Link Protocol

This command displays the Radio Link Protocol parameters that are used when non-transparent data calls are originated.

Command Type	Syntax	Response/Action	Remarks
Set	**+CRLP= [<iws>[,<mws>[,<T1>[,<N2>]]]]**	**OK** **or:** **+CME ERROR: <err>**	The Set command enables you to change the RLP parameters.
Read	**+CRLP?**	**+CRLP= <iws>,<mws>,<T1>,<N2>** **OK** **or:** **+CME ERROR: <err>**	
Test	**+CRLP=?**	**+CRLP= (list of supported <iws>s), (list of supported <mws>s), (list of supported <T1>s), (list of supported <N2>s)** **OK** **or:** **+CME ERROR: <err>**	

The following table shows the +CRLP parameters.

Table 3-77: +CRLP Parameters

<Parameter>	Description
<iws>	IWF to MS window size. The default value is 61.
<mws>	MS to IWF window size. The default value is 61.
<T1>	Acknowledgement timer T1. The default value is 48.
<N2>	Retransmission attempts N2 in integer format (refer to GSM 04.22 [18] subclause 5.4.3) The default value is 6.

Example

AT+CRLP=?
+CRLP: (010-061),(010-061),(048-255),(006-010)
OK
AT+CRLP?
+CRLP: 061,061,048,006
OK

+CREG, Network Registration Status

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CREG=<n>**	**OK** **or:** **+CME ERROR: <err**	The Set command controls the presentation of an unsolicited result code and the result of the Read operation.
Read	**AT+CREG?**	**+CREG: <n>,<stat>[,<lac>,<ci>]** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the status of the result code presentation and shows whether the network has currently indicated the registration of the G24. Location information elements <lac> and <ci> are returned only when <n>=2 and the G24 is registered in the network.
Test	**AT+CREG=?**	**+CREG: (list of supported <n>s)** **OK**	

The following table shows the +CREG parameters.

Table 3-78: +CREG Parameters

<Parameter>	Description
<n>	0 Disables the network registration unsolicited result code. 1 Enables the network registration unsolicited result code +CREG: <stat>. 2 Enables the network registration and location information in unsolicited reports and Read command +CREG:<stat>[,<lac>,<ci>]. The default is 0.
<stat>	0 Not registered, and the ME is not currently searching for a new operator to which to register. 1 Registered, home network. 2 Not registered, but the ME is currently searching for a new operator to which to register. 3 Registration denied. 4 Unknown. 5 Registered, roaming.
<lac>	Two-byte location area code in hexadecimal format.
<ci>	Two-byte cell ID in hexadecimal format.

Example

```
at+creg=?
+CREG: (000 - 002)
OK
at+creg?
+CREG: 000,001
OK
at+creg=2
OK
at+creg?
+CREG: 002,001, a065,988b
OK
at+creg=1
OK
at+creg?
+CREG: 001,001
OK
at+creg=0
OK
```

+CGREG, GPRS Network Registration

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CGREG=[<n>]**	**OK** **or:** **+CME ERROR: <err>**	The Set command controls the presentation of an unsolicited result code "+CGREG:" and the result of the Read operation.
Read	**AT+CGREG?**	**+CGREG: <n>,<stat>[,<lac>,<ci>]** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the status of the result code presentation and shows whether the network has currently indicated the GPRS registration of the G24. Location information elements <lac> and <ci> are returned only when <n>=2 and the G24 is registered in the network.
Test	**AT+CGREG=?**	**+CGREG: (list of supported <n>s)** **OK**	The Test command displays the supported values of <n>.

The following table shows the +CGREG parameters.

Table 3-79: +CGREG Parameters

<Parameter>	Description
<n>	0 Disables the network registration unsolicited result code. 1 Enables the network registration unsolicited result code +CGREG: <stat>. 2 Enables the network registration and location information in unsolicited result code and Read command +CGREG:<stat>[,<lac>,<ci>]. The default is 0.
<stat>	0 Not registered, and the ME is not currently searching for a new operator to which to register. 1 Registered, home network. 2 Not registered, but the ME is currently searching for a new operator to which to register. 3 Registration denied. 4 Unknown. 5 Registered, roaming.
<lac>	Two-byte location area code in hexadecimal format.
<ci>	Two-byte cell ID in hexadecimal format.

Example

```
at+cgreg=?
+CGREG: (000-002)
OK
at+cgreg=2
OK
at+cgreg?
+CGREG: 002,001,2648,988b
OK
at+cgreg=1
OK
at+cgreg?
+CGREG: 001,001
OK
at+cgreg=0
OK
//Example for unsolicited reports:
at+cgreg=1
OK
at+cgatt=0
OK
+CGREG: 000
at+cgatt=1
OK
+CGREG: 002
+CGREG: 001
//Remove GPRS enabled SIM
+CGREG: 000
//Insert GPRS enabled SIM
+CGREG: 002
+CGREG: 001
```

+COPS, Operator Selection

This command enables accessories to access the network registration information, and the selection and registration of the GSM network operator. The G24 is registered in the Home network.

The Enhanced Operator Name String (EONS) feature enables the G24 to return the operator name displayed on the handset. This feature allows the SIM card to store a mapping of MCC/MNC code pairs to the displayed operator name. As a result, several operators can share a single network while having their handsets display their own name as the network operator.

Testing the enhanced ONS feature requires a "SIM ONS" SIM card.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+COPS=[<mode>[,<format>[,<oper>]]]**	**OK** **or:** **+CME ERROR: <err>**	The Set command can force an attempt to select and register a specific GSM network operator. The <mode> selects whether this is done automatically by the G24, or whether the selection is forced to an operator <oper> (given in format <format>). If the selected operator is not available, no other operator is selected (except when the <mode> is set to 4). <mode>=2 forces an attempt to deregister from the network. <mode>=3 sets the operator format to all further Read commands (+COPS?) as well. The selected mode applies to future network registrations, for example, once you deregister from the network, the G24 remains unregistered until you select <mode>=0, <mode>=1, or <mode>=4
Read	**AT+COPS?**	**+COPS: <mode>[,<format>,<oper>]** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the current mode and the currently selected operator.
Test	**AT+COPS=?**	**+COPS: [list of supported (<stat>, long alpha numeric <oper>, short alphanumeric <oper>, numeric <oper>)] [,list of supported <mode>s, (list of supported <format>s)]** **OK** **or:** **+CME ERROR: <err>**	The Test command returns a list of quadruplets, each representing an operator present in the network. A quadruplet consists of an integer indicating the availability of the operator <stat>, long and short alphanumeric format of the name of the operator, and numeric format representation of the operator. If any of the formats are unavailable, there is an empty field. After the operator list, the G24 returns lists of the supported <mode>s and <format>s. These lists are separated from the operator list by two commas.

The following table shows the +COPS parameters.

Table 3-80: +COPS Parameters

<Parameter>	Description
<format>	The operator format type: 0 Long alphanumeric 1 Short alphanumeric 2 Numeric The default value is 0.
<mode>	Determines whether what is displayed is defined by <oper>, or is done automatically by the G24. 0 Automatic (<oper> field is ignored) 1 Manual (<oper> field is present) 2 De-register from network 3 Set only <format> (<oper> field is ignored); used for Read command only, do not attempt registration/deregistration 4 Manual/automatic (<oper> field is present; if manual selection fails, use automatic mode) The default value is 0.
<stat>	0 Unknown 1 Available 2 Current 3 Forbidden
<oper>	Operator name displayed on the handset. The long alphanumeric format can be up to 16 characters long. The short alphanumeric format can be up to 8 characters long. The numeric format is the GSM Location Area Identification number (refer to GSM 04.08 [8] subclause 10.5.1.3), consisting of a three BCD digit country code (as per ITU-T E.212 Annex A [10]), plus a two BCD digit network code, which is administration specific. The returned <oper> is not in BCD format, but in IRA characters converted from BCD, and therefore the number has the following structure: (country code digit 3)(country code digit 2)(country code digit 1)(network code digit 2)(network code digit 1)

Example

AT+COPS=?
+COPS:(002,"IL ORANGE","ORANGE","42501"),(003,"IL Cellcom","Cellcom","42502"),(001,"IL-77","I-77","42577"),, (000,001,002,003,004),(000,001,002)
OK
AT+COPS?
+COPS: 000,000,"IL ORANGE"
OK
AT+COPS=3,2
AT+COPS ?
+COPS: 000,002,"42501"//Specific provider number
AT+COPS=0
OK
AT+COPS=1,2,"31038"
OK
AT+COPS=1,1,"ORANGE"
OK

+CPOL, Preferred Operators

This command is used to edit the list of preferred network operators located in the SIM card.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CPOL=[<index>][,<format>[,<oper>]]**	**OK** **or:** **+CME ERROR: <err>**	The Set command writes an entry in the list of preferred operators. **Note:** The G24 may also update this list automatically when new networks are selected.
Read	**AT+CPOL?**	**+CPOL: <index1>,<format>,<oper1>** **[<CR><LF>+CPOL: <index2>,<format>,<oper2>** **[...]]** **OK** **or:** **+CME ERROR: <err>**	The Read command displays all the preferred operators that have been entered into the list.
Test	**AT+CPOL=?**	**+CPOL: (list of supported <index>s),(list of supported <format>s)** **OK** **or:** **+CME ERROR: <err>** *** Index range is SIM dependent**	The Test command displays the entire index range supported by the SIM.

The following table shows the +CPOL parameters.

Table 3-81: +CPOL Parameters

<Parameter>	Description
<indexn>	Order number of network operator in the SIM preferred operator list
<format>	Defines the <oper> format: 0 Long alphanumeric format (up to 16 characters) 1 Short alphanumeric format (up to 8 characters) 2 Numeric (default)
<oper>	Name of the network operator

Note: To delete an entry from the list, enter an <index> without an <oper>.

If an <oper> is entered without an <index>, the <oper> is placed in the next free location in the list.

To change the format of <oper> displayed with the Read command, enter a <format>.

User is prevented to edit index No. 0. This is the HOME PLMN and is not stored in the SIM preferred list element file.

When entering a new item with an <index> to a full list, the G24 deletes the last item, stores the new item in the requested entry, and shifts the rest of the list down.

When entering a new item without an <index> to a full list, the G24 replaces the last entry with the new item.

Example

```
at+cpol=?
+CPOL: (001-032),(000-002)
OK
at+cpol?
+CPOL: 000,002,"42501"
OK
at+cpol=,0
OK
at+cpol?
+CPOL: 000,000,"IL ORANGE"
OK
at+cpol=?
+CPOL: (001-032),(000-002)
OK
at+cpol=1,2,"42502"
OK
at+cpol?
+CPOL: 000,000,"IL ORANGE"
+CPOL: 001,000,"IL Cellcom"
OK
at+cpol=1
OK
at+cpol?
+CPOL: 000,000,"IL ORANGE"
OK
```

+MFS, Motorola Frequency of Search

This command is used to determine how long the G24 waits before attempting to reregister after a registration attempt has failed and the G24 is not registered. The available settings are Slow Search, Medium Search, Fast Search or Continuous Search.

See Table 3-82, "+MFS Parameters", for the minimum interval lengths for every frequency of search. The interval between attempts can vary, depending on the number of operators displayed in the preferred operator list.

This command sets or reads Frequency of Search and Search mode settings. After a Set command has been executed, new Frequency of Search and Search mode values are active.

This command is a non-basic command, which means that the G24 module rejects the command with an appropriate error message when the SIM is not present and/or the phone is in lock state.

Command Type	Syntax	Response/Action	Remarks
Set	**+MFS=<freq> [,<mode>]**	**OK** **or:** **+CME ERROR: <err>**	This command enables you to change and store in Flex the new values of Frequency of Search <freq> and Search mode <mode>. If only the <freq> value is given, then the Set command is interpreted as follows: • Store new <freq> value. The <mode> value remains unchanged. If <freq> and <mode> values are given, then the Set command is interpreted as follows: • Store new <freq> and <mode> values. Otherwise, an error message is sent to the DTE. **Note:** If the phone is not registered, then a set operation of Search mode to Manual is refused and ERROR is sent to the DTE.
Read	**+MFS?**	**+MFS: <freq>,<mode>** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the current settings for values of <freq> and <mode>.
Test	**+MFS=?**	**+MFS: (List of supported <freq>,(List of supported <mode>s)** **OK** **or:** **+CME ERROR: <err>**	The Test command returns the possible <freq> and <mode> values.

The following table shows the +MFS parameters.

Table 3-82: +MFS Parameters

<Parameter>	Description
<freq>	This value defines the frequency of search. 0 Continuous. Minimum interval between subsequent search attempts is 1 second. 1 Medium. Minimum interval between subsequent search attempts is 10 seconds. 2 Slow. Minimum interval between subsequent search attempts is 30 seconds. 3 Fast. Minimum interval between subsequent search attempts is 5 seconds. The default value is already stored in NVM (FLEX) and thus is flex dependent.
<mode>	This value defines the search mode. The mode defines whether network selection and registration are performed automatically by the G24, or whether the selection is forced to the specific operator to which the G24 is registered to at a given moment. 0 Automatic 1 Manual The default value is already stored in NVM (FLEX) and thus is flex-dependent.

Example

at+mfs=? //Test command
+MFS: (0-3),(0,1)
OK
at+mfs? //Read command
+MFS: 1,0
OK
at+mfs=3 //Set only Frequency of search
OK
at+mfs?
+MFS: 3,0
OK
at+mfs=2,1 //Set Frequency of search and search mode.
OK
at+mfs?
+MFS: 2,1
//POWER CYCLE phone
at+mfs? //Previous values restored after power up.
+MFS: 2,1
OK
at+mfs=0
OK
at+mfs?
+MFS: 0,1
OK

+MCI, Motorola Cell Information

This command returns neighbor cell information.

Command Type	Syntax	Response/Action	Remarks
Set **Execute**	**AT+MCI=[<Filter>]** **Or** **AT+MCI**	**+MCI: <serving cell ARFCN>,<serving cell BSIC>,<signal strength>** **[,<neighbor 1 ARFCN>,[<neighbor 1 BSIC>],<signal strength>** **[,<neighbor 2 ARFCN>,[<neighbor 2 BSIC>],<signal strength>** **[,<neighbor 3 ARFCN>,[<neighbor 3 BSIC>],<signal strength>** **[,<neighbor 4 ARFCN>,[<neighbor 4 BSIC>],<signal strength>** **[,<neighbor 5 ARFCN>,[<neighbor 5 BSIC>],<signal strength>** **[,<neighbor 6 ARFCN>,[<neighbor 6 BSIC>],<signal strength>]]]]]]** **OK**	+MCI (Motorola Cell Information) command returns ARFCN, BSIC and RX level of serving and adjacent cells. In case G24 is registered, adjacent cells are from registered PLMN. In case G24 is in Emergency Mode, adjacent cells are physical neighbours. BSIC is displayed only in case SCH (Synchronization Channel) is decoded. The command output is <filter> dependent. In case the command output should be filtered to include just cells of a specific GSM band (one or more) the filter parameter should be set accordingly, see Table 3-83. The filtering will apply to the neighbour's cells only - the serving cell info will always be returned. Using the set command without a parameter will return output according to the currently set <Filter> value.
Read	**AT+MCI?**	**+MCI: <Filter>** **OK**	The Read command returns the current set <Filter> value.
Test	**AT+MCI=?**	**+MCI: (List of supported <Filter>s)** **OK**	The Test command returns the range of <Filter>'s supported values.

The following table shows the +MCI parameters.

Table 3-83: +MCI Parameters

<Parameter>	Description
<Filter>	The requested GSM band's ARFCNs. This is an integer which can be a combination of all (1-15): 1 - GSM 850 2 - GSM 900 4 - GSM 1800 8 - GSM 1900 The default value is 15.
<ARFCN>	Absolute Radio Frequency Channel Number Range: [1-124], [128-251], [512-885], [975-1023].
<BSIC>	Base transceiver Station Identity Code Range: [0 - 63]
<signal strength>	Range: -110 - (-48) dBm. For serving cell signal strength is defined as: • In dedicated mode - TCH Rx level • In idle mode average BCCH Rx level For adjacent cells, signal strength is defined as the average Rx level in the both modes.

Example

```
AT+MCI          // Get the current serving and neighbour's info.
+MCI: 74,17,-68,642,52,-77,77,53,-90,76,11,-93,81,,-94,66,57,-96
OK
AT+MCI=2  // Get serving cell info and GSM 900 neighbour's only info.
+MCI: 74,17,-68,77,53,-90,76,11,-93,81,,-94,66,57,-96
OK
AT+MCI=6  // Get serving cell info and GSM 1800 only neighbour's
                // only info.
+MCI: 74,17,-68,642,52,-77
OK
AT+MCI=?     // Get <Filter> supported values.
+MCI: (1-15)
OK
AT+MCI?     // Get current set <Filter> value.
+MCI: 6
OK
```

Hardware Information

Hardware Information Commands

+CBC, Battery Charger Connection

This command enables a user to query the battery charger connection.

Command Type	Syntax	Response/Action
Read	**+CBC**	**+CBC:<bcs>,<bcl>**

The following table shows the +CBC parameters.

Table 3-84: +CBC Parameters

<Parameter>	Description
<bcs>	Battery status values 0 Battery powered 1 Externally powered **Note:** The G24 input power source is connected via the battery pins.
<bcl>	Battery charge level:

VCC, V	Battery Level
4.3-4.75	90
4.1-4.3	60
3.9-4.1	20
3.7-3.9	10
3.25-3.7	5

Note: The G24 does not allow the detection of battery use. The power supply of the G24 is connected via the battery pins. However, users can use this command to verify the level of the G24 input power source.

Example

at+cbc
+CBC: 0,60 //This example shows 0 (battery powered) with 60% power.
OK

Note: The battery level is an average value, which updated once in 0.5 … 2min.

Each battery level update couses change of one 5 stages sequentaly. It means that If the VCC level has changed, for example, from 3.8V to 4.5V, the reports will be as following.

at+cbc
+CBC: 0,10 //This example shows 0 (battery powered) with 10% power.
OK
at+cbc
+CBC: 0,20 //This example shows 0 (battery powered) with 20% power.
OK
at+cbc
+CBC: 0,60 //This example shows 0 (battery powered) with 60% power.
OK
at+cbc
+CBC: 0,90 //This example shows 0 (battery powered) with 90% power.
OK

+CBAUD, Baud Rate Regulation

This command sets the baud rate. The baud rate of the G24 is changed/set to the request value <rate> written in the command.

Specifying a value of 9 or 0 disables the function and allows operation only at rates automatically detectable by the G24. The specified rate takes effect following the issuing of any result code(s) associated with the current command line.

The UART is configured according to the request, or to the specific constant baud rate or auto baud rate after output "OK" response to the terminal. For example, AT+CBAUD=8 is equivalent to AT+CBAUD=57600. Using AT+CBAUD with the <rate> value other than 9 or 0 disables the auto baud rate detection feature. The G24 supports up to 115200 auto baud.

Command Type	Syntax	Response/Action
Set	**AT+CBAUD=<n>** **AT+CBAUD=<rate>**	**OK** **or:** **ERROR**
Read	**AT+CBAUD?**	**+CBAUD: <rate>**
Test	**AT+CBAUD=?**	**+CBAUD: (list of supported <n>s, list of supported <rate>s)**

The following table shows the +CBAUD parameters.

Table 3-85: +CBAUD Parameters

<Parameter>		Description
<n>	0	Auto baud rate
<rate>	1	600
	2	1200
	3	2400
	4	4800
	5	9600
	6	19200
	7	38400
	8	57600
	9	Auto baud rate
	10	115200
	11	300
	The default value is 9.	

Example

AT+CBAUD=57600
or
AT+CBAUD=8//These commands have the same effect
OK
AT+CBAUD?
+CBAUD: 57600
OK
AT+CBAUD=?
+CBAUD: (0-11,300,600,1200,2400,4800,9600,19200,38400,57600,115200)
OK

+IPR, Local Terminal/G24 Serial Port Rate

This command is responsible for setting and saving the request baud rate. This numeric extended-format parameter specifies the data rate at which the G24 accepts commands. Specifying a value of 9 disables the function and allows operation only at rates automatically detectable by the G24. The specified rate takes effect following the issuing of any result code(s) associated with the current command line.

The <rate> value specified is the rate in bits per second at which the terminal-G24 interface operates, for example, 19200 or 115200. The rates supported by the G24 are manufacturer-specific. However, the +IPR parameter permits setting any rate supported by the G24 during online operation.

The UART is configured to rates of 300, 600, 1200, 4800, 9600, 19200, 38400, 57600 or 115200 bits per second according to the parameters of the +IPR command.

Using AT+IPR=<rate> with a <rate> value other than 9 and 0 disables the auto baud rate detection feature. The entered baud rate is stored in the G24 and is restored after power up.

Note: +IPR is similar to +CBAUD, but with the ability to save.

Command Type	Syntax	Response/Action
Set	**AT+IPR=<n>** **AT+IPR=<rate>**	**OK** **or:** **ERROR**
Read	**AT+IPR?**	**+IPR: <rate>**
Test	**AT+IPR=?**	**+IPR: (list of supported <rate>s)**

The following table shows the +IPR parameters.

Table 3-86: +IPR Parameters

<Parameter>		Description
<n>	0	Auto baud rate
<rate>	1	600
	2	1200
	3	2400
	4	4800
	5	9600
	6	19200
	7	38400
	8	57600
	9	Auto baud rate
	10	115200
	11	300

Example

AT+IPR=6
OK
AT+IPR?
+IPR: 19200
OK
AT+IPR=?
+IPR: (0-11,300,600,1200,2400,4800,9600,19200,38400,57600,115200)
OK

+GCAP, Request Overall Capabilities

This command indicates the major capability areas of the G24. The support of different areas is presented in the response of the +GCAP command. Each area may be presented by the selection command name of a specific capability area. The G24 supports only FCLASS - fax support.

Command Type	Syntax	Response/Action
Execute	**AT+GCAP**	**GCAP: <list of supported features><CR><LF>** **OK // at the end of the list.**

Example

```
AT+GCAP
+GCAP: +FCLASS
OK
```

+MTDTR, DTR Line Test Command

This command checks and outputs the physical current status of the DTR pin of the RS232.

Command Type	Syntax	Response/Action
Set	**AT+MTDTR**	**+MTDTR:<n>** **OK**
Read	**AT+MTDTR?**	**+MTDTR:<n>** **OK**
Test	**AT+MTDTR=?**	**OK**

The following table shows the +MTDTR parameters.

Table 3-87: +MTDTR Parameters

<Parameter>		Description
<n>	0	DTR OFF
	1	DTR ON

Example

```
AT+MTDTR?
+MTDTR:1
OK
AT+MTDTR
+MTDTR:1
OK
AT+MTDTR=?
OK
```

+MTCTS, CTS Line Test Command

This command sets the CTS pin of the RS232 to active high, waits one second and then returns the CTS to active low.

Command Type	Syntax	Response/Action
Execute	AT+MTCTS	OK

Example

AT+MTCTS
OK

&K, RTS/CTS Flow Control

This command configures the flow control. The RTS (Request To Send) is an input line. The RTS signal is received from the terminal and a low condition indicates that the G24 can send more data. The CTS (Clear To Send) is an output line. The CTS signal is sent to the terminal and a low state indicates that more data can be sent to the G24.

The RTS and CTS together make up what is called RTS/CTS or “hardware” flow control. Both lines are used when “hardware flow control” is enabled in both the terminal and the G24 devices. When the terminal is ready and able to receive data, it puts the CTS line in an active (low) condition to indicate this to the G24. If the terminal is not able to receive data (typically because its receive buffer is almost full), it puts the CTS line in an inactive (high) condition as a signal to the G24 to stop sending data. When the terminal is ready to receive more data (for example, after data has been removed from its receive buffer), it places this line back in the active condition. The RTS line complements the CTS line. The G24 puts the RTS line in an active condition to tell the terminal that it is ready to receive the data. Likewise, if the G24 is unable to receive data, it places the RTS line in an inactive condition.

Command Type	Syntax	Response/Action
Set	AT&K<param>	OK
Read	AT&K?	&K: <param>
Test	AT&K=?	&K: (list of supported <param>s)

The following table shows the &K parameters.

Table 3-88: &K Parameters

<Parameter>	Description
<param>	0 Disable all terminal/G24 flow control 3 Enable CTS/RTS terminal/G24 flow control 4 Enable Xon/Xoff terminal/G24 flow control 5 Enable Xon/Xoff terminal/G24 flow control 6 Enable CTS/RTS terminal/G24 flow control The default value is 3.

Example

AT&K?
&K: 3
OK
AT&K4
OK

&C, Circuit 109 Behavior

This parameter determines how the state of the DCD line relates to the detection of the received line signal from the distant end. Changing the parameters will take effect immediately in both the command and online command states.

The DCD line is an output line that indicates the following:

- In Circuit Switch Data mode an active (low) indicates that a valid carrier (data signal) was detected by the G24 (CONNECT message is received), and inactive (high) indicates idle. The AT&C command always puts the DCD command ON, when set to 0. If the AT&C command is set to 1 then the "+++" escape command sets the DCD signal to an inactive state and the ATO command is set to active. The AT&C set to 2 sets the DCD signal OFF.
- In GPRS mode, the DCD line indicates the PDP context status. PDP context active sets the DCD to active (low); PDP context inactive sets the DCD to inactive (high). The DCD is activated only when the PDP context is achieved. The DCD is de-activated when the PDP context is off.

When AT&C is set to 0, the DCD signal is always ON. When AT&C is set to 1, the DCD is activated in online mode. When AT&C is set to 2, the DCD is activated only when the PDP context is achieved (temporary IP address is received).

Command Type	Syntax	Response/Action
Set	**AT&C<param>**	**OK**
Read	**AT&C?**	**&C:<param>**
Test	**AT&C=?**	**&C:(list of supported <param>s)**

The following table shows the &C parameters.

Table 3-89: &C Parameters

<Parameter>	Description
<param>	DCD signal ON 0 DCD is forced ON at all times. 1 DCD is set to ON when: a A CSD carrier is detected. b A GPRS external session is being established: G24 enters PPP mode TE is about to send an LCP configure-request to the G24 (GPRS connection is not yet established). DCD is set to OFF when: a No CSD carrier is detected. This can happen when a CSD call has been disconnected or when G24 enters CSD online command mode (switch operation). b The G24 has lost its GPRS connection with the network (PDP context was deactivated and the IP address is cancelled). 2 DCD is set to ON when G24 establishes a GPRS connection with the network (PDP context is activated and the IP address is received from the network). DCD is set to OFF when G24 has lost its GPRS connection with the network (PDP context was deactivated and the IP address is cancelled). The default value is 1.

Note: If &C is set to 2 when a CSD call is set, DCD will always remain OFF.

Example

AT&C?
&C: 1
OK
AT&C0
OK

&D, Circuit 108 Behavior

This command determines how the G24 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state. The DTR is an input line that indicates that the terminal is ready.

The DTR line must be active (low) in order for the G24 to recognize the terminal. This signal is raised by the terminal when a process activates the serial port. If the DTR is not used by the application, it should connect this line to ground (DTR active). The default value is active (low).

Command Type	Syntax	Response/Action
Set	**AT&D<param>**	**OK**
Read	**AT&D?**	**&D:<param>**
Test	**AT&D=?**	**&D:(list of supported <param>s)**

The following table shows the &D parameters.

Table 3-90: &D Parameters

<Parameter>	Description
<param>	The G24's reaction when the DTR status is changed from ON to OFF. In CSD calls: 0,4 Ignores DTR changes 1 Switches the CSD call to asynchronous command mode (the call remains connected) 2,3 Disconnects the call and returns to the command mode In GPRS calls: 0,4 Ignores DTR changes 1-3 Deactivates the GPRS and returns to command mode In MUX and MUX_INIT state: 0-3 Ignores DTE changes 4 Drops the MUX application and returns to PRE_MUX state The default value is 2.

Example

AT&D?
&D: 2
OK
AT&D1
OK

+MCWAKE, GPRS Coverage

This command tells the G24 whether to report on the status of the GPRS coverage. There are three possibilities:

- Do not report the status of the GPRS coverage
- Report only when the GPRS coverage goes off.
- Report only when the GPRS coverage goes on.

Command Type	Syntax	Response/Action
Set	**AT+MCWAKE=<param>**	**OK**
Read	**AT+MCWAKE?**	**+MCWAKE: <param>** **OK**
Test	**AT+MCWAKE =?**	**+MCWAKE: (list of supported <param>s)** **OK**

The following table shows the +MCWAKE parameters.

Table 3-91: +MCWAKE Parameters

<Parameter>		Description
<param>	0	Sends no indication.
	1	Sends an indication when GPRS coverage goes off.
	2	Sends an indication when GPRS coverage goes on.
	The default value is 2.	

Example

at+mcwake=0
OK
at+mcwake?
+MCWAKE: 0
OK
at+mcwake=1
OK
at+mcwake=2
OK
at+mcwake=?
+MCWAKE: (0,1,2)
OK

+CFUN, Shut Down Phone Functionality

This command shuts down the phone functionality of smart phones and PDAs with phone capabilities in order to prevent interference from a nearby environment. This enables other functionality to continue to be used in environments where phone use is either impractical or not permitted. For example, on airplanes the use of cellular phones is forbidden during the entire flight, but the use of computers is allowed during much of the flight. This command enables other functionality to continue while preventing use of phone functionality.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CFUN=[<fun>[,<rst>]]**	**OK** **+CME ERROR: <err>**	The Set command selects the level of functionality <fun> in the smart phone or PDA incorporating the G24.
Read	**AT+CFUN?**	**+CFUN: <fun>** **OK**	The Read command displays the current level of functionality.
Test	**AT+CFUN=?**	**+CFUN: (list of supported <fun>s), (list of supported <rst>s)** **OK**	The Test command displays the list of supported functionality settings.

The following table shows the AT+CFUN parameters.

Table 3-92: +CFUN Parameters

<Parameter>	Description
<fun>	Functionality levels: 0, 1 Full functionality (default 0) 2 Disables phone transmit RF circuits only 3 Disables phone receive RF circuits only 4 Disables phone transmit & receive RF circuits 5-127 Reserved for future use
<rst>	0 Sets functionality to <fun> without resetting the device (default) 1 Resets the device before setting functionality to <fun>

Examples

at+cfun=?
+CFUN:(0-4),(0-1)
OK
at+cfun?
+CFUN: 0
OK
at+cfun=4//Disable phone transmit and receive RF circuits
OK

+ICF, DTE-DCE Character Framing

This command determines the local serial port start/stop (asynchronous) character framing used by the DCE when accepting DTE commands and transmitting information text and result codes, whenever these are not done automatically. Auto detect framing is not supported.

Command Type	Syntax	Response/Action	Remarks
Set	**+ICF=[<format>[,<parity>]]**	**OK** **+CME ERROR: <err>**	The Set command determines the local serial port start/stop character framing.
Read	**+ICF?**	**+ICF: <format>,<parity>** **+CME ERROR: <err>**	The Read command displays the currently selected character framing.
Test	**+ICF=?**	**:+ICF:(list of supported <format> values),(list of supported <parity> values)** **+CME ERROR: <err>**	The Test command displays a list of supported <format> and <parity> values.

The following table shows the +ICF parameters.

Table 3-93: +ICF Parameters

<Parameter>	Description
<format>	Determines the number of bits in the data bits, the presence (or absence) of a parity bit, and the number of stop bits in the start/stop frame. 1 8 Data, 2 Stop - can be set only with <parity> 4 2 8 Data, 1 Parity, 1 Stop - can be set with <parity> of 0 or 1 3 8 Data, 1 Stop (default) - can be set only with <parity> 4 4 7 Data, 2 Stop - can be set only with <parity> 4 5 7 Data, 1 Parity, 1 Stop - can be set with <parity> of 0 or 1 6 7 Data, 1 Stop - can be set only with <parity> 4 7 8 Data, 1 Parity, 2 Stop - can be set with <parity> of 0 or 1 8 7 Data, 1 Parity, 2 Stop - can be set with <parity> of 0 or 1
<parity>	Determines how the parity bit is generated and checked (if present). 0 Odd 1 Even 4 No parity (default)

Example

```
at+icf?
+ICF: 3,4
OK
at+icf=?
+ICF: (1-8),(0,1,4)
OK
at+icf=5,1
OK
```

ATS97, Antenna Diagnostic

This command indicates whether an antenna is physically connected to the G24 RF connector. This information is also provided by a dedicated hardware signal, which is outputted on pin 41 (ANT_DET) of the interface connector.

Command Type	Syntax	Response/Action	Remarks
Execute	**ATS97**	**OK** **or:** **+CME ERROR: <err>**	
Read	**ATS97?**	**<info>** **OK** **or:** **+CME ERROR: <err>**	The Read command indicates whether the antenna is connected.

The following table shows the ATS97 parameters.

Table 3-94: ATS97 Parameters

<Parameter>		Description
<info>	000	The antenna is not connected
	001	The antenna is connected

Example

// Connect the antenna
ATS97?
001
ATS97
OK
ATS97=?
ERROR
// Disconnect the antenna
ATS97?
000

+MRST, Perform Hard Reset

The +MRST command enables customer software to perform a hard reset to the G24 unit. This command provides a software simulation for pressing the power-off button. The command can be sent to the G24 unit from each of the MUX channels.

Command Type	Syntax	Response/Action	Remarks
Set	**+MRST**	**OK**	The Set command performs a graceful hard reset to the G24 module. **Note:** The Read and Test commands are not permitted for the +MRST command.

Example

at+mrst
OK
// Result - G24 module performs a power down

Audio

Scope

The audio control can be Summerized to the following three issues:

- Path: Selection of microphone and speaker to be used.
- Gain: Control of volume levels for rings, voice, etc.
- Algorithm: Activation of audio algorithms (echo cancelation, noise suppression and sidetone).

The G24 incorporates two audio modes: 'Basic Audio' and 'Advanced Audio'. Each mode has a different behavior and a set of relevant AT commands. Figure 3-2 describes the two audio modes, switching between them and the AT commands related to each mode.

Audio Control of Path, Gain and Algorithms is available by these two different modes' sets of commands. It is advised to select the audio mode according to the application needs, either the 'Basic Audio' set or the 'Advanced Audio' set.

Basic Audio

This mode of commands suits most users. It provides a simple audio control. In this mode the G24 will also adjust the paths automatically upon headset interrupt. The G24 powers up in 'Basic Audio' mode.

Basic audio specific commands are: +CRSL, +CLVL, +CMUT, S94, S96.

Advanced Audio

This mode suits users who require a full control of the audio. When using these advanced commands, the audio control will ignore the headset interrupt (when the headset will be connected the paths will not change automatically). Upon invoking, any of the advanced Audio specific commands: +MAVOL, +MAPATH, +MAFEAT, +MAMUT, the G24 enters 'Advanced Audio' mode. G24 remains in 'Advanced audio' mode until the next power up.

While in Advanced Mode, all Basic Audio AT commands (+CRSL, +CLVL, +CMUT, S94, S96) are blocked and will return an error.

General Audio Commands

The following audio commands can be used in both Basic and Advanced audio modes:

+CRTT, +VTD, +VTS, +CALM, +MMICG, +MADIGITAL

Table 3-95 shows the differences between Basic and Advanced audio modes in controlling the audio.

Table 3-95: Basic and Advanced Audio Modes Comparison

	Basic Audio	Advanced Audio
Path	Paths are set automatically (upon interrupt).	Paths are set manually. All routings are available; any microphone with any speaker for each type of sound (voice, keypad, ring, etc.).
Gain	There are two types of gains: phone (voice, keypad) and ring.	There is a matrix of gains: a different gain is saved for each type of sound through a specific speaker. For example, one volume level for rings through the speaker and a different volume level for rings through the transducer. Therefore, there will be 16 different volume levels, which is the product of the number of output accessories (speaker, headset speaker, transducer and digital output) and the number of audio tones (voice, keypad, ring and alert).
Algorithm	Algorithms are set by ATS94 and ATS96.	Algorithms are set by AT+MAFEAT.

Audio Setup

The G24 has two audio modes: 'Basic Audio' and 'Advanced Audio'. Each mode has a different behavior and a set of relevant AT commands.

Figure 3-1 describes the two audio modes, switching between them and the AT commands related to each mode.

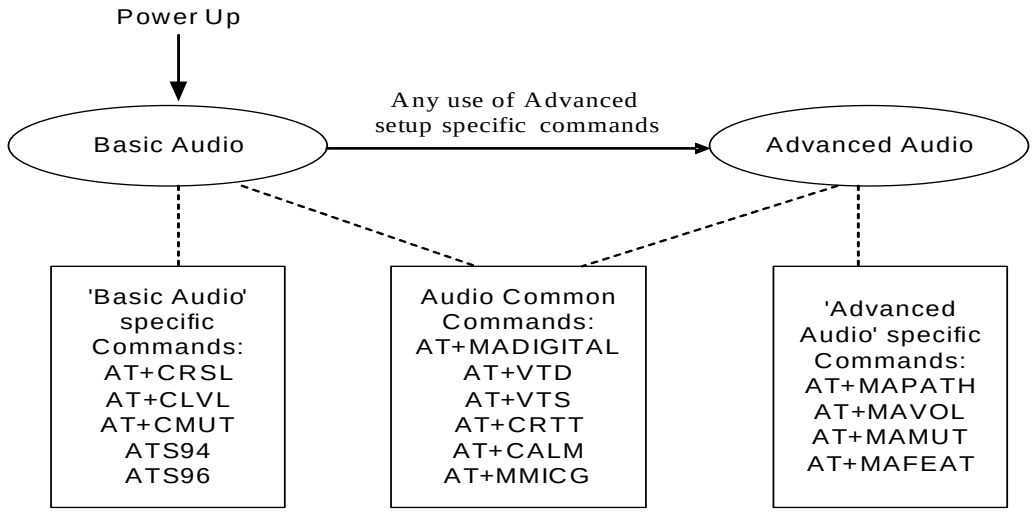


Figure 3-1: Audio Modes

Audio Control of Path, Gain and Algorithms is available by these two different modes' sets of commands. It is advised to select the audio mode according to the application needs, either the 'Basic Audio' set or the 'Advanced Audio'.

Basic Audio Setup

This mode's set of commands suits most users. It provides a simple audio control. In this mode the G24 will also adjust the paths automatically upon headset interrupt. The G24 powers up in 'Basic Audio' mode.

Basic audio specific commands are: +CRSL, +CLVL, +CMUT, S94, S96.

Figure 3-2 shows the basic audio setup.

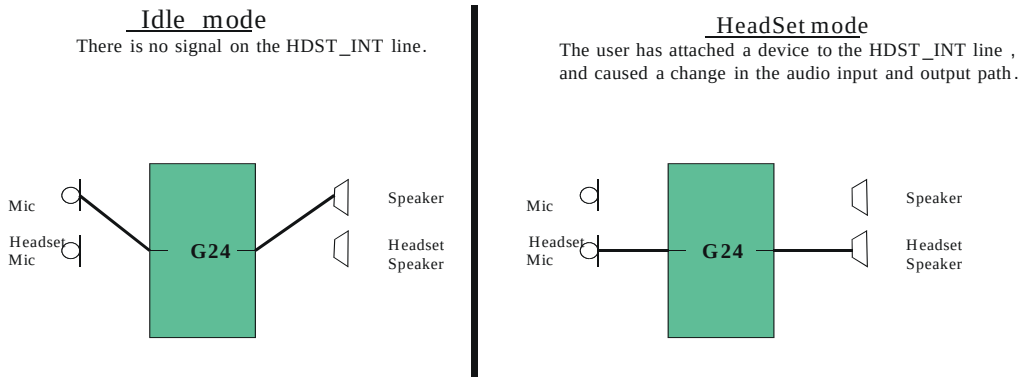


Figure 3-2: Basic Audio Setup

Advanced Audio Setup

This mode suits users which require a full control of the audio. When using these advanced commands the audio control will ignore the headset interrupt (when the headset will be connected the paths will not change automatically). Upon invoking any of the advanced Audio specific commands: +MAVOL, +MAPATH, +MAFEAT, +MAMUT the G24 will enter 'Advanced Audio' mode. G24 will remain in 'Advanced audio' mode until power cycle.

While in Advanced Mode, all Basic Audio AT commands (+CRSL, +CLVL, +CMUT, S94, S96) are blocked and will return an error.

Figure 3-3 shows the advanced setup.

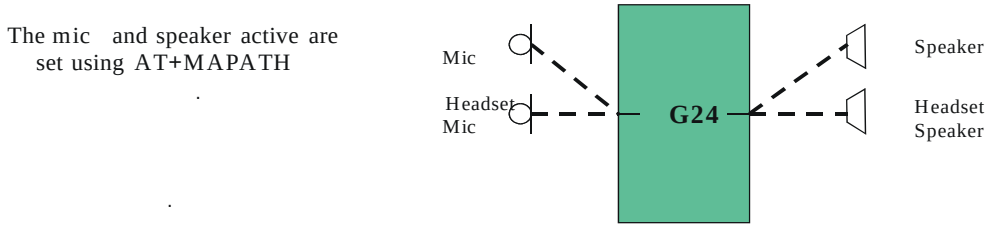


Figure 3-3: Advanced Audio Setup

G24 supports both analog and digital audio. Digital audio is supported in both basic and advanced audio setups. Switching between analog and digital audio modes is done by AT+MADIGITAL command. The default state is analog.

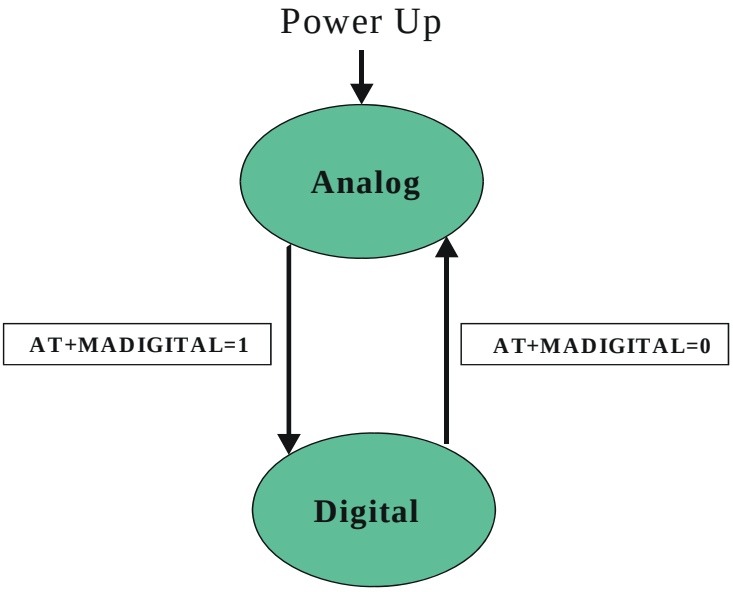


Figure 3-4: Analog/Digital Switching

General Audio Commands

The following audio commands can be used in both Basic and Advanced audio modes.

General audio commands are: +CRTT, +VTD, +VTS, +CALM, +MMICG, +MADIGITAL.

Basic Audio Setup Commands

+CRSL, Call Ringer Level

This command handles the selection of the incoming call ringer and alert tone (SMS) sound level on the alert speaker of the G24. The new value remains after power cycle.

Command Type	Syntax	Response/Action	Remarks
Set	**+CRSL=<level>**	**OK** **+CME ERROR: <err>**	The Set command sets the call ringer and alert (SMS) level.
Read	**+CRSL?**	**+CRSL: <level>** **+CME ERROR: <err>**	The Read command displays the current ringer alert (SMS) sound level setting.
Test	**+CRSL=?**	**+CRSL: (list of supported <level>s)** **+CME ERROR: <err>**	The Test command displays the list of supported sound level settings.

The following table shows the +CRSL parameters.

Table 3-96: +CRSL Parameters

<Parameter>		Description
<level>	0	Mute
	1-7	Ringer sound level (1 is lowest; 7 is default)

Example

at+crsl?
+CRSL: 7
OK
at+crsl=?
+CRSL: (0-7)
OK
at+crsl=5
OK

+CLVL, Loudspeaker Volume

This command sets the volume of the internal loudspeaker (which also affects the key feedback tone) of the G24.

Note: The +CLVL command does not control the alert speaker.
In this command, the new value remains after power cycle.

The +CLVL command can be used even when the SIM is not inserted.

Command Type	Syntax	Response/Action	Remarks
Set	**+CLVL=<level>**	**OK** **+CME ERROR: <err>**	The Set command sets the internal loudspeaker volume level.
Read	**+CLVL?**	**+CLVL: <level>** **+CME ERROR: <err>**	The Read command displays the current internal loudspeaker volume setting.
Test	**+CLVL=**	**+CLVL: (list of supported <level>s)** **+CME ERROR: <err>**	The Test command displays the possible loudspeaker volume settings.

The following table shows the +CLVL parameters.

Table 3-97: +CLVL Parameters

<Parameter>	Description
<level>	0-7 Manufacturer-specific volume range. 0 is lowest volume (not mute). The default value is 7.

Example

at+clvl?
+CLVL: 7
OK
at+clvl=?
+CLVL: (0-7)
OK
at+clvl=3
OK

+CMUT, Mute/Unmute Currently Active Microphone Path

This command is used to mute/unmute the currently active microphone path by overriding the current mute state.

Command Type	Syntax	Response/Action	Remarks
Set	**+CMUT=<state>**	**OK** **or:** **+CME ERROR: <err>**	The Set command enables/disables uplink voice muting during a voice call.
Read	**+CMUT?**	**+CMUT: <state>** **OK**	The Read command returns the current uplink voice mute/unmute state.
Test	**+CMUT=?**	**+CMUT: (list of supported <state>s)** **OK**	The Test command returns the possible <state> values.

The following table shows the +CMUT parameters.

Table 3-98: +CMUT Parameters

<Parameter>	Description
<n>	0 Unmute microphone path 1 Mute microphone path

Example

AT+CMUT=?
+CMUT:(0-1)
OK
AT+CMUT?
+CMUT: 0 uplink voice is unmuted
OK
AT+CMUT=1 uplink voice is muted
OK
AT+CMUT?
+CMUT: 1
OK
AT+CMUT =2
+CME ERROR: <err>

S94, Sidetone Effect

This command reduces the microphone audio input that is routed to the selected speaker, so that people speaking will hear themselves talking (The default value of S94 is "1").

The following table explains the use of the ATS94 set.

Table 3-99: ATS94 and ATS96 Behavior

ATS94	ATS96	Echo Cancel	Noise Suppress	ST
0	**0**	Disabled	Disabled	Disabled
1	**0**	Disabled	Disabled	Enabled
0	**1**	Enabled	Enabled	Disabled
1	**1**	Enabled	Enabled	Disabled

Command Type	Syntax	Response/Action	Remarks
Set	**ATS94=<n>**	**OK** **or:** **+CME ERROR: <err>**	The Set command sets the sidetone status.
Read	**ATS94?**	**<000-disabled, 001-enabled>** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the sidetone status.
Test	**ATS94=?**	**+CME ERROR: <err>**	The Test command displays the supported values of <n>.

The following table shows the S94 parameters.

Table 3-100: S94 Parameters

<Parameter>	Description
<n>	0 Disable sidetone 1 Enable sidetone On power up the sidetone is enabled.

Example

ATS94=0//Disable sidetone
OK
ATS94=2
+CME ERROR: <err>
ATS94?
000//Sidetone disabled
OK

S96, Echo Canceling

This command suppresses a large amount of the output sound picked up by the input device (cancels all echo). S96 value is saved in the Flex.

The following table explains the use of the ATS96 set.

Table 3-101: ATS96 and ATS94 Behavior

ATS96	ATS94	Echo Cancel	Noise Suppress	ST
0	**0**	Disabled	Disabled	Disabled
0	**1**	Disabled	Disabled	Enabled
1	**0**	Enabled	Enabled	Disabled
1	**1**	Enabled	Enabled	Disabled

Command Type	Syntax	Response/Action	Remarks
Set	**ATS96=<n>**	**OK** **or:** **+CME ERROR: <err>**	The Set command sets the echo canceling status.
Read	**ATS96?**	**<000-disabled, 001-enabled>** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the echo canceling status.
Test	**ATS96=?**	**+CME ERROR: <err>**	

The following table shows the S96 parameters.

Table 3-102: S96 Parameters

<Parameter>		Description
<n>	0	Disable echo canceling. Disable noise suppression
	1	Enable echo canceling. Enable noise suppression

Example

ATS96=1//Enable echo canceling
OK
ATS96=4
+CME ERROR: <err>
ATS96?
001//Echo canceling enabled
OK

Advanced Audio Setup Commands

This group of commands enables accessory devices to control certain audio aspects within the system.

+MAPATH, Audio Path

This command sets/requests the active input accessory, and the output accessory for each feature. For example, you can choose the headset mic to be active, the voice and keypad feedbacks to go to the speaker, and the alerts and rings to go to the alert speaker. On power up, the default path, mic, speaker and alert speaker are restored.

Note: +MAPATH cannot be used to set digital audio, but only to read it. In order to set the digital audio path, use +MADIGITAL. For more information, refer to section "+MADIGITAL, Analog/Digital Audio Switching" on page 3-162.

The following diagram shows the audio paths:.

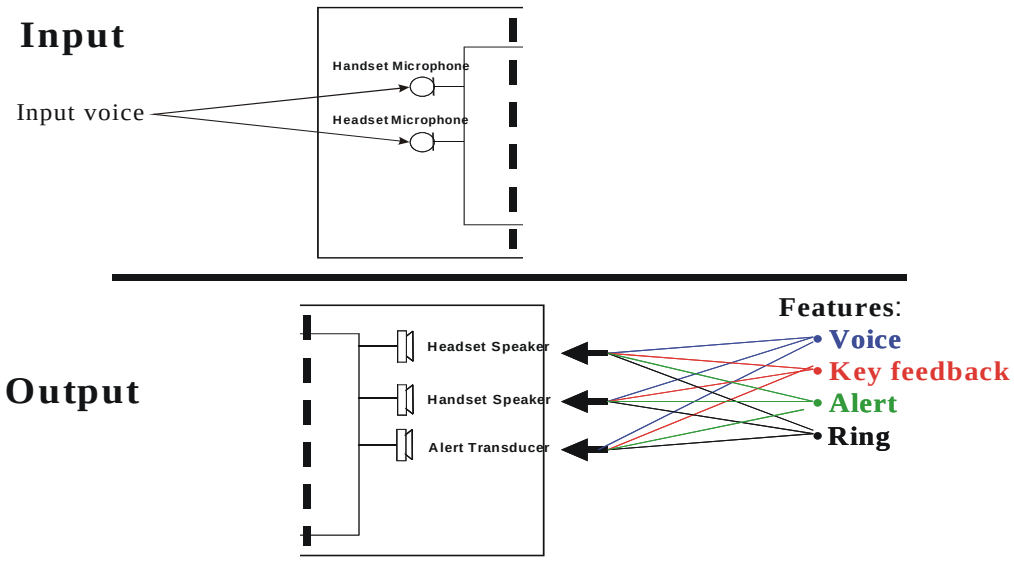


Figure 3-5: Audio Paths

Command Type	Syntax	Response/Action	Remarks
Set	**+MAPATH= <direct>,<accy> [,<features>]**	**OK** **or:** **+CME ERROR: <err>**	The Set command sets the audio path mode. The mode indicates which I/O accessories are now active for the different audio features. The <features> field is only used for outputs (direct=1).
Read	**+MAPATH?**	**+MAPATH:1(mode in),<accy>** **+MAPATH:2(mode out), <accy>,<feature>** **[<CR><LF>+MAPATH:2(mode out), <accy>,<feature>** **[...]]** **OK**	The Read command returns the active input audio accessory and the output accessory for each feature.
Test	**+MAPATH=?**	**+MAPATH: (list of supported directions),(list of supported accessories),(list of supported features combinations)** **OK**	The Test command returns the supported audio directions (input/output), accessories and features.

The following table shows the +MAPATH parameters.

Table 3-103: +MAPATH Parameters

<Parameter>		Description
<direct>	1	Mode in, field <features> is ignored.
	2	Mode out, field <features> is present.
<accy>	Mode in:	
	1	Mic
	2	Headset mic
	3	Digital RX (for read command only)
	Mode out:	
	1	Speaker
	2	Headset speaker
	3	Alert speaker, for example, battery low, incoming SMS, power up, and so on
	4	Digital TX (for read command only)
<features> (1-15)	1	Voice
	2	Key feedback
	4	Alert
	8	Ring

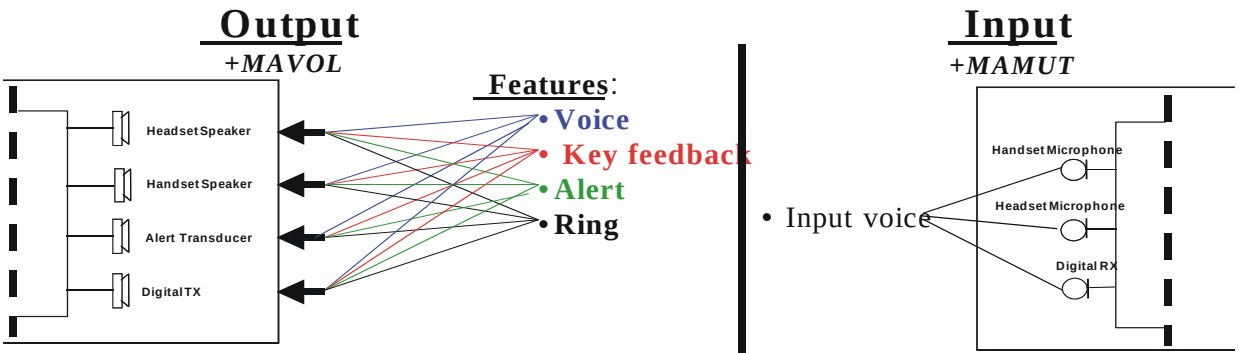
Example

AT+MAPATH=1,2//Direct=1 (input), accy=2 (headset mic)
OK
AT+MAPATH=2,1,3//Direct=2 (output), accy=1 (speaker), feature=1 (voice and keypad)
OK
AT+MAPATH? //Set the headset mic as the input accessory
MAPATH: 1,2 //Direct=1 (input), accy=2 (headset mic)
MAPATH: 2,1,1//Direct=2 (output), accy=1 (speaker), feature=1 (voice)
MAPATH: 2,1,2 //Direct=2 (output), accy=1 (speaker), feature=2 (keypad)
MAPATH: 2,3,4 //Direct=2 (output), accy=3 (alert speaker), feature=4 (alert)
MAPATH: 2,3,8//Direct=2 (output), accy=3 (alert speaker), feature=8 (ring)
OK
AT+MAPATH=?
+MAPATH: (1,2),(1-4),(1-15)
OK

+MAVOL, Volume Setting

This command enables you to determine a volume level for a particular feature via a particular accessory. The gain levels are saved in flex. Therefore, upon power up, the path active (mic, speaker and alert speaker) will have these saved gain levels.

Note: The SMS MT volume is adjusted using the +MAVOL command with type "ring". The RING value is related to the SMS alert, the MT call, and so on.



Example of current G24 volume levels Matrix

	Voice	Key feedback	Alert	Ring
Headset Speaker	1	2	4	7
Handset Speaker	3	5	4	2
Alert Transducer	6	4	6	1
Digital TX	6	3	3	1

Example :G24 Mute state

	Handset Mic	Headset Mic	Digital RX
Mute state	0	1	0

Figure 3-6: G24 Audio Gain

Command Type	Syntax	Response/Action	Remarks
Set	**+MAVOL=<accy>,<feature>,<vol>**	**OK** **or:** **+CME ERROR: <err>**	The Set command sets the volume level <n> to a certain <feature> through a certain <accy>.
Read	**+MAVOL?**	**(Current path volume)** **+MAVOL: <accy>,<feature1>,vol>** **+MAVOL: <accy>,<feature2>,vol>** **+MAVOL: <accy>,<feature4>,vol>** **+MAVOL: <accy>,<feature8>,vol>** **OK**	The Read command returns the volume level of all the features in the current active accessories.
Test	**+MAVOL=?**	**+MAVOL:(supported accessories),(supported features combinations),(supported volume levels)**	Test command returns the supported range of volume levels, accessories and features.

The following table shows the +MAVOL parameters.

Table 3-104: +MAVOL Parameters

<Parameter>		Description
<accy> (1-15)	1	Speaker
	2	Headset speaker
	4	Alert speaker
	8	Digital TX
<feature> (1-15)	1	Voice
	2	Keypad feedback
	4	Alert
	8	Ring
<vol>	Volume level 0-7	

Example

//Set volume level 3 for voice through speaker
AT+MAVOL=1,1,3 //Accy=1 (speaker), feature=1 (voice), vol=3 (volume level)
OK
//Set volume level 5 for voice and keypad through speaker
AT+MAVOL=1,3,5//Accy=1 (speaker), feature=3 (voice and keypad), vol=5 (volume level)
OK
AT+MAVOL? //Requests the volume level of the current path's features
//Currently the voice outputs through speaker and its volume level is 5
+MAVOL: 1,1,5 //Accy=1 (speaker), feature=1 (voice), vol=5
//Currently the keypad outputs through speaker and its volume level is 5
+MAVOL: 1,2,5 //Accy=1 (speaker), feature=2 (keypad), vol=5
//Currently the alert outputs through alert speaker and its volume level is 2
+MAVOL: 4,4,2 //Accy=4 (alert speaker), feature=4 (alert), vol=2
//Currently the ring outputs through alert speaker and its volume level is 2
+MAVOL: 4,8,2 //Accy=4 (alert speaker), feature=8 (ring), vol=2
OK

+MAMUT, Input Devices Mute

This command controls the muting/unmuting of all input paths (mic, headset mic or digital RX). Upon power up, all the devices are unmuted.

Command Type	Syntax	Response/Action	Remarks
Set	**+MAMUT=<accy>,<state>**	**OK** **or:** **+CME ERROR: <err>**	The Set command mutes/unmutes any input accessory or any combination of them.
Read	**+MAMUT?**	**+MAMUT:<accy1>,<state>** **+MAMUT:<accy2>,<state>** **+MAMUT:<accy4>,<state>** **OK**	The Read command returns the current mute/unmute state of all the input accessories.
Test	**+MAMUT=?**	**+MAMUT:(<accy> range),(<state> range)**	The Test command returns the mute states available and the output accessories supported.

The following table shows the +MAMUT parameters.

Table 3-105: MAMUT Parameters

<Parameter>		Description
<accy> (1-7)	1	Mic
	2	Headset mic
	4	Digital RX
<state>	0	Unmute
	1	Mute

Example

```
AT+MAMUT=2,0//Accy=2 (headset mic), state=0 (unmute)
OK
AT+MAMUT=5,1//Accy=5 (mic + Digital RX), state=1 (mute)
OK
AT+MAMUT?
+MAMUT: 1,1//Accy=1 (mic), state=1 (mute)
+MAMUT: 2,0//Accy=2 (headset mic), state=0 (unmute)
+MAMUT: 4,1//Accy=4 (Digital RX), state=1 (mute)
AT+MAMUT=?
+MAMUT: (1-7),(0,1)
OK
```

+MAFEAT, Features Selection

This command controls the algorithm features: sidetone, echo cancel and noise suppression. Upon power up, the sidetone is enabled, and echo canceling and noise suppression are disabled.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+MAFEAT=<feature>,<state>**	**OK** **or:** **+CME ERROR: <err>**	The Set command enables/disables feature combinations.
Read	**AT+MAFEAT?**	**+MAFEAT: <feature><state>,** **[<CR><LF>+MAFEAT: <feature><state>** **[...]]** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the features state (enabled/disabled).
Test	**AT+MAFEAT=?**	**+MAFEAT: (<list of supported <feature>s), (<list of supported <state>s)** **OK** **or:** **+CME ERROR: <err>**	The Test command returns the list of supported features' numbers and supported states (enable/disable).

The following table shows the +MAFEAT parameters.

Table 3-106: MAFEAT Parameters

<Parameter>	Description
<feature>	A number between 1 to 7 which is built from a combination of: 1 - Side tone 2 - Echo cancel 4 - Noise suppress
<state>	0 - Disable 1 - Enable

Example

AT+MAFEAT=5,1//Enables sidetone and noise suppress
OK
AT+MAFEAT?
+MAFEAT: 1,1//Feature=1 (sidetone), state=1 (enabled)
+MAFEAT: 2,0//Feature=2 (echo cancel), state=0 (disabled)
+MAFEAT: 4,1//Feature=4 (noise suppress), state=1 (enabled)
OK

General Audio Commands

+MADIGITAL, Analog/Digital Audio Switching

This command switches between analog and digital audio modes. AT+MADIGITAL=1 switches to digital audio mode, and AT+MADIGITAL=0 switches it back to analog mode.

Command Type	Syntax	Response/Action	Remarks
Set	**+MADIGITAL=<mode>**	**OK** **or:** **+CME ERROR: <err>**	The Set command toggles between analog and digital audio modes.
Read	**+MADIGITAL?**	**+MADIGITAL:<mode>** **OK**	The Read command returns the current audio mode (analog or digital).
Test	**+MADIGITAL=?**	**+MADIGITAL: <available audio modes>** **OK**	The test command returns the available digital audio modes.

The following table shows the +MADIGITAL parameters.

Table 3-107: +MADIGITAL Parameters

<Parameter>		Description
<mode>	0	G24 works in analog audio mode.
	1	G24 works in digital audio mode.

Example

```
at+madigital=?
+MADIGITAL: (0,1)
OK
at+madigital?
+MADIGITAL: 0
OK
at+madigital=1
OK
at+madigital?
+MADIGITAL: 1
OK
at+madigital=0
OK
at+madigital?
+MADIGITAL: 0
OK
at+madigital=3
ERROR
at+madigital?
+MADIGITAL: 0
OK
```

+CALM, Alert Sound Mode

This command handles the selection of the G24's alert sound mode. The value of the command is saved after a power cycle.

Command Type	Syntax	Response/Action	Remarks
Set	**+CALM=<mode>**	**OK** **+CME ERROR: <err>**	The Set command sets the alert sound mode.
Read	**+CALM?**	**+CALM: <mode>** **+CME ERROR: <err>**	The Read command displays the current alert sound mode setting.
Test	**+CALM=?**	**+CALM: (list of supported <mode>s)** **+CME ERROR: <err>**	The Test command displays the list of supported modes.

The following table shows the +CALM parameters.

Table 3-108: +CALM Parameters

<Parameter>	Description
<mode>	Alert sound mode of the G24. 0 Ring (default) 1 Silent mode (ring prevented)

Note: Selecting the ring mode with this command retrieves the current alert volume level setting.

Example

```
at+calm=?
+CALM: (0,1)
OK
at+calm?
+CALM: 0
OK
at+calm=1
OK
```

+ MMICG, Microphone Gain Value

This command handles the selection of microphone gain values of MIC-handsets (not MIC-headsets). The new value remains after power cycle.

Command Type	Syntax	Response/Action	Remarks
Set	**+MMICG=<gain>**	**OK** **+CME ERROR: <err>**	The Set command sets the microphone gain value.
Read	**+MMICG?**	**+MMICG: <gain>** **+CME ERROR: <err>**	The Read command displays the current microphone gain.
Test	**+MMICG=?**	**+MMICG (list of supported <gain>s)** **+CME ERROR: <err>**	The Test command displays the list of supported gain values.

The following table shows the +MMICG parameters.

Table 3-109: +MMICG Parameters

<Parameter>	Description
<gain>	Microphone gain values in db: 0-31 0 is lowest gain value (not mute); default is 16 db

Example

```
at+mmicg=?
+MMICG: (0-31)
OK
at+mmicg?
+MMICG: 16
OK
at+mmicg=30
OK
```

+CRTT, Ring Type Selection

This command plays one cycle of a tone ring, stops the cycle in the middle and sets the tone ring to be used.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CRTT=<RingTypeNumber>, <operation>**	**OK** **or:** **+CME ERROR: <err>**	The Set command sets the ring type and operation.
Read	**AT+CRTT?**	**+CRTT: <RingTypeNumber>** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the ring type number.
Test	**AT+CRTT=?**	**+CRTT: (list of supported <RingTypeNumber>s), (list of supported <operation>s)** **OK** **or:** **+CME ERROR: <err>**	The Test command returns the list of supported tone type numbers and operations.

The following table shows the +CRTT parameters.

Table 3-110: +CRTT Parameters

<Parameter>	Description
<RingType Number>	Ring tone styles
<operation>	Play or set a tone 0 Play (play one cycle) 1 Set 2 Stop

Example

```
AT+CRTT=4,0//Ring type number 4, operation 0 (play)
OK//When 4 is in the supported <RingTypeNumber> range
AT+CRTT=4,2//Ring type number=4, operation 2 (stop)
OK
AT+CRTT=?
+CRTT: (6-47),(0-2)
OK
AT+CRTT?
+CRTT: 4//Ring type number 4
AT+CRTT=5,4//Invalid operation
+CME ERROR: <err>
```

+VTD, Tone Duration

This command handles the selection of tone duration. An integer <n> defines the length of tones emitted as a result of the +VTS command. This command does not affect the D (dial) command. (Refer to “D, Dial Command”, page 11.)

Any value other than zero causes a tone of duration <n> in multiples of 100 msec.

In this command, the new value is erased after power down.

Note: In GSM, the tone duration value can be modified depending on the specific network.

Command Type	Syntax	Response/Action	Remarks
Set	**+VTD=<n>**	**OK.** **+CME ERROR: <err>**	The Set command sets the tone duration.
Read	**+VTD?**	**<n>** **+CME ERROR: <err>**	The Read command displays the current tone duration.
Test	**+VTD=?**	**+VTD: (list of supported <n>s)** **+CME ERROR: <err>**	The Test command displays the list of supported tone durations.

The following table shows the +VTD parameters.

Table 3-111: +VTD Parameters

<Parameter>	Description
<n>	Defines the length of tones emitted by the +VTS command. 0-600 Multiples of 100 msec (0 is equivalent to 1, that is, 100 msec) The default is 5 multiples of 100 msec.

Example

```
AT+VTD=?
+VTD: (0-600)
OK
AT+VTD?
+VTD: 5
OK
AT+VTD=10
OK
```

+VTS, Command-Specific Tone Duration

This command transmits a string of DTMF tones when a voice call is active. DTMF tones may be used, for example, when announcing the start of a recording period.

The duration does not erase the VTD duration (Refer to "+VTD, Tone Duration" on page 3-166).

Note: In GSM, the tone duration value can be modified depending on the specific network.

If the active call is dropped in the middle of playing a DTMF tone, the following unsolicited message transfers to TE: +V+S: "Call termination stopped DTMF tones transmission".

Command Type	Syntax	Response/Action	Remarks
Set	**+VTS= <DTMF>,[<duration>]**	**OK** **+CME ERROR: <err>**	The Set command sets the tone and duration (if entered).
Read	**+VTS?**	**+VTS: <DTMF>** **+CME ERROR: <err>**	The Read command displays the currently transmitted DTMF tone. An error is displayed if no tone is active.
Test	**+VTS=?**	**+VTS: (list of supported <DTMF>, (list of supported <durations>s)** **+CME ERROR: <err>**	The Test command displays the list of supported DTMF tones and tone lengths.

The following table shows the +VTS parameters.

Table 3-112: +VTS Parameters

<Parameter>	Description
<DTMF>	String of ASCII characters (0-9, #, *, A-D) String length is up to 32 characters long.
<duration>	A DTMF tone of different duration from that set by the +VTD command. 0-600 Multiples of 100 msec (0 is equivalent to 1, that is, 100 msec) <duration> does not erase the +VTD duration.

Note: The duration defined by +VTS is specific to the DTMF string in this command only. It does not erase the duration defined by the +VTD command, and is erased when the G24 is powered down.

If <duration> is not defined, the +VTD value is used.

Example

```
AT+VTS ?
+VTS: "5"
OK
AT+VTS="2",10
OK
```

Access

Access Control Commands

When the phone or SIM card is locked or blocked, the only accessory operations allowed are those found in the list of Core AT commands (allowed while phone/SIM card is locked), shown in "Core AT Commands" on page 2-9. All other AT commands are not executed, for example, accessing phone book entries. However, the phone is still capable of sending asynchronous message events via AT responses, for example, incoming call notification.

A/, Repeat Last Command

This command repeats the last command. It is not necessary to press <Enter> after this command.

Command Type	Syntax	Response/Action
Execute	**A/**	Repeats last command

Example

AT&D?
&D: 2
OK
A/
&D: 2
OK

AT, Check AT Communication

This command only returns OK.

Command Type	Syntax	Response/Action
Execute	**AT**	**OK**

Example

AT
OK

+CPIN, Enter PIN for Unlocking SIM Card or Enter PUK for Unblocking SIM Card

This command locks the SIM card, and therefore is only relevant for phones that use SIM cards. It unlocks the SIM card when the proper SIM PIN is provided and unblocks the SIM card when the proper SIM PUK is provided.

The SIM card is unlocked only once the provided pin is verified as the SIM PIN. If the required PIN (determined by the error code returned from the requested operation or the Read command) is SIM PUK or SIM PUK2, the second pin is required. This second pin, <newpin>, is used to replace the old pin in the SIM card. When entering the pin, a <new pin> is not required.

Note: For a list of commands that can be given when the G24 is awaiting the SIM PIN or SIM PUK, refer to Table 2-1, "Core AT Commands" on Page 2-9.

Note: The SIM card lock is another level of security independent of the phone lock (See "Access Control Commands" on page 3-168 for more information).

Figure 3-7 presents a diagram of what occurs when using the SIM card. Note that if an incorrect password is entered three times, the G24 requires that a master password be entered, If this also fails three times, the SIM will be blocked, and you will have to go to your provider to unblock it.

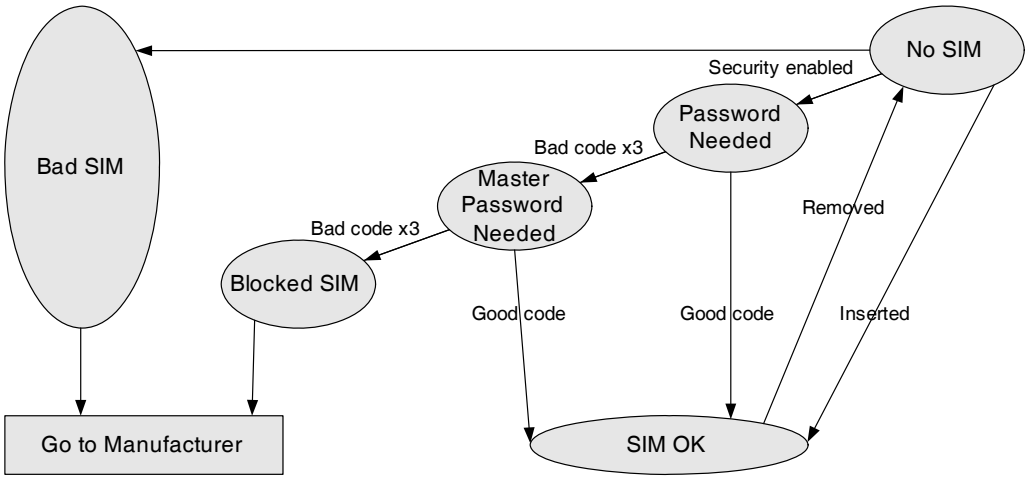


Figure 3-7: SIM States

A SIM card related error is returned if an AT command operation is unsuccessful due to a SIM card problem. The following table shows the SIM card errors.

Table 3-113: SIM Card Errors

Error	Description
10 SIM not inserted	SIM Card is not inserted
11 SIM PIN required	SIM Card waiting for SIM PIN to be entered
12 SIM PUK required	SIM PIN is blocked
13 SIM failure	SIM Card is permanently blocked
17 SIM PIN2 required	SIM Card is waiting for SIM PIN2 to be entered
18 SIM PUK2 required	SIM PIN2 is blocked

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CPIN=[<puk> or <pin>], [<newpin>]**	**OK** **or:** **+CME ERROR: <err>**	The Set command sends the password to the G24 that is necessary before it can be operated (SIM PIN or SIM PUK). If there is no PIN request pending, no action is taken towards the G24, and an error message, +CME ERROR, is returned to the terminal. The Set command issued gives the code (SIM PIN or SIM PUK) corresponding to the error code required or returned as the result of the Read command. For example, if the SIM PIN is blocked, the error code 11 or "SIM PIN required" is returned. The user must then issue the Set command with the SIM PIN.
Read	**AT+CPIN?**	**+CPIN: <code>** **OK** **or:** **+CME ERROR: <err>**	The Read command returns an alphanumeric string indicating the status of the SIM card, and whether a password is required or not. This is an independent SIM card lock status check only, and does not check the phone lock status.
Test	**AT+CPIN=?**	**OK** **or:** **+CME ERROR: <err>**	

The following table shows the +CPIN parameters.

Table 3-114: +CPIN Parameters

<Parameter>	Description
<puk>	PUK code for unblocking a blocked phone
<pin>	Current PIN for unlocking a locked phone
<newpin>	New PIN (after changing or after entering PUK) 4 - 8 digits
<code>	READY - Not waiting for a password SIM PIN - Waiting for SIM PIN SIM PUK - Waiting for SIM PUK SIM PIN2 - Waiting for SIM PIN, this response is given when the last executed command resulted in PIN2 authentication failure SIM PUK2 - Waiting for SIM PUK2, this response is given when the last executed command resulted in PUK2 authentication failure
SIM PIN **SIM PUK** **SIM PUK2** **SIM PIN 2**	AT+CPIN=<pin> AT+CPIN=<puk>,<newpin> AT+CPIN=<puk2>,<newpin2> AT+CPIN=<pin2>

Example

AT+CPIN=?
OK
At+clck="SC",1,"<correct PIN>"//Not case-sensitive
OK
The facility is enabled by the +CLCK command (Refer to "+CLCK, Facility Lock" on page 3-173**)**
AT+CPIN?
+CPIN: SIM PIN
OK
AT+CPIN="<correct PIN>"
OK
AT+CPIN?
+CPIN: READY
OK
The status of the SIM is still enabled, but the PIN is READY for this session.
The SIM is enabled per session. After power-up SIM must be unlocked again by using the +CLCK command.
The following case shows an example of three unsuccessful attempts at entering the PIN:
AT+CPIN?
+CPIN: SIM PIN
OK
AT+CPIN="<wrong pin>"
+CME ERROR: incorrect password
AT+CPIN="<wrong pin>"
+CME ERROR: incorrect password
AT+CPIN="<wrong pin>"
+CME ERROR: SIM PUK required
AT+CPIN?
+CPIN: SIM PUK//PIN is blocked. The PUK is needed for unblocking.
OK
AT+CPIN="<PUK>","<NEW PIN>" //Enter PUK and new PIN
OK
AT+CLCK="FD",1,"<wrong PIN2>"
+CME ERROR: incorrect password
AT+CLCK="FD",1,"<wrong PIN2>"
+CME ERROR: incorrect password
AT+CLCK="FD",1,"<wrong PIN2>"
+CME ERROR: SIM PUK2 required
AT+CPIN?
+CPIN: SIM PUK2//PIN2 is blocked. The PUK2 is needed for unlocking.
OK
AT+CPIN="<PUK2>","<NEW PIN2>" //Enter PUK2 and new PIN2
OK

+CPWD, Change Password

This command sets a new password for the facility lock. The password can only be changed once the required facility is enabled by the +CLCK command. (Refer to "+CLCK, Facility Lock" on page 3-173).

A password can be changed only if the provided password <oldpwd> has been verified. The entered password <newpwd> must also comply to the password rules. The facility value <fac> is not case-sensitive. In the password value, letters are not allowed.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CPWD=<fac>,<oldpwd>, <newpwd>**	**OK** **or:** **+CME ERROR: <err>**	The Set command sets a new password for the facility lock function, defined by the +CLCK command. (Refer to "+CLCK, Facility Lock" on page 3-173).
Read	**AT+CPWD?**	**+CME ERROR: <err>**	
Test	**AT+CPWD=?**	**+CPWD:list of supported (<fac>,<pwdlength>)s** **OK** **or:** **+CME ERROR: <err>**	The Test command returns a list of pairs which represent the available facilities, and the maximum length of their passwords.

The following table shows the +CPWD parameters.

Table 3-115: +CPWD Parameters

<Parameter>	Description
<fac>	List of supported facilities. All the facility messages, except for SC and P2, are sent to the network. (The facilities are not case-sensitive.) SC SIM (lock SIM card) The SIM requests the password during G24 power-up and when this command is issued. AO BAOC (Bar All Outgoing Calls) OI BOIC (Bar Outgoing International Calls) OX BOIC-exHC (Bar Outgoing International Calls except to Home Country) AI BAIC (Bar All Incoming Calls) IR BIC-Roam (Bar Incoming Calls when Roaming outside the home country) AB All Barring services (applicable only for <mode>=0) AG All outGoing barring services (applicable only for <mode>=0) AC All inComing barring services (applicable only for <mode>=0) P2 SIM PIN2 (Refer to "+CLCK, Facility Lock", page 3-173)
<oldpwd>	String type, 4-8 character password specified for the facility from the G24 user interface.
<newpwd>	String type, 4-8 character new password specified by the user.
<pwdlength>	Maximum length of the facility password. Integer type.

Example

```
at+cpwd =?
+CPWD: ("SC",8),("AO",8),("OI",8),("OX",8),("AI",8),("IR",8),("AB",8),("AG",8), ("AC",8),("P2",8)
OK
```

```
at+cpwd?
+CME ERROR: operation not supported
at+clck: "sc",1,"current pin password"
at+cpwd="sc","incorrect old password","new password"
+CME ERROR: incorrect password
at+clck="sc",2
+CLCK: 0
OK
at+cpwd="sc","old password","new password"
+CME ERROR: operation not allowed
at+clck="fd",1,"current pin2 password"
at+cpwd="p2","old password","new password"
OK
at+clck="ai",2
+CLCK: 0,1
+CLCK: 0,2
+CLCK: 0,4
OK
at+clck="ai",1,"correct password"
OK
at+clck="ai",2
+CLCK: 1,1
+CLCK: 1,2
+CLCK: 1,4
OK
at+cpwd="ai","old password","new password"
OK
```

+CLCK, Facility Lock

This command locks, unlocks or interrogates a G24 or a network facility <fac> (any kind of call barring program). A password is mandatory for performing locking and unlocking actions, but not for querying. The features of the G24 that are affected by this are the keypad power-up operation and fixed dialing list. When querying the status of a single call barring program <mode>=2, the <status> for each call type will be returned.

For <fac>="SC", SIM Card PIN setting and for <fac>="FD", SIM Fixed Dialing memory setting, the <class> is irrelevant (For more information about <class>, refer to The following table shows the +CLCK parameters.). The <passwd> for "sc" is SIM PIN, and for "fd" it is SIM PIN2.

Command Type	Syntax	Response/Action	Remarks
Set	**+CLCK=<fac>,<mode>[,<passwd>[,<classx>]]**	**For <fac> where <class> is irrelevant (SC, FD):** **+CLCK=<fac>,2** **+CLCK: <status>** **For <fac> with several supported <class>es:** **+CLCK=<fac>,2** **+CLCK: <status>,<class1>** **[<CR><LF>+CLCK: <status>,<class2>** **[…]]** **OK**	The Set command performs the specified <mode> action on the specified <fac>.
Read	**+CLCK?**	**+CLCK: ERROR**	
Test	**+CLCK=?**	**+CLCK: (list of supported <fac>s)**	The Test command returns the list of supported facilities.

The following table shows the +CLCK parameters.

Table 3-116: +CLCK Parameters

<Parameter>	Description	
<fac>	SC	SIM Card PIN setting <mode>0 Disable PIN 1 Enable PIN)
	FD	SIM Fixed Dialing memory setting <mode>0Disable fixed dialing feature 1Enable fixed dialing feature)
	AO	BAOC (Bar All Outgoing Calls)
	OI	BOIC (Bar Outgoing International Calls)
	OX	BOIC-exHC (Bar Outgoing International Calls except to Home Country)
	AI	BAIC (Bar All Incoming Calls)
	IR	BIC-Roam (Bar Incoming Calls when Roaming outside the home country)
	AB	All Barring services (applicable only for <mode>=0)
	AG	All outgoing barring services (applicable only for <mode>=0)
	AC	All incoming barring services (applicable only for <mode>=0)
<passwd>	String type, 4-8 character password	
<mode>	0	Unlock
	1	Lock
	2	Query status (<passwd> does not apply)

Table 3-116: +CLCK Parameters (Cont.)

<Parameter>	Description
<class>	Sum of integers, each representing a class of information <class>. Only applies to call barring related facilities. 1 Voice (telephony) 2 Data (refers to all bearer services) 4 Fax (facsimile services) 8 SMS (Short Message Services) The default value is 7.
<status>	0 Inactive 1 Active

Example

```
AT+CLCK=?
+CLCK: ("SC","AO","OI","OX","AI","IR","AB","AG","AC","FD")
OK
AT+CLCK="SC",2
+CLCK: 0
OK
AT+CLCK="SC",1
+CME ERROR: operation not allowed
AT+CLCK="SC",1,"incorrect password
+CME ERROR: incorrect password
AT+CLCK="SC",1,"correct password"
OK
(From now SIM Card is locked and PIN is requested on power up)
AT+CLCK="AB",0,"incorrect password"
+CME ERROR: incorrect password
AT+CLCK="IR",2
+CLCK: 0,1
+CLCK: 0,2
+CLCK: 0,4
+CLCK: 0,8
OK
AT+CLCK="IR",1,"correct password" //<classx> is defaulted to 7 when not specified
OK
AT+CLCK="IR",2
+CLCK: 1,1
+CLCK: 1,2
+CLCK: 1,4
+CLCK: 0,8
OK
AT+CLCK="OI",2
+CLCK: 0,1
+CLCK: 0,2
+CLCK: 0,4
+CLCK: 0,8
OK
AT+CLCK="OI",1,"correct password",3
```

OK
(Voice and data international calls barred, fax and SMS not barred.)
AT+CLCK="OI",2
+CLCK: 1,1
+CLCK: 1,2
+CLCK: 0,4
+CLCK: 0,8
OK

Modem Configuration and Profile

Modem Register Commands

The G24 holds certain data items in selected memory space, named Software Registers (S-registers) and Modem Registers. Some of these registers are used as bitmaps, where one register holds more than one data item.

All S-registers can be accessed using the S command, described in "S, Bit Map Registers" on page 3-181. Some registers can also be accessed using dedicated commands, detailed below.

V, G24 Response Format

This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses. This command also determines whether the result codes are transmitted in a numeric or an alphabetic ("verbose") form. The text portion of information responses is not affected by this setting.

The following table shows the effect that setting this parameter has on the format of information text and result codes.

Table 3-117: Effects of Parameter Settings

V0	V1	Information Responses
<text><cr><lf>	<cr><lf><text><cr><lf>	Result Codes
<numeric code><cr>	<cr><lf><verbose code><cr><lf>	

Command Type	Syntax	Response/Action	Remarks
Set	**ATV<value>**	**OK** **or:** **+CME ERROR: <err>**	The Set command sets the format of information responses and result codes.
Read	**ATV?**	**<current value>**	The Read command reads the current setting of response format.
Test			The Test command for V is not defined, and therefore is not supported by the G24. The G24 returns an error.

The following table shows the V parameters.

Table 3-118: V Parameters

<Parameter>	Description
<value>	0 Transmits limited headers and trailers, and numeric text. 1 Transmits full headers and trailers, and verbose response text. The default value is 1.

Example

ATV?
V: 1
OK
ATV0
0
ATV7
4
ATV1
OK
ATV7
ERROR

Q, Result Code Suppression

This command determines whether to output the result codes. Information text transmitted in response to commands is not affected by the setting of this parameter.

Command Type	Syntax	Response/Action	Remarks
Set	**ATQ<value>**	**OK** **or:** **+CME ERROR: <err>**	The set commands sets whether or not to output result codes.
Read	**ATQ?**	**<current value>**	The Read command reads the current setting for result code suppression.
Test			The Test command for Q is not defined, and therefore is not supported by the G24. The G24 returns an error.

The following table shows the Qn parameters.

Table 3-119: Qn Parameters

<Parameter>		Description
<value>	0	Transmit result codes.
	1	Suppress result codes.
	The default value is 0.	

Example

ATQ0
OK
ATQ?
Q: 0
OK
ATQ4
ERROR
ATQ1 //No response because result codes are suppressed.
ATQ4 //No response because result codes are suppressed.

E, Command Echo

This command defines whether input characters are echoed to output. If so, these characters are echoed at the same rate, parity and format at which they were received.

Command Type	Syntax	Response/Action	Remarks
Set	**ATE<value>**	**OK** **or:** **+CME ERROR: <err>**	The Set command sets whether or not to echo characters.
Read	**ATE?**	**<current value>**	The Read command reads the current setting for command echo.
Test			The Test command for E is not defined by ITU, and therefore is not supported by the G24. The G24 returns an error.

The following table shows the E parameters.

Table 3-120: En Parameters

<Parameter>		Description
<value>	0	Does not echo characters
	1	Echoes characters
	The default value is 0.	

Example

ATE?
001
OK

X, Result Code Selection and Call Progress Monitoring Control

This command defines the CONNECT result code format. It determines whether or not the G24 transmits particular result codes to the user. It also controls whether the G24 verifies the presence of dial tone when it first goes off-hook to begin dialing, and whether the engaged tone (busy signal) detection is enabled.

Command Type	Syntax	Response/Action	Remarks
Set	**ATX<value>**	**OK** **or:** **+CME ERROR: <err>**	The Set command sets the result code and call progress monitoring control.
Read	**ATX?**	**<current value>**	
Test			The Test command for X is not defined by ITU, and therefore is not supported by the G24. The G24 returns an error.

The following table shows the X parameters.

Table 3-121: X Parameters

<Parameter>		Description
<value>	0	CONNECT result code given upon entering online data state: Dial tone detection - Disabled Busy detection - Disabled
	1	CONNECT <text> result code given upon entering online data state: Dial tone detection - Disabled Busy detection - Disabled
	2	CONNECT <text> result code given upon entering online data state: Dial tone detection - Enabled Busy detection - Disabled
	3	CONNECT <text> result code given upon entering online data state: Dial tone detection - Disabled Busy detection - Enabled
	4	CONNECT <text> result code given upon entering online data state: Dial tone detection - Enabled Busy detection - Enabled
	The default value is 0.	

Example

ATX?
000
OK

S, Bit Map Registers

This command reads/writes values of the S-registers. The G24 supports this command for various S values, according to official specifications (ITU-I, ETSI, or manufacturer specific).

Command Type	Syntax	Response/Action	Remarks
Set	**ATSn=<value**	**OK** **or:** **+CME ERROR: <err>**	The Set command is allowed for read/write S-registers, and not allowed for read-only S-registers.
Read	**ATSn?**	**<current value of S-register n>** **or:** **+CME ERROR: <err>**	
Test			The Test command for Sn is not defined by ITU, and therefore is not supported by the G24. The G24 returns an error.

The following table shows the different S-registers and their associated values.

Sn	Description	Min Value	Max Value	Default Value
S0	Sets/gets number of rings before auto answer.	0	255	0
S2	Sets/gets escape code character.	0	255	43
S3	Sets/gets carriage return code character.	0	127	13
S4	Sets/gets line feed code character.	0	127	10
S5	Sets/gets command line editing character (backspace).	0	127	8
S7	Sets the number of seconds in which connection must be established before the call is disconnected.	1	255	30
S12	Sets/gets guard time (in units of 50 msec) for the escape character during CSD connections	0	255	20
S14	Read-only. Holds values of En (in bit 1), Qn (in bit 2), Vn (in bit 3).	—	—	170
S21	Read-only. Holds values of &Dn (in bits 2, 3 and 4), &Cn (in bits 5 and 6).	—	—	40
S22	Read-only. Holds values of Mn (in bits 2 and 3), Xn (in bits 4, 5 and 6)	—	—	134
S31	Read-only. Holds value of Wn (in bits 2 and 3).	—	—	0
S36	Sets/gets value of \Nn.	0	7	5
S39	Read-only. Holds value of &Kn (in bits 0, 1 and 2).	—	—	3
S40	Read-only. Holds value of \An (in bits 6 and 7).	—	—	192
S41	Read-only. Holds value of %Cn (in bits 0 and 1).	—	—	3

Note: S0 (Auto Answer) should work regardless of the DTR HW line state. This is a deviation from the ITU V. 25-ter standard.

Example

ATS36?
005
OK
ATS0=3
OK
ATS0?
003
OK

S2

This command handles the selection of the escape characters, which are stored in S-Register 2, and specifies the escape character used in CSD connections.

Command Type	Syntax	Response/Action	Remarks
Set	**S2=<escape_character>**	**OK** **+CME ERROR: <err>**	The Set command sets the CSD escape character value if all parameters are valid.
Read	**S2?**	**<escape_character>** **OK** **+CME ERROR: <err>**	The Read command displays the currently defined escape character for CSD connections.

The following table shows the S2 parameters.

Table 3-122: S2 Parameters

<Parameter>	Description
<escape_character>	CSD escape character. Range is 0 to 255. The default value is 43 ("+").

S12

This command handles the selection of the guard time, which is stored in S-Register 12, and specifies the behavior of escape characters during CSD connection.

Note: For a guard time specified by S-Register 12, no character should be entered before or after "+++". The duration between escape codes must be smaller than the guard time.

Command Type	Syntax	Response/Action	Remarks
Set	**S12=<guard_time>**	**OK** **+CME ERROR: <err>**	The Set command sets the CSD escape character guard time value if all parameters are valid.
Read	**S12?**	**<guard_time>** **OK** **+CME ERROR: <err>**	The Read command displays the current CSD escape character guard time.

The following table shows the S12 parameters.

Table 3-123: S12 Parameters

<Parameter>	Description
<guard_time>	CSD escape character guard time (units of 50 msec). Range is 0 to 255. The default value is 20.

\S, Show the Status of the Commands and S-registers in Effect

This command displays the status of selected commands and S-registers.

\G, Software Control

This command sets the use of the software control. It is used for backward compatibility.

\J, Terminal Auto Rate

This command adjusts the terminal auto rate. It is used for backward compatibility.

\N, Link Type

This command displays the link type. It is used for backward compatibility.

+CBAND, Change Radio Band

This command has no effect, and only returns OK. It is used for backward compatibility.

?, Return the Value of the Last Updated S-register

This command displays the most recently updated value stored in an S-register.

Command Type	Syntax	Response/Action	Remarks
Read	**AT?**	**000** **OK**	The Read command returns the value of the last updated S-register.

Example

AT?
000
OK
AT?
003
OK
ATS36=5
OK
AT?
005
OK

&F, Set to Factory Defined Configuration

This command restores the factory default configuration profile. The G24 only supports one factory default profile, 0.

Command Type	Syntax	Response/Action	Remarks
Set	**AT&F<value>**	**OK** **or:** **+CMS ERROR: <err>**	
Read	**AT&F?**	**<current profile number>**	
Test			The Test command for &F is not defined by ITU, and therefore is not supported by the G24. The G24 returns an error.

The following table shows the &F parameters.

Table 3-124: &F Parameters

<Parameter>		Description
<value>	0	Factory default configuration profile. This is the only value supported.

Example

AT&F?
&F: 0
OK

Z, Reset to Default Configuration

This command drops the current call, and resets the values to default configuration.

Command Type	Syntax	Response/Action	Remarks
Set	**ATZ<value>**	**OK** **or:** **+CMS ERROR: <err>**	
Read			The Read command for Z is not defined, and therefore is not supported by the G24. The G24 returns an error.
Test			The Test command for Z is not defined, and therefore is not supported by the G24. The G24 returns an error.

The following table shows the Z parameters.

Table 3-125: Z Parameters

<Parameter>	Description
<value>	0 Set to user profile 0 1 Set to user profile 1 The default value is 0.

Example

ATZ0
OK

Sleep Mode Commands

When the G24 is connected using RS232 connection to external device, a sleep mechanism is available. In order to improve the power consumption, the G24 supports a low-power consumption mode, called "Sleep mode". The G24 has internal decision conditions for entering and exiting sleep mode. As the terminal and the G24 operate in a combined system, and as the communication between the G24 and the terminal must be reliable, there should be a mechanism agreed upon by both the G24 and the terminal to co-ordinate their separate sleep mode entering and exiting sequences. The G24 will not enter sleep mode unless the terminal enables the G24

sleep mode and signals its readiness for sleep. For this purpose, a set of AT commands and dedicated HW lines are defined.

Note: The Sleep mode feature is not relevant when using USB. In USB mode the G24 is always awake. While USB is connected, do not use the following:
1. Sleep mode AT commands.
2. Sleep mode dedicated HW line (wake in/wake out).

Sleep Mode AT Commands

The following are the Sleep mode AT commands:

- ATS24: Activates/deactivates Sleep mode.

  The G24 receives a request to activate or deactivate Sleep mode.
- ATS102: Sets the value of the delay before sending data to the terminal.

  The G24 receives the value that defines the period to wait between sending the wake-up signal, and sending data to the terminal.
- ATS100: The minimum time that takes the Terminal to enter sleep mode. Only if this time period passes, the G24 will wait ATS102 time between wake-up out line and data transmission.
- AT+MSCTS: The UART's CTS line control.

  The G24 receives a request to define the behavior of the CTS line when the G24 is in Sleep mode. It enables or disables activation of the CTS line after wakeup.

Sleep Mode HW Signals

Two HW lines are used:

- One for waking the G24 (Wakeup-In)
- One for waking the terminal (Wakeup-Out)

Terminal Does Not Wake the G24 (If the Terminal Uses Hardware Flow Control Only)

When the G24 is in Sleep mode, the CTS line is also inactive. The terminal does not send any characters to the G24 if the CTS is inactive, otherwise the character may be lost (Hardware Flow Control).

Terminal Wakes the G24 Using the Wakeup-In Line

The terminal uses the Wakeup-In line (pin #16) to wake up the G24 when it wants to send data. When the Wakeup-In line is low, the G24 will not enter the Sleep mode. If the terminal has data to send while the G24 is sleeping, it activates the line (brings it to active low), then waits 30 ms (the time required to wake the G24). Only then can the terminal start sending data.

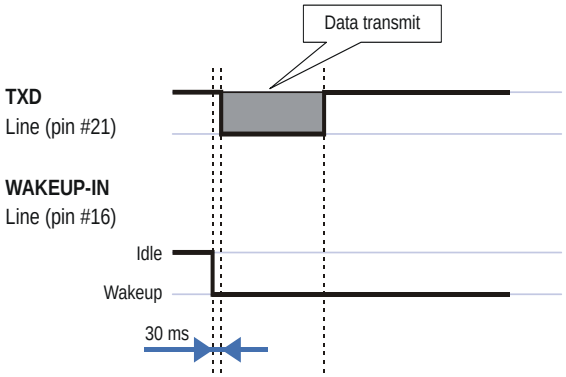


Figure 3-8: Wakeup-In Line

Two modes exist:

- Idle Mode: The terminal has no data to send. If the terminal enables sleep mode (using ats24), the G24 activates its Sleep mode module.
- Wakeup Mode: The G24 does not enter sleep mode, and the terminal can send data.

Once the terminal changes the line edge to Wakeup mode, it needs a 30 ms delay before sending any data to the G24 (using the RS232 protocol).

G24 Wakes the Terminal

- The G24 follows these steps in order to wake up the terminal:
- The G24 indicates to the terminal that it has data and that it must wake up. The G24 uses the Wakeup-Out Line (pin #26) (brings it to active low).
- While the Wakeup Out line is low, the terminal should not enter Sleep mode.
- The terminal should set a value of the delay (in ms) needed for waking it (using the ATS102 command) before receiving data (default value is 30 ms).

When the data transmission is complete, the G24 gets the output wakeup line to high.

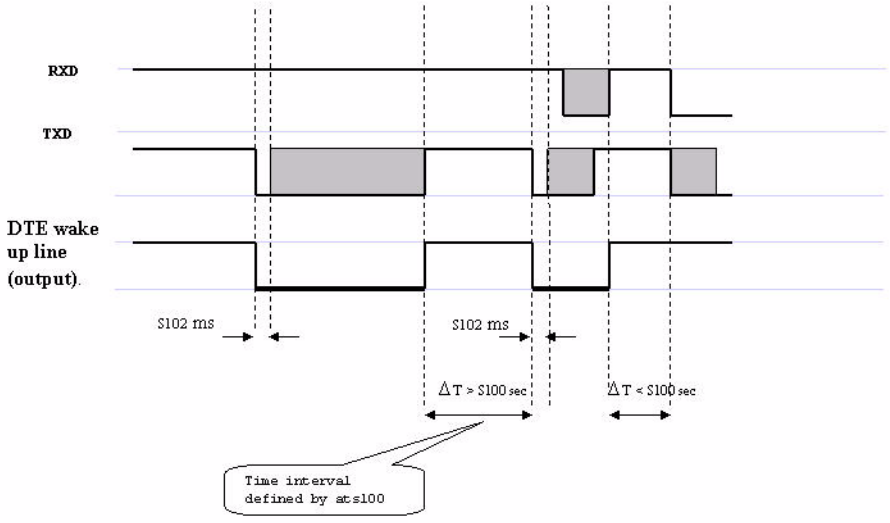


Figure 3-9: Wake up Outline

Two modes exist:

- Idle mode: The G24 has no data to send.
- Wakeup mode: The G24 has data to send to the terminal.

After the G24 changes the line edge to Wakeup mode, there will be a delay (the default is 30 ms) sent by the ats102 command before sending any data to the terminal (using RS232 protocol).

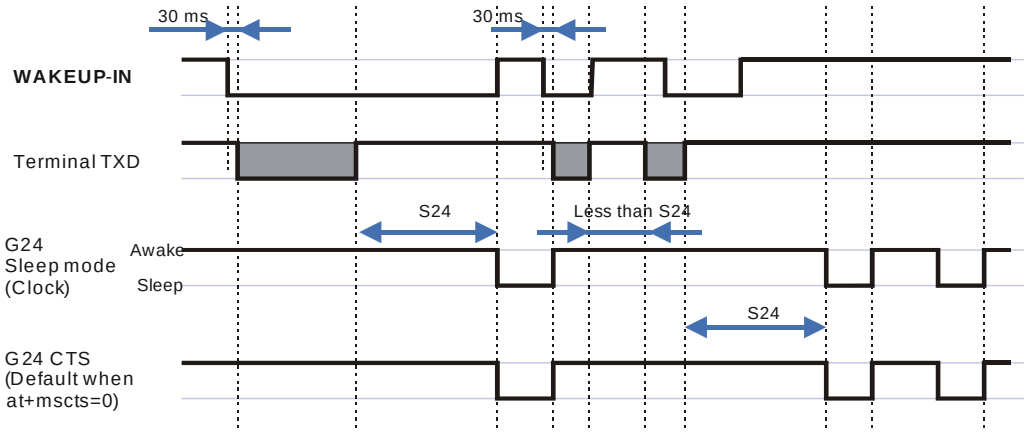


Figure 3-10: Sleep Mode when S24 > 0

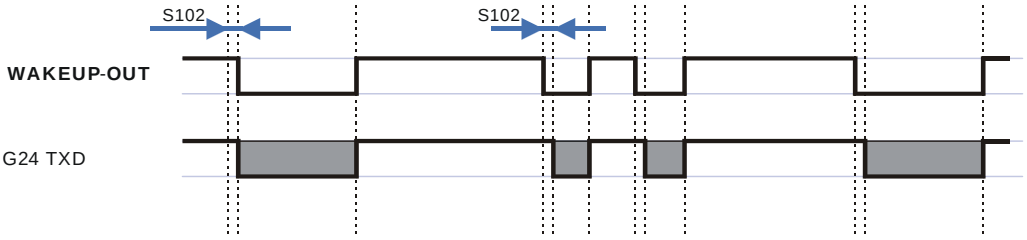


Figure 3-11: G24 Lines when S24 > 0

S24, Set Number of Seconds Delay Before G24 Enters Sleep Mode

This command activates/disables the Sleep mode. The terminal sends ATS24=5, and if there are no radio and UART activities, the G24 enters sleep mode in 5 seconds.

If terminal has some indication of the CTS pin activity, it can see:

- If +MSCTS=0 (default), the line changes its state periodically. (For more information refer to "+MSCTS, Enable/Disable CTS During Wakeup Period" on page 3-192.)
- If +MSCTS=1, the line is switched off at the moment of entering Sleep mode and stays off even if G24 is awakened.

Command Type	Syntax	Response/Action	Remarks
Set	**ATS24=[<value>]**	**OK**	The Set command sets the amount of time, in seconds, the G24 should wait before entering Sleep mode.
Read	**ATS24?**	**<value>** **OK**	The Read command returns the current value.

The following table shows the S24 parameters.

Table 3-126: S24 Parameters

<Parameter>	Description
<value>	Number of seconds (0 <= n <= 255) 0 Disable Sleep mode >0 Enable Sleep mode The default value is 0.

Example

ATS24? <enter>
000
OK
ATS24=5 <enter>
OK
ATS24? <enter>
005
OK
(If there are no radio and UART activities, the G24 will enter sleep mode in 5 seconds)

S102, Set Delay Before Sending Data to the Terminal

This command sets the value of the delay before sending data to the terminal. Before receiving data, the terminal connected to the G24 will receive:

- Terminal Wakeup signal (the Wakeup Out Line (pin #26) state will be active low).
- A delay that is equal ATS102 value.
- Data (GPRS, CSD, AT commands' echo and results, unsolicited reports).

Command Type	Syntax	Response/Action	Remarks
Set	**ATS102 = <value>**	**OK**	The Set command sets the delay before sending data to the terminal, and defines a period between sending the wakeup signal and sending data to the terminal.
Read	**ATS102?**	**<value>** **OK**	The Read command returns the current value.

The following table shows the S102 parameters.

Table 3-127: S102 Parameters

<Parameter>	Description
<value>	0 <= value <= 255 The default value is 30 ms.

Example

ATS102? <enter>
030
OK
ATS102=100 <enter>
OK
ATS102? <enter>
100
OK

(This means if there is data for transmission to the terminal, the G24 drops the Wakeup Out line, waits 100 ms. and then sends data to the terminal.)

S100, Set Minimum Time for Terminal to Fall into Sleep Mode

ATS100 is a terminal minimum time limit for entering sleep mode.

In order to limit the number of interrupts on the DTE side and reduce data sending delay time on our side, G24 sends wakeup-out pulse when the interval between one burst of sent/received data to the other is bigger than specified in ATS100.

Command Type	Syntax	Response/Action	Remarks
Set	**ATS100=<delta>**	**OK** **Or** **+CME ERROR: <err>**	The set command sets the terminal minimum time limit for entering sleep mode.
Read	**ATS100?**	**<delta>** **OK**	The Read command returns the current ATS100 value.

Table 3-128: Command parameters

<Parameter>	Description
<delta>	Time interval between one burst of sent/received data to the other before the terminal enters sleep mode. 0 : Wakeup out feature isn't active. (default at power up) 1 - 255: Time in seconds.

Example

ats100?
001
OK
ats100=0
OK
ats100?
000
OK

+MSCTS, Enable/Disable CTS During Wakeup Period

This command defines the behavior of the CTS line when the G24 is in normal mode (not Sleep mode).

The command configures the G24 CTS line behavior always to follow the flow control requirements, or to follow it only if the terminal initiated a serial transmission session. This saves the terminal from following the CTS interrupt every time the G24 exits Sleep mode for internal G24 reasons (non-terminal communication related reasons).

Command Type	Syntax	Response/Action	Remarks
Set	**AT+MSCTS=<control>**	**OK**	The Set command tells the G24 whether to activate the CTS when the unit is awakening.
Read	**AT+MSCTS?**	**+MSCTS: <current control>** **OK**	The Read command returns the current control value.
Test	**AT+MSCTS=?**	**+MSCTS: (list of supported <control>)** **OK**	The Test command returns the possible control values.

The following table shows the +MSCTS parameters.

Table 3-129: +MSCTS Parameters

<Parameter>	Description
<control>	0 In Normal Mode: The CTS is used for Flow Control In Sleep mode: The CTS is inactive. 1 Wakeup In line is Active: The CTS is used for Flow Control. Wakeup In line is Inactive: The CTS is inactive. The default value is 0.

Example

AT+MSCTS = ?
+MSCTS: (0-1)
OK
AT+MSCTS?
+MSCTS: 0
OK
AT+MSCTS = 1
OK
ATS102?
1
OK

Note: This means that by waking up, the CTS line will stay OFF and it can be activated by the Wakeup IN Line interrupt only.

Error Handling Commands

+CMEE, Report Mobile Equipment Error

The Set command disables or enables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the G24. When enabled, G24-related errors cause a +CME ERROR: <err> final result code instead of the regular ERROR final result code. Usually, ERROR is returned when the error is related to syntax, invalid parameters or terminal functionality.

For all Accessory AT commands besides SMS commands, the +CMEE set command disables or enables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the G24. When enabled, G24 related errors cause a +CME ERROR: <err> final result code instead of the regular ERROR result code.

For all SMS AT commands that are derived from GSM 07.05, the +CMEE Set command disables or enables the use of result code +CMS ERROR: <err> as an indication of an error relating to the

functionality of the G24. When enabled, G24-related errors cause a +CMS ERROR: <err> final result code instead of the regular ERROR final result.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CMEE=[<n>]**	**OK** **or:** **+CME ERROR: <err>**	The Set command enables or disables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the G24.
Read	**AT+CMEE?**	**+CMEE: <n>** **OK**	The Read command returns the current setting format of the result code.
Test	**AT+CMEE=?**	**+CMEE: (list of supported <n>s)** **OK**	The Test command returns values supported by the terminal as a compound value.

The following table shows the +CMEE parameters.

Table 3-130: +CMEE Parameters

<Parameter>	Description
<n>	0 Disable the +CME ERROR: <err> result code and use ERROR. 1 Enable the +CME ERROR: <err> or +CMS ERROR: <err> result codes and use numeric <err> values. 2 Enable the +CME ERROR: <err> or +CMS ERROR: <err> result codes and use verbose <err> values. The default value is 0.

Table 3-131: +CME Errors

<Parameter>	Description
<err>	Numeric format followed by verbose format: 0, "phone failure" 1, "no connection to phone" 2, "phone-adaptor link reserved" 3, "operation not allowed" 4, "operation not supported" 5, "PH-SIM PIN required" 6, "PH-FSIM PIN required" 7, "PH-FSIM PUK required" 10, "SIM not inserted" 11, "SIM PIN required" 12, "SIM PUK required" 13, "SIM failure" 14, "SIM busy" 15, "SIM wrong" 16, "incorrect password" 17, "SIM PIN2 required" 18, "SIM PUK2 required" 20, "memory full" 21, "invalid index" 22, "not found" 23, "memory failure" 24, "text string too long" 25, "invalid characters in text string" 26, "dial string too long" 27, "invalid characters in dial string" 30, "no network service" 31, "network timeout" 32, "network not allowed - emergency calls only" 33, "command aborted" 34, "numeric parameter instead of text parameter" 35, "text parameter instead of numeric parameter" 36, "numeric parameter out of bounds" 37, "text string too short" 40, "network personalization PIN required" 41, "network personalization PUK required" 42, "network subset personalization PIN required" 43, "network subnet personalization PUK required" 44, "service provider personalization PIN required" 45, "service provider personalization PUK required" 46, "corporate personalization PIN required" 47, "corporate personalization PUK required" 60, "SIM service option not supported" 100, "unknown" 103, "Illegal MS (#3)" 106, "Illegal ME (#6)" 107, "GPRS services not allowed (#7)" 111, "PLMN not allowed (#11)" 112, "Location area not allowed (#12)"

Table 3-131: +CME Errors (Cont.)

<Parameter>	Description
<err> ***Continued***	113, "Roaming not allowed in this location area (#13)" 132, "service option not supported (#32)" 133, "requested service option not subscribed (#33)" 134, "service option temporarily out of order (#34)" 147, "long context activation" 151, "GPRS disconnection timer is active" 149, "PDP authentication failure" 150, "invalid mobile class" 148, "unspecified GPRS error" 256, "too many active calls" 257, "call rejected" 258, "unanswered call pending" 259, "unknown calling error" 260, "no phone num recognized" 261, "call state not idle" 262, "call in progress" 263, "dial state error" 264, "unlock code required" 265, "network busy" 266, "Invalid phone number" 267, "Number Entry already started" 268, "Cancelled by user" 269, "Number Entry could not be started" 280, "Data lost" 281, "Invalid message body length" 282, "inactive socket" 283, "socket already open"} Numeric format followed by verbose format: 1, "Unassigned (unallocated) 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 not implemented" 98, "Message not compatible with short message protocol state" 99, "Information element non-existent or not implemented" 111, "Protocol error, unspecified"

Table 3-131: +CME Errors (Cont.)

<Parameter>	Description
<err> ***Continued***	127, "Interworking, unspecified" 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 (alphabet) 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" 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" 198, "TP-VPF not supported" 199, "TP-VP not supported" 208, "SIM SMS storage full" 209, "No SMS storage capability in SIM" 210, "Error in MS" 211, "Memory Capacity Exceeded" 213, "SIM Data Download Error" 255, "an unspecified error" 300, "ME failure" 301, "SMS service of ME reserved" 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 required" 312, "PH-SIM PIN required" 313, "SIM failure" 314, "SIM busy" 315, "SIM wrong" 316, "SIM PUK required" 317, "SIM PIN2 required" 318, "SIM PUK2 required" 320, "memory failure" 321, "invalid memory index" 322, "memory full" 330, "SMSC address unknown" 331, "no network service" 332, "network timeout" 340, "no +CNMA acknowledgement expected" 500, "unknown error"

Table 3-131: +CME Errors (Cont.)

<Parameter>	Description
<err> ***Continued***	512, "network busy" 513, "invalid destination address" 514, "invalid message body length" 515, "phone is not in service" 516, "invalid preferred memory storage" 517, "user terminated"

Note: +CME ERROR:280, Data lost, is sent to the terminal in extreme cases when the G24 has to transmit data to the terminal and the buffers are full (Flow control Xoff status).

This error occurs when:

- An unsolicited indication (such as RING, +CLCC and so on) encounters the Xoff status. When the flow control status returns to Xon, Error 280, Data lost, is sent to the terminal instead of the unsolicited indication.
- An initiated AT command is waiting for a response, and the response encounters the Xoff status.
  When the flow control status returns to Xon, the AT command is aborted (if not yet aborted) and Error 280, Data lost is sent to the terminal instead of OK (and the missing data).

Example

AT+CMEE=0 //+CME ERROR is not used
OK
AT+VTD
ERROR
AT+CMEE=1 //Use numeric <err>
OK
AT+VTD
+CME ERROR: 1
AT+CMEE=2 //Use verbose <err>
OK
AT+VTD
+CME ERROR: operation not supported

+CEER, Extended Error Report

This execution command returns an extended error report containing one or more lines of information text <report>, determined by the manufacturer, providing reasons for the following errors:

- Failure in the last unsuccessful call setup (originating or answering) or the in-call modification.
- Last call release.

Typically, the text consists of a single line containing the reason for the error according to information given by GSM network, in textual format.

Command Type	Syntax	Response/Action
Set	**AT+CEER=[<n>]**	**OK**
Execute	**AT+CEER**	**+CEER: <report>** **OK**
Read	**AT+CEER?**	**+CEER: <n>** **OK**
Test	**AT+CEER=?**	**+CEER: (List of supported <n>s)** **OK**

The following table shows the +CEER parameters.

Table 3-132: +CEER Parameters

<Parameter>	Description
<n>	1 Returns numeric response. 2 Returns verbose response. The default value is 2.
<report>	The total number of characters and line terminators (up to 2041) in the information text. The text must not contain the sequence 0<CR> or OK<CR>. Numeric format followed by verbose format: 1 Unassigned or unallocated number 3 No route to destination 6 Channel unacceptable 8 Operator determined barring 16 Normal call clearing 17 User busy 18 No user responding 19 User alerting, no answer 21 Call rejected 22 Number changed 26 Non selected user clearing 27 Destination out of order 28 Invalid number format (incomplete number) 29 Facility rejected 30 Response to STATUS ENQUIRY 31 Normal, unspecified 34 No circuit/channel available 38 Network out of order 41 Temporary failure 42 Switching equipment congestion 43 Access information discarded 44 Requested circuit/channel not available

Table 3-132: +CEER Parameters (Cont.)

<Parameter>		Description
<report>	47	Resources unavailable, unspecified
	49	Quality of service unavailable
(continued)	50	Requested facility not subscribed
	55	Incoming calls barred within the CUG
	57	Bearer capability not authorized
	58	Bearer capability not presently available
	63	Service or option not available, unspecified
	65	Bearer service not implemented
	69	Requested facility not implemented
	70	Only restricted digital information bearer capability is available
	79	Service or option not implemented, unspecified
	81	Invalid transaction identifier value
	87	User not member of CUG
	88	Incompatible destination
	91	Invalid transit network selection
	95	Semantically incorrect message
	96	Invalid mandatory information
	97	Message type non-existent or not implemented
	98	Message type not compatible with protocol state
	99	Information element non-existent or not implemented
	100	Conditional IE error
	101	Message not compatible with protocol state
	102	Recovery on timer expiry
	111	Protocol error, unspecified
	127	Interworking, unspecified

Example

At+CEER
+CEER: "No information available"
OK
AT+CEER?
+CEER:2
OK
AT+CEER=?
+CEER: (001-002)
OK

UI (User Interface)

+CRSM, Restricted SIM Access

This command enables you to read the following data from the SIM card:

- IMSI
- GID1
- GID2
- ICC ID
- Preferred languages
- CPHS

Command Type	Syntax	Response/Action	Remarks
Set	**+CRSM=<command>,<field>**	**+CRSM: <sw1>,<sw2>[,<response>]** **OK** **or:** **+CRSM: <sw1>,<sw2>,<code>[<code>...]** **or:** **+CME ERROR: <err>**	The Set command issues a request for information stored in the SIM card. In case of a successful read operation, the information is sent to the DTE. IMSI, GID1, GID2 and CPHS require an unlocked SIM. For ICC ID and preferred language, the SIM may be locked.
Test	**+CRSM=?**	**+CRSM: (list of supported <command>s),(list of supported <field>s)** **OK** **or:** **+CME ERROR: <err>**	The Test command returns the possible <command> and <field> values.

The following table shows the +CRSM parameters.

Table 3-133: +CRSM Parameters

<Parameter>	Description
<command>	176 Read BINARY
<field>	Type of read field from SIM card: 197 IMSI 214 GID1 242 ICC ID 243 GID2 251 CPHS 252 Preferred languages

Table 3-133: +CRSM Parameters

<Parameter>	Description
<sw1> <sw2>	Indicates the outcome of the operation: 0 0 Success 0 1 SIM card not inserted 0 2 Service is not available 0 3 Pin required 0 4 Unavailable. Data is temporarily unavailable (initializing)
<response>	Response of a successful completion of the issued command (hexidecimal character uppercase format). This is the requested data.
<code>	CBS coding scheme

Example

```
AT+CRSM=176,214
+CRSM: 0,0,FFFFFFFFFFFFFFFFFFFF00000000000000000000
OK
AT+CRSM=176,242
+CRSM: 0,0,89972010102050863733
OK
AT+CRSM=176,252
+CRSM: 0,0,04,01,01,01
OK
at+crsm=176,251
+CRSM: 0,0,01F802F803D804F005FE0600078008FB09CCC0FDD5FF
OK
at+crsm=176,251
+CRSM: 0,3              // PIN locked
OK
```

&V, View Configuration

Command Type	Syntax	Response/Action	Remarks
Execute	**&V**	**ACTIVE PROFILE:** **... (profile data)** **STORED PROFILE 0:** **...(profile data)** **STORED PROFILE1:** **...(profile data)** **OK** **or** **+CME ERROR: <err>**	The Execute command displays the current active configuration and stored user profiles.

Example

```
at&v
ACTIVE PROFILE:
E1 Q0 V1 X4 &C1 &D2 &K3 &Y0
S00:000 S01:000 S02:043 S03:013 S04:010 S05:008 S06:004 S07:050
S08:004 S09:006 S10:014 S12:040 S14:AAH S16:80H S18:000 S21:30H
S22:F6H S23:1BH S25:005 S26:001 S27:09H
STORED PROFILE 0:
E1 Q0 V1 X4 &C1 &D2 &K3
S00:000 S02:043 S03:013 S04:010 S05:008 S07:050 S12:040
STORED PROFILE 1:
E1 Q0 V1 X4 &C1 &D2 &K3
S00:000 S02:043 S03:013 S04:010 S05:008 S07:050 S12:040
OK
```

&W, Store User Profile

Command Type	Syntax	Response/Action	Remarks
Set	**&W[<n>]**	**OK** **or:** **+CME ERROR: <err>**	he Set command stores the current active configuration to user profile 0 or 1.

The following table shows the &W parameters.

Table 3-134: &W Parameters

<Parameter>	Description
<n>	User's profile number: 0 Store to user's profile 0 1 Store to user's profile 1 The default value is 0.

The parameters that are set in a profile are described in the table below.

Table 3-135: Profile Parameters

Profile Parameter	Description	Parameter Range	Default Value	Length in Bits
ATE	Echo	0-1	1	1
ATQ	Result code return mode	0-1	0	1
ATV	Display result code	0-1	1	1
ATX	Select result code	0-4	0	3

Table 3-135: Profile Parameters (Cont.)

Profile Parameter	Description	Parameter Range	Default Value	Length in Bits
AT&C	Set circuit 109 (DCD) behavior	0-2	1	2
AT&D	Set circuit 109 (DTR) behavior	0-4	2	3
AT&K	Flow control	0, 3-6	3	3
AT&Y	Power-up profile	0-1	0	1
S0	Auto-answer	0-255	0	8
S2	Escape code character	0-255	43	8
S3	Carriage return character	0-127	13	7
S4	Line feed character	0-127	10	7
S5	Backspace character	0-32	8	6
S7	Wait time for carrier. Register S7 tells the data adaptor how many seconds to wait for a remote data adaptor's carrier signal before hanging up. The register value can be increased if the data adaptor does not detect a carrier within the specified time. If the data adaptor detects a remote carrier signal within the specified time, it sends a CONNECT response and enters Data mode. If it does not detect a remote carrier signal within the specified time, it sends the NO ANSWER (or 8) response, hangs up, and returns to the Command Mode.	1-255	30	8
S 12	Time, in 50ths of a second, until OK is displayed after entering command mode by an escape sequence.	0-255	20	8

Example

at&w0
OK
at&w1
OK

&Y, Default User Profile

Command Type	Syntax	Response/Action
Set	**&Y[<n>]**	**OK** **or:** **+CME ERROR: <err>**

The following table shows the &Y parameters.

Table 3-136: &Y Parameters

<Parameter>	Description
<n>	User's profile number: 0 Selects power-up configuration to user's profile 0 1 Selects power-up configuration to user's profile 1 The default value is 0.

Example

```
at&y0
OK
at&y1
OK
```

+CKPD, Keypad Control

This command emulates key presses, or virtual keycodes, as if entered from the G24 keypad or from a remote handset. If a key is not supported by the G24, the G24 returns +CME ERROR: indicating that error 25 (Invalid character) has occurred.

When using this command, numeric keys (0-9) must be placed within double quotes, for example, at+ckpd="4". Multiple numeric key presses can be strung together into one command, for example, at+ckpd+"18478622544".

The characters ^ (up) and v (down) can be used with this command to scroll through menu items. The number of characters indicates the number of times to scroll in that direction. For example, at+ckpd=vvvv scrolls four menu items down.

This command is provided primarily to support test efforts, and to allow the emulation of a handset device by a peripheral. This command is not intended to be used by accessory devices to access items within the G24 menus.

It is not recommended to dial using this command. Using CKPD for call control purposes can cause inconsistencies between call control indications and the true call control state. If CKPD is

used for call control despite this recommendation, it should not be mixed with call control AT commands like ATH/AT+CHLD and so on.

Note: The +CKPD command does not support DTMF tones.

Command Type	Response/Action	Remarks
Set	**+CKPD=<keys>[,<time>[,<pause>]]**	**OK** **or:** **+CME ERROR: <err>**

The following table shows the +CKPD parameters.

Table 3-137: +CKPD Parameters

<Parameter>	Description
<keys>	Virtual keycode (See Table 3-136).
<time>	Time for which to hold the key (in 0.1 seconds) 0...255 Seconds (default values are manufacturer specific, but should long enough that a normal G24 can handle keystrokes correctly).
<pause>	Time for which to pause between key presses (in 0.1 seconds) 0...255 Seconds (default values are manufacturer specific, but should be long enough that a normal G24 can handle keystrokes correctly).

The following table shows the Character codes.

Table 3-138: Character Codes

Character	IRA (dec)	Comment (and Known Key Symbols)
#	35	Hash (Number sign)
%	37	Percent sign (P)
*****	42	Star (*)
0... 9	48... 57	Number keys
:	58	Escape character for manufacturer specific keys
;	59	Escape character for string entering
<	60	Left arrow
>	62	Right arrow
@	64	Alpha key (α/ABC)
A/a	65/97	Channel A (A)

Table 3-138: Character Codes (Cont.)

Character	IRA (dec)	Comment (and Known Key Symbols)
B/b	66/98	Channel B (B)
C/c	67/99	Clear display (C/CLR)
D/d	68/100	Volume down
E/e	69/101	Connection end (END)
F/f	70/102	Function (FCN)
L/l	76/108	Phone lock (LOCK)
M/m	77/109	Menu (MENU)
P/p	80/112	Power (PWR)
Q/q	81/113	Quiet/Mute (MUTE)
R/r	82/114	Recall last number (R/RCL/MR)
S/s	83/115	Connection start (SEND)
T/t	84/116	Store/Memory (STO/M/M+)
U/u	85/117	Volume up
V/v	86/118	Down arrow
W/w	87/119	Pause character
X/x	88/120	Auxiliary (AUX)
Y/y	89/121	Delete last character (C)
[	91	Soft Key Left
]	93	Soft Key Right
^	94	Up arrow

Example

AT+CMER=0,2,0,0,0
OK
AT+CKPD=m //Emulate pressing the MENU button
OK
+CKEV: "M",1 //If +CMER is configured to echo and phone not locked
+CKEV: "M",0
AT+CKPD=[//Emulate pressing the EXIT button - the left soft-key button
OK
+CKEV: "[",1
+CKEV: "[",0

+MKPD, Auxiliary Keypad Control

This command enables accessories to control the press and release of key presses. If a key is not supported by a G24, the G24 returns a +CME ERROR: indicating that error 25 (Invalid character) has occurred.

Only a single key may be pressed at a given time. Sending in a new key press without releasing the previous key results in the previous key being automatically released.

Command Type	Response/Action	Remarks
Set	**+MKPD=<key>,<state>**	**OK** **or:** **+CME ERROR: <err>**

The following table shows the +MKPD parameters.

Table 3-139: +MKPD Parameters

<Parameter>	Description
<state>	Key press state 0 Release 1 Press
<key>	Virtual keycodes, described in Table 3-138.

Example

AT+CMER=0,2,0,0,0
AT+MKPD=m,1//Emulate pressing the MENU button
OK
+CKEV: "M",1 //If +CMER is configured to echo and phone not locked
AT+MKPD=m,0//Emulate releasing the MENU button
OK
+CKEV: "M",0

+CMER, Mobile Equipment Event Reporting

Command Type	Syntax	Response/Action	Remarks
Set	**+CMER=[<mode>[,<keyp>[,<disp>[,<ind>[,<bfr>]]]]]**	**OK** **or:** **+CME ERROR: <err>**	The Set command enables/disables an external accessory to receive event reports from the G24. In some cases, this is used to track the user activity for redisplay on a vehicle system, or to perform accessory-specific menu operations.
Read	**+CMER?**	**+CMER: <mode>,<keyp>,<disp>,<ind>,<bfr>** **OK** **or:** **+CME ERROR: <err>**	The Read command queries the current settings for the AT+CMER command.
Test	**+CMER=?**	**+CMER: (list of supported <mode>s),(list of supported <keyp>s),(list of supported <disp>s),(list of supported <ind>s),(list of supported <bfr>s)**	The Test command returns the possible <mode>, <keyp>, <disp>, <ind>, and <bfr> values.

The following table shows the +CMER parameters.

Table 3-140: +CMER Parameters

<Parameter>	Description
<mode>	Controls the processing of unsolicited result codes specified within this command. 0 Buffer unsolicited result codes in G24
<keyp>	0 Do not report keypad events. 1 Display events reporting using result code +CKEV. Only keypad events that are not caused by the +CKPD command are reported. 2 Keypad events reporting using result code +CKEV. All keypad events, including those caused by the +CKPD command, are reported. The default value is 0.
<disp>	0 No display of event reporting. 1 Display event reporting using result code +CDEV: <x>,<y>,<text>,<highlighted> <x> indicates the x coordinate of the text. <y> indicates the y coordinate of the text. <text> is the new value of the text element. < highlighted> indicates whether the line has a backlight The character set used in <text> is as specified by the Select TE Character Set (+CSCS) command.

Table 3-140: +CMER Parameters (Cont.)

<Parameter>	Description
<ind>	0 No indicator events reporting. 1 Indicator event +CIEV: <ind>,<value>. <ind> shows the indicator order number and <value> is new value of indicator. The default value is 0.
<bfr>	Controls the effect on buffered codes. 0 Clear buffer.

Unsolicited UI Status Messages

Certain actions performed in the G24 UI by the user are transmitted to all attached accessories, primarily as a notification of a change in state. For example, notification of a phone-book storage, recall operation or setting a call restriction level. These messages are required by certain accessories to maintain local information, or to provide additional information on an auxiliary display.

+CKEV, Key Press Echo Output

This unsolicited message is sent when local key press echo is enabled (as described in "+CMER, Mobile Equipment Event Reporting" on page 3-209) and a key is pressed on the G24 keypad. The identity of the key is broadcast to all the accessories, as well as information about whether the key was pressed or released. This command can be configured to send key presses from the G24 keypad only, or from other accessories as well.

When the phone is locked and a digit or a softkey is pressed, the "@" character is used in the message event instead of the actual key being pressed. This prevents passwords or codes entered by the user being monitored or stolen by attached accessories (for example, Bluetooth devices).

Unsolicited Report

+CKEV: <key>,<press>

The following table shows the +CKEV parameters.

Table 3-141: +CKEV Parameters

<Parameter>	Description
<key>	Key that changed state
<press>	0 Key released 1 Key pressed

Example

```
AT+CMER=?
+CMER: (0),(0,1,2),(0,1),(0,1),(0)
OK
AT+CMER?
+CMER: 0,0,0,0,0
OK
```

AT+CMER=0,2,0,0,0
OK
AT+CMER?
+CMER: 0,2,0,0,0
OK
AT+CKPD=M
OK
+CKEV: "M",1
+CKEV: "M",0

+CDEV, Change Display Indication

When text on the display changes and the <disp> parameter of the +CMER command is set to 1, the +CDEV indication is sent to the DTE.

Unsolicited Report

+CDEV: <x>,<y>,<text>,<highlighted>

Table 3-142: +CDEV Parameters

<Parameter>	Description
<x>	Indicates the x coordinate of the text.
<y>	Indicates the x coordinate of the text.
<text>	Is the new value of the text element.
< highlighted>	indicates whether the line has a backlight 0 - not highlighted 1 - highlighted

+CIEV, Indicator Event Reporting

When a G24 indication is changed and the <ind> parameter of the +CMER command is set to 1, the +CIEV indication is sent to the DTE.

Unsolicited Report

+CIEV: <ind>,<value>

The following table shows the +CIEV parameters.

Table 3-143: +CIEV Parameters

<ind>	Description	<value> Range		Explanation
0	Battery indicator	0-3	0 3	Low battery Full battery
1	Signal bars	0-5	0 1 5	No signal Low signal strength High signal strength

Table 3-143: +CIEV Parameters (Cont.)

<ind>	Description	<value> Range		Explanation
2	Service availability	0/1	0 1	Service available Service not available
3	Unread message indication	0/1	0 1	No unread messages Unread messages exist
4	Call in progress	0/1	0 1	Call not in progress Call in progress
5	Roaming indicator	0/1	0 1	Not roaming Roaming
6	SIM Pin 1 requested	0/1	0 1	SIM pin ready SIM pin required
7	SIM SMS full	0/1	0 1	SIM SMS storage is not full SIM SMS storage is full
8	GPRS coverage	0-2	0 1 2	No GPRS coverage GPRS coverage EDGE coverage **Note:** GPRS/EDGE coverage will be detected only when SIM has GPRS ability.
12	SIM insertion/removal indication	0/1	0 1	SIM card removed from phone SIM card inserted into phone

+MUPB, Phone Book Event

This output is sent by the G24 when a phone book entry is accessed or modified.

Command Type	Syntax	Response/Action
Set	**+MUPB=<n>**	**OK**

Unsolicited Report

+MUPB: <event>,<index>,<ph_list>

The following table shows the +MUPB parameters.

Table 3-144: +MUPB Parameters

<Parameter>	Description
<n>	0 Event reporting Off 1 Event reporting On
<event>	The type of operation performed on the location 1 Stored (new) 2 Modified 3 Cleared
<index>	Location number of the accessed entry
<ph_list>	Phone list affected by the change

Example

AT+MUPB=1
OK
+MUPB: 2,4."ME"//User modifies location 4

GPRS

GPRS Functionality

GSM 07.07 defines commands that a TE may use to control a GPRS ME via a non-multiplexed character-stream interface. This places certain limitations on the functionality of the interface. For example, it is not possible for the ME to send control information to the TE or for the TE to send commands to the ME whilst the interface is in the online data state, unless the layer 2 protocol itself supports this feature (GSM 07.60-12). However, G24-specific escape mechanism (DTR) is provided to enable the TE to switch the G24 into limited online command state.

The use of a multiplexed interface, (GSM 07.10), is not considered here (See “RS232 Multiplexer Feature”). The G24-specific escape mechanism use DTR as an escape signal (following &D parameters) and designed for limited non network related commands. This specific mechanism purpose is to give the user a way to retrieve the signal strength. The time limit of consecutive DTR toggles is a minimum of 90 seconds. The G24-specific is not designed to support online command and data states both at the same time, therefore any wrong or extreme usage can cause unexpected behaviors. The basic GPRS concept is be “always connected” and there is no charge for being connected (only per real data transferred).

GPRS Commands

This section defines commands that a terminal may use to control a GPRS ME. GPRS MTs vary widely in functionality. A class A ME might support multiple PDP-types as well as circuit-switched data, and use multiple external networks QoS profiles. At the other extreme, a class C ME might support only a single PDP-type using a single external network, and rely on the HLR to contain the PDP context definition. A comprehensive set of GPRS-specific commands is defined below to provide the flexibility needed by the more complex ME. The commands are designed to be expandable to accommodate new PDP types and interface protocols, merely by defining new values for many of the parameters. Multiple contexts may be activated if the interface link-layer protocol is able to support them. The commands use the extended information and error message capabilities described in this specification. For MTs of intermediate complexity, most commands have simplified forms where certain parameters may be omitted. For the simplest MTs, and for backwards compatibility with existing communications software, it is possible to control access to the GPRS using existing modem-compatible commands. This "modem compatible" mode of operation is described below.

+CGCLASS, GPRS Mobile Station Class

This command is used to set the G24 to operate according to the specified GPRS mobile class. If the requested class is not supported, an ERROR or +CME ERROR response is returned. Extended error responses are enabled by the +CMEE command.

Command Type	Syntax	Response/Action	Remarks
Read	**AT +CGCLASS?**	**+CGCLASS: <class>** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the current GPRS mobile class.
Test	**AT +CGCLASS=?**	**+CGCLASS: (list of supported <class>s)** **OK** **or;** **+CME ERROR: <err>**	The Test command is used for requesting information on the supported GPRS mobile classes.

Note: Issuing GPRS actions over a poor-quality connection may cause protocol errors and harm data validity. To prevent these problems, G24 is equipped with a protection mechanism that confirms GPRS signal strength before issuing GPRS network-related commands.

The following table shows the +CGCLASS parameters.

Table 3-145: +CGCLASS Parameters

<Parameter>	Description
<class>	String parameter that indicates the GPRS mobile class: B Class B

Example

AT+CGCLASS=?
+CGCLASS: (B)
OK

Note: If a SIM card without GPRS allowance is used:
at+cgclass=?
+CGCLASS: (CC) //Note that CC is a not supported value.

+CGDCONT, Define PDP Context

This command specifies the PDP (Packet Data Protocol) context.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CGDCONT= [<cid> [,<PDP_type>[,< APN> [,<PDP_addr>[,< d_comp> [,<h_comp>]]]]]**	**OK** **or:** **+CME ERROR: <err>**	The Set command specifies the context identification parameter values for a PDP context. A special form of the Set command, +CGDCONT= <cid> causes the values for context number <cid> to become undefined.
Read	**AT+CGDCONT?**	**+CGDCONT: <cid>, <PDP_type>, <APN>, <PDP_addr>, <data_comp>, <head_comp>[<CR>< LF>+CGDCONT: <cid>, <PDP_type>, <APN>, <PDP_addr>, <data_comp>, <head_comp>**	The Read command returns the current settings for each defined context.
Test	**AT+CGDCONT= ?**	**+CGDCONT: (range of supported <cid>s), <PDP_type>, , , (list of supported <d_comp>s), (list of supported <h_comp>s)**	The Test command returns the values supported as a compound value. If the ME supports several PDP types, <PDP_type>, the parameter value ranges for each <PDP_type> are returned on a separate line.

The following table shows the +CGDCONT parameters.

Table 3-146: +CGDCONT Parameters

<Parameter>	Description
<cid>	Numeric parameter specifying a particular PDP context definition (PDP Context Identifier). The parameter is local to the Terminal-Mobile Terminal interface and is used in other PDP context-related commands. The Test command returns the range of permitted values (minimum value=1).
<"PDP_type"> (Packet data protocol type)	String parameter (in quotation marks) specifying the type of packet data protocol: IP Internet Protocol (IETF STD 5)
<"APN"> (Access Point Name)	String parameter (in quotation marks), which is a logical name that is used to select the GGSN or the external packet data network. If the value is null or omitted, the subscription value is requested.
<"PDP_address">	String parameter (in quotation marks), which identifies the ME in the address space applicable to the PDP. If the value is null or omitted, a value may be provided by the terminal during the PDP startup procedure or, failing that, a dynamic address is requested. The Read form of the command continues to return the null string even if an address has been allocated during the PDP startup procedure. The allocated address may be read using the +CGPADDR command. The default value is 0.
<d_comp>	Numeric parameter that controls PDP data compression. 0 OFF 1 ON Other values are reserved. The default value is 0.
<h_comp>	Numeric parameter that controls the PDP header compression. 0 OFF 1 ON Other values are reserved. **Note:** Currently, only one data compression algorithm (V.42bis) is provided in SNDCP. If and when other algorithms become available, a command will be provided to select one or more data compression algorithms. The default value is 0.

Note: The IP address may be entered without double quotes (" ").

For example:

AT+CGDCONT=1, IP,RTY,123.32.45.9
OK

Example

```
AT+CGDCONT=?
+CGDCONT: (1-3),("IP"),,,(0,1),(0,1)
OK
AT+CGDCONT?
+CGDCONT: 1,"IP","","0.0.0.0",0,0
+CGDCONT: 2,"IP","","0.0.0.0",0,0
```

```
+CGDCONT: 3,"IP","","0.0.0.0",0,0
OK
at+cgdcont= 1,"IP","internetg","0.0.0.0",0,0
OK
at+cgdcont?
+CGDCONT: 1,"IP","internetg","0.0.0.0",0,0
+CGDCONT: 2,"IP","","0.0.0.0",0,0
+CGDCONT: 3,"IP","","0.0.0.0",0,0
OK
at+cgdcont= 1,"IP","internetg","0.0.0.0",0,0
OK
at+cgdcont=2,"IP","internetg","0.0.0.0",1,1
OK
```

+CGQMIN, Quality of Service Profile (Min Acceptable)

This command enables the terminal to specify the minimum acceptable profile which is checked by the ME against the negotiated profile returned in the Activate PDP Context Accept message.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CGQMIN=[<cid> [,<precedence> [,<delay> [,<reliability.> [,<peak> [,<mean>]]]]]]**	**OK** **or:** **+CME ERROR: <err>**	The Set command specifies a profile for the context identified by the (local) context identification parameter, <cid>. As this is the same parameter that is used in the +CGDCONT command, the +CGQMIN command is effectively an extension of the +CGDCONT command. The QoS profile consists of a number of parameters, each of which may be set to a separate value.

Command Type	Syntax	Response/Action	Remarks
Read	**AT+CGQMIN?**	**+CGQMIN: <cid>, <precedence>, <delay>, <reliability>,<peak>, <mean>[<CR><LF>+CGQMIN: <cid>, <precedence>,<delay>, <reliability.>, <peak>, <mean>[...]]** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the current settings for each defined context.
Test	**AT+CGQMIN=?**	**+CGQMIN: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s), (list of supported <peak>s), (list of supported <mean>s)** **[<CR><LF>+CGQMIN: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s), (list of supported <peak>s), (list of supported <mean>s)** **OK** **or:** **+CME ERROR: <err>**	The Test command returns the parameter value ranges for each <PDP_type>

The following table shows the +CGQMIN parameters.

Table 3-147: +CGQMIN Parameters

<Parameter>	Description
<cid>	A numeric parameter that specifies a particular PDP context definition. The value is from 1 to 3.
<precedence>	A numeric parameter that specifies the precedence class.
<delay>	A numeric parameter that specifies the delay class.
<reliability>	A numeric parameter that specifies the reliability class.
<peak>	A numeric parameter that specifies the peak throughput class.
<mean>	A numeric parameter that specifies the mean throughput class.

Example

```
AT+CGQMIN=?
+CGQMIN: ("IP"),(0-3),(0-4),(0-5),(0-9),(0-18,31)
OK
AT+CGQMIN?
+CGQMIN: 1,2,4,3,9,10
+CGQMIN: 2,2,4,3,9,10
+CGQMIN: 3,2,4,3,9,10
OK
```

+CGQREQ, Quality of Service Profile (Requested)

This command enables the terminal to specify a Quality of Service Profile that is used when the ME sends an Activate PDP Context Request message to the network.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CGQREQ=[<cid> [,<precedence> [,<delay> [,<reliability.> [,<peak> [,<mean>]]]]]]**	**OK** **or:** **+CME ERROR: <err>**	The Set command specifies a profile for the context identified by the (local) context identification parameter, <cid>. As this is the same parameter that is used in the +CGDCONT command, the +CGQREQ command is effectively an extension of the +CGDCONT command. The QoS profile consists of a number of parameters, each of which may be set to a separate value. A special form of the Set command, +CGQREQ= <cid>, causes the requested profile for context number <cid> to become undefined.
Read	**AT+CGQREQ?**	**+CGQREQ: <cid>, <precedence>, <delay>, <reliability>, <peak>, <mean>** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the current settings for each defined context.
Test	**AT+CGQREQ=?**	**+CGQREQ: <PDP_type>, (list of supported <precedence>s), (list of supported <delay>s), (list of supported <reliability>s), (list of supported <peak>s), (list of supported <mean>s)** **OK** **or:** **+CME ERROR: <err>**	The Test command returns values supported as a compound value. If the ME supports several PDP types, the parameter value ranges for each PDP type are returned on a separate line.

The following table shows the +CGQREQ parameters.

Table 3-148: +CGQREQ Parameters

<Parameter>	Description
<cid>	A numeric parameter that specifies a particular PDP context definition. The value is from 1 to 3.
<precedence>	A numeric parameter that specifies the precedence class.
<delay>	A numeric parameter that specifies the delay class.
<reliability>	A numeric parameter that specifies the reliability class.
<peak>	A numeric parameter that specifies the peak throughput class.
<mean>	A numeric parameter that specifies the mean throughput class.

Example

```
AT+CGQREQ=?
+CGQREQ: ("IP"),(0-3),(0-4),(0-5),(0-9),(0-18,31)
OK
AT+CGQREQ?
+CGQREQ: 1,2,4,3,9,10
+CGQREQ: 2,2,4,3,9,10
+CGQREQ: 3,2,4,3,9,10
OK
AT+CGQREQ=1,0,,0,0,0
OK
AT+CGQREQ?
+CGQREQ: 1,0,4,0,0,0
+CGQREQ: 2,2,4,3,9,10
+CGQREQ: 3,2,4,3,9,10
OK
```

+CGATT, GPRS Attach or Detach

This command attaches/detaches the ME to/from the GPRS service. When the command has completed, the ME remains in V.25ter command state. If the ME is already in the requested state, the command is ignored and the OK response is returned. If the requested state cannot be achieved, an ERROR or +CME ERROR response is returned. Extended error responses are

enabled by the +CMEE command. Any active PDP contexts will be automatically deactivated when the attachment state changes to detached.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CGATT= [<state>]**	**OK** **or:** **+CME ERROR: <err>**	The Set command attaches/detaches the ME to/from the GPRS service.
Read	**AT+CGATT?**	**+CGATT: <state>** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the current GPRS service state.
Test	**AT+CGATT=?**	**+CGATT: (list of supported <state>s)** **OK** **or:** **+CME ERROR: <err>**	The Test command requests information on the supported GPRS service states.

Note: This command has the characteristics of both the V.25ter action and parameter commands. Therefore, it has the Read form in addition to the Execution/Set and Test forms.

The following table shows the +CGATT parameters.

Table 3-149: +CGATT Parameters

<Parameter>	Description
<state>	Indicates the state of the GPRS attachment: 0 Detached. 1 Attached.

Example

AT+CGATT=?
+CGATT: (0,1)
OK
AT+CGATT?
+CGATT: 0
OK
AT+CGATT=0
OK

D*99, Request GPRS Service "D"

This command enables the ME to perform the actions necessary for establishing communication between the terminal and the external Packet Data Network (PDN).

The ITU V.25ter 'D' (Dial) command causes the ME to enter the ITU V.25ter Online Data state and together with the terminal, to start the specified layer 2 protocol. The ME returns CONNECT to confirm acceptance of the command prior to entering the ITU V.25ter Online Data state. No further commands may follow on the AT command line.

The detailed behavior after the Online Data state has been entered is dependent on the PDP type, and is described briefly. GPRS attachment and PDP context activation procedures may take place prior to, or during the PDP startup if they have not already been performed using the +CGATT and +CGACT commands.

When the layer 2 protocols have terminated, either as a result of an orderly shut down of the PDP or an error, the ME enters the ITU V.25ter command state and returns the NO CARRIER final result code.

If <called address> is supported and provided, the ME automatically sets up a virtual call to the specified address after the PDP context has been activated.

If <L2P> and <cid> are supported, the +CGDCONT, +CGQREQ and other such commands may then be used in the modem initialization AT command string to set values for PDP type, APN, QoS and so on.

If <L2P> is not supported, or is supported but omitted, the ME uses a layer 2 protocol appropriate to the PDP type.

If <cid> is not supported, or is supported but omitted, the ME attempts to activate the context using one of the following:

- Any information provided by the terminal during the PDP startup procedure. For example, the terminal may provide a PDP type and/or PDP address to the ME.
- A prior knowledge, for example, the ME may implement only one PDP type.

Using the "Empty PDP type" No PDP address or APN is sent in this case and only one PDP context subscription record is present in the HLR for this subscriber.

This command may be used in both normal and modem compatibility modes.

Command Type	Syntax	Response/Action
Set	**ATD*<GPRS_SC>[* [<called_address>][*[<L2P>] [*[<cid>]]]]#**	**CONNECT or: ERROR**

The following table shows the D*99 parameters.

Table 3-150: D*99 Parameters

<Parameter>	Description
<GPRS_SC> (GPRS Service Code)	Digit string (value 99) which identifies a request to use GPRS.
<called_address>	String that identifies the called party in the address space applicable to the PDP. For communications software that does not support arbitrary characters in the dial string, a numeric equivalent may be used. Also, the comma character "," may be used as a substitute for the period character ".". For PDP type OSP:IHOSS, the following syntax may be used for <called_address>:[<host>][@[<port>][@ [<protocol>]]] where <host>, <port> and <protocol> are defined in "+CGDCONT, Define PDP Context" on page 3-216. For communications software that does not support arbitrary characters in the dial string, a numeric value equivalent to the hostname may be used. However, this should be avoided if at all possible.
<L2P>	String variable which indicates the layer 2 protocol to be used. For communications software that does not support arbitrary characters in the dial string, the following numeric equivalents are used: 0 NULL 1 PPP 2 PAD 3 X25 9 yyyy M-xxxx Other values are reserved and result in an ERROR response to the Set command. Note: V.250 (and certain communications software) do not permit arbitrary characters in the dial string. The <L2P> and <called_address> strings are therefore specified as containing digits (0-9) only.
<cid>:	Digit string which specifies a particular PDP context definition (See "+CGDCONT, Define PDP Context" on page 3-216).

Example

ATD*99//Try connecting to GPRS according to the first <cid>, defined in +CGDCONT

+CGPRS, GPRS Coverage

This command indicates whether there is GPRS coverage.

Note: GPRS/EDGE coverage will be detected only when SIM has GPRS ability.

Command Type	Syntax	Response/Action	Remarks
Execute	**AT+CGPRS**	**+CGPRS: <mode>** **OK** **or:** **+CME ERROR: <err>**	The Execute command returns the mode of the GPRS coverage.
Read	**AT+CGPRS?**	**+CGPRS: <mode>** **OK** **or:** **+CME ERROR: <err>**	The Read command returns the mode of the GPRS coverage

The following table shows the +GPRS parameters.

Table 3-151: +GPRS Parameters

<Parameter>	Description
<mode>	0 No GPRS coverage 1 GPRS coverage 2 EDGE coverage There is no parameter default value

Example

Without GPRS coverage
AT+CGPRS
+CGPRS: 0
OK
AT+CGPRS?
+CGPRS: 0
OK
With GPRS coverage
AT+CGPRS
+CGPRS: 1
OK

+CGACT, PDP Context Activate or Deactivate

This command activates/deactivates the specified PDP context(s).

Command Type	Syntax	Response/Action	Remarks
Set	**AT+CGACT=[<state> [,<cid> [,<cid>[,]]]]**	**OK** **or:** **NO CARRIER** **or:** **+CME ERROR: <err>**	The Set command activates/deactivates the specified PDP context(s). When the command is completed, the ME remains in V.25 command state. If any PDP context is already in the requested state, the state for that context remains unchanged. If the requested state for any specified context cannot be achieved, an ERROR or +CME ERROR response is returned. Extended error responses are enabled by the +CMEE command. If the ME is not GPRS-attached when the activation form of the command is executed, the ME first performs a GPRS attach and them attempts to activate the specified contexts. If the attach fails, the ME responds with an ERROR or, if extended error responses are enabled, with the appropriate failure-to-attach error message.
Read	**AT+CGACT?**	**+CGACT: <cid>, <state>** **<CR><LF>+CGACT: <cid>, <state>** **<CR><LF>+CGACT: <cid>, <state>** **OK**	The Read command returns the current activation states for all the defined PDP contexts.
Test	**AT+CGACT=?**	**+CGACT: (list of supported <state>s)** **OK** **or:** **+CME ERROR: <err>**	The Test command requests informaton on the supported PDP context activation states.

The following table shows the +CGACT parameters.

Table 3-152: +CGACT Parameters

<Parameter>	Description
<state>	Indicates the activation state of the context: 0 Non-active 1 Active
<cid>	1-3 A numeric parameter that specifies a particular PDP context definition

Example

AT+CGACT=?
+CGACT: (0,1)
OK
AT+CGACT?
+CGACT: 1,0
+CGACT: 2,0
+CGACT: 3,0
OK
AT+CGACT=1
ERROR//GPRS network not present.

Note: In some GPRS networks, +CGACT is not supported. the ATD*99 # command can be used to establish a connection.
Activating a context can take up to 150 seconds.
Deactivating a context can take up to 40 seconds.
When aborting a +CGACT Set command, the context is closed. This can take up to 40 seconds.

TCP/IP

+MIPCALL, Create a Wireless Link

This command sets up a PPP (Point to Point Protocol) connection with the GGSN (Gate GPRS Support Node), and returns a valid dynamic IP for the G24.

Note: The DCD line changes only to reflect the state change from command mode to data mode.

Command Type	Syntax	Response/Action
Set	**+MIPCALL= <Operation> [<APN>, [<User name>, <Password>]]**	OK +MIPCALL: <"local IP address"> or: ERROR: <err> **+MIPCALL: 0**
Read	**+MIPCALL?**	**+MIPCALL: <status>[,<IP>]**
Test	**+MIPCALL=?**	**+MIPCALL: (list of supported <operation>s)**

Note: The +MIPCALL command does not return the prompt to the terminal until it the IP is received from the provider, or time out has occurred, therefore, no other commands can be issued in the meantime.

The +MIPCALL command does not have a general ABORT mechanism, therefore a command cannot be issued until the previous command ends.

Note: When a call exists the dynamic IP address will be returned.
For example:
AT+MIPCALL?
+MIPCALL: 1,"172.17.237.80"

The following table shows the +MIPCALL parameters.

Table 3-153: +MIPCALL Parameters

<Parameter>	Description
<status>	0 Disconnect 1 Connected
"APN"	APN of service provider (in quotation marks). Contact your service provider for details.
"User name"	User name in provider server (in quotation marks). Contact your service provider for details.
"Password"	Password for provider server (in quotation marks). Contact your service provider for details.
Local IP-address	IP address given by server after PPP negotiation.

Example

at+MIPCALL=1,"internet","User1","Pswd"//Connecting the provider 'Orange' and getting an IP
+MIPCALL: "123.145.167.230"
at+MIPCALL=0//The terminal hangs up the link
OK

+MIPOPEN, Open a Socket (UDP or TCP)

This command causes the G24 to initialize a new socket and open a connection with a remote side. Each socket allocates an accumulating buffer whose size is 1372 bytes.

Note: The +MIPOPEN command returns a +MIPSTAT unsolicited event if it fails, for example, if it was rejected by the remote side.

MIPxxx is a complete set of GPRS commands. This set should not be used with other GPRS commands, such as CGATT, CGACT, and so on.

Command Type	Syntax	Response/Action	Remarks
Set	**+MIPOPEN=<Socket ID>,<Source Port>,<"Destination IP">,<Destination Port>, <Protocol>**	**OK** **+MIPOPEN: <Socket ID>,<State>** **or:** **ERROR: <err>**	
Read	**+MIPOPEN?**	**+MIPOPEN:[<SocketID>]** **for each socket that can be opened** **or:** **+MIPOPEN 0** **if there are no free sockets.**	The Read command returns the numbers of the sockets that can be opened.
Test	**+MIPOPEN=?**	**+MIPOPEN: (list of supported <socket ID>s),(list of supported <source port>s),(list of supported<"Destination IP">s), (list of <destination port>s),(list of supported <protocol>s)**	

Example

+MIPOPEN: 1 2 3 4//All sockets closed
+MIPOPEN: 1 3 4 //Socket 2 opened

The following table shows the +MIPOPEN parameters.

Table 3-154: +MIPOPEN Parameters

<Parameter>	Description
Socket ID	A unique number that identifies a connection (provided by the terminal application). 0 Invalid socket number 1,2,3,4 Valid socket number
Source Port	Port of source site. Port range: 0-65535 (decimal digits)
"Destination IP"	IP of the destination site in the format "AAA.BBB.CCC.DDD". The range of each octant is 0-255. The value can be written in 1, 2, or 3 digits.
Destination Port	Port of destination site. Port range: 0-65535 (decimal digits)
Protocol	Type of protocol stack. 0 TCP 1 UDP
State	State of socket or error indication. 0 Inactive 1 Active

Note: Motorola does not recommend using port numbers below 1024. These numbers are defined to be reserved for operating systems.

Example

at+MIPOPEN=1,1200,"123.245.213.012",1234,0//Opening socket 1, using TCP protocol, from port 1200, targeting 123.245.213.012 port 1234

+MIPOPEN=2,1300,"123.133.074.192",1242,1//Opening socket 2, using UDP protocol, from port 1300, targeting 123.133.074.192 port 1242

at+MIPOPEN=1,1222,"123.245.213.012",1234,0//Opening socket 1, using TCP protocol, from port 1222, targeting 123.245.213.012 port 1234

at+MIPOPEN: //Invalid command

ERROR

at+MIPOPEN? //Terminal checking the free sockets

+MIPOPEN: 3 4

OK

+MIPCLOSE, Close a Socket

This command causes the G24 to free the socket accumulating buffer and to close the socket.

Note: All data stored in the accumulating buffer will be lost. Refer to "+MIPSETS, Set Size for Automatic Push" on page 3-232 and "+MIPPUSH, Push Data into Protocol Stack" on page 3-234.

Command Type	Syntax	Response/Action
Set	**+MIPCLOSE = <Socket ID>**	**OK** **+MIPCLOSE: <Socket ID>[,< number_of_acknowledged_bytes >]** **or:** **ERROR**
Read	**+MIPCLOSE?**	**+MIPCLOSE 1234** **+MIPCLOSE: [<socket ID>] - for all ACTIVE sockets.**
Test	**+MIPCLOSE=?**	**+MIPCLOSE 1234** **+MIPCLOSE: [<socket ID>] - for all ACTIVE sockets.**

The following table shows the +MIPCLOSE parameters.

Table 3-155: +MIPCLOSE Parameters

<Parameter>	Description
Socket ID	Unique number that identifies a connection: Valid socket numbers are: 1,2,3,4
<number_of_acknowledged_bytes >	Total number of bytes that were acknowledged

Example

```
at+MIPCLOSE=1//The terminal closes the opened socket
OK
at+MIPCLOSE=2 //The terminal closes the socket that wasn't opened
ERROR
at+mipclose?//Sockets 1 and 2 are opened
+MIPCLOSE: 1 2
at+mipclose? //No opened sockets
+MIPCLOSE: 0
```

+MIPSETS, Set Size for Automatic Push

This command causes the G24 to set a watermark in the accumulating buffer. When the watermark is reached, data is pushed from the accumulating buffer into the protocol stack.

Data chunks between the terminal and the G24 are limited to be smaller than 80 characters (160 characters in coded form). In order to reduce the overhead of sending small amounts of data over the air, the G24 uses an accumulating buffer. The terminal can specify a watermark within the accumulating buffer size limits to indicate how much data should be accumulated. When the data in the accumulating buffer exceeds the watermark, only data equal to the watermark is sent. Data remaining in the buffer is sent with the next packet.

Note: If there is data in the accumulating buffer, the +MIPSETS command will be rejected.

Command Type	Syntax	Response/Action
Set	**+MIPSETS= <Socket ID>,<Size>**	**OK** **or:** **ERROR** **+MIPSETS: <err>**
Read	**+MIPSETS?**	**+MIPSETS: [<SocketID>,<Current Size Settings>]** **For all ACTIVE sockets.**
Test	**+MIPSETS=?**	**+MIPSETS: (1-4),(list of supported <size>s)**

The following table shows the +MIPSETS parameters.

Table 3-156: +MIPSETS Parameters

<Parameter>	Description
Size	Size of the buffer 1 < size ≤ 1372 The default value is 1372.
Extended err	3 Operation not allowed

Example

at+MIPSETS=1,340//Asks the G24 to accumulate 340 bytes on socket 1 prior to sending (socket should be activated by the +mipopen command)

+MIPSETS: 0

OK

at+MIPSETS=1,200//Asks the G24 to accumulate 200 bytes on socket 1 prior to sending (socket should be activated by the +mipopen command)

+MIPSETS: 0

OK

at+MIPSETS=2,400//Asks the G24 to accumulate 400 bytes on socket 2 prior to sending

+MIPSETS: 0

OK

at+mipsets=?

+MIPSETS: (1-4),(1-1372)
OK
at+mipsets?
+MIPSETS: 1,100//Information provided only for active sockets
+MIPSETS: 2,1372//Information provided only for active sockets
OK

+MIPSEND, Send Data

This command causes the G24 to store the data that the terminal provides in the accumulating buffer, and then send this data using an existing protocol stack when the amount of data reaches the predefined amount (see "+MIPSETS, Set Size for Automatic Push" on page 3-232). Before sending data, a valid connection must be created using the +MIPCALL and +MIPOPEN commands.

Motorola recommends that the terminal sets the watermark in the accumulating buffer prior to this command, using the +MIPSETS command. By default, the watermark is set to 1372 bytes of data.

Command Type	Syntax	Response/Action	Remarks
Set	**+MIPSEND = <Socket ID>,<Data>**	**ERROR** **+MIPSEND: <Socket ID>,<Status>,<Free Size>**	Data in the +MIPSEND command is limited to 80 characters (160 in coded form). <Status>: 0 - Success 1 - Socket is flowed off
Read	**+MIPSEND?**	**+MIPSEND <Socket ID>,<Free Size>>[<Socket ID> <Free Size>]<CR><LF>** **For all ACTIVE sockets.**	
Test	**+MIPSEND=?**	**ERROR**	

The following table shows the +MIPSEND parameters.

Table 3-157: +MIPSEND Parameters

<Parameter>	Description
<socket ID>	1,2,3,4 Number of valid socket
<Free Size>	Free space in current buffer. Free size is calculated from the 1372. 0 < Free Size < 1372
<Data>	User data string is sent encoded with 0-F hexadecimal digits (String ends with a <CR>)

Example

(Socket 4 was not opened using +MIPOPEN AT command)
at+mipsend=4,"4444"
ERROR
at+mipsend=1,"4444"
+MIPSEND: 1,1370//1372- 2 chars 'DD' = 1370
OK
at+mipsend=?
ERROR
at+mipsend?
+MIPSEND: 1,1372 //Sockets 1 and 2 were opened using + MIPOPEN AT command
+MIPSEND: 2,1372 //Sockets 1 and 2 were opened using + MIPOPEN AT command
OK

+MIPPUSH, Push Data into Protocol Stack

This command causes the G24 to push the data accumulated in its accumulating buffers into the protocol stack. It is assumed that before using this command, some data should exist due to previous +MIPSEND commands.

Command Type	Syntax	Response/Action	Remarks
Set	**+MIPPUSH = <Socket ID>[,<"Destination IP">,<Destination Port>]**	**+MIPPUSH: <Socket_ID>,<Status>[,<accumulated_sent_length>]** **OK** **Or:** **ERROR**	Optional parameters are used only for UDP connections. If the Destination IP and Destination Port are not provided by the user, a datagram is sent to the last target (or the default target provided by the +MIPOPEN command). <accumulated_sent_length> - this parameter counts how many bytes were sent to the remote side by the G24 TCP/IP stack. When user open socket, <accumulated_sent_length> initialized to zero. Size of <accumulated_sent_length> is four octets unsigned digit (0-4294967295). <Status>: 0 - Success 1 - socket is flowed off 2 - there is no data in socket to send
Read	**+MIPPUSH?**	**MIPPUSH:[<socket ID>]**	
Test	**+MIPPUSH=?**	**MIPPUSH=<socket ID>,<IP>,<Port>**	

The following table shows the +MIPPUSH parameters.

Table 3-158: +MIPPUSH Parameters

<Parameter>	Description
Socket ID	1,2,3,4Number of valid socket
Destination IP	IP of destination site in the format AAA.BBB.CCC.DDD. The value can be written in 1, 2 or 3 digits.
Destination Port	0-65535Port of destination site. Written in decimal digits.

Example

at+MIPPUSH=1 //Terminal asks the G24 to flush the buffer in socket 1 (was opened using the +MIPOPEN command)
+MIPPUSH: 0
OK

+MIPFLUSH, Flush Data from Buffers

This command causes the G24 to flush (delete) data accumulated in its accumulating buffers.

Command Type	Syntax	Response/Action
Set	**+MIPFLUSH = <Socket ID>**	**ERROR** **or:** **+MIPFLUSH: <Socket ID>** **OK**
Read	**+MIPFLUSH?**	**+MIPFLUSH:[<socket ID>]**
Test	**+MIPFLUSH=?**	**+MIPFLUSH=(<Socket ID>)**

The following table shows the +MIPFLUSH parameters.

Table 3-159: +MIPFLUSH Parameters

<Parameter>	Description
Socket ID	1,2,3,4 - Number of valid sockets

Example

```
at+mipflush=2//Socket number 2 was previously opened using the +MIPOPEN command
+MIPFLUSH: 2
OK
at+mipflush=5
ERROR
at+mipflush?
+MIPFLUSH: 1 2
OK
```

+MIPRUDP, Receive Data from UDP Protocol Stack

This unsolicited event is sent by the G24 to the terminal when data is received from the UDP protocol stack.

Set Command Event

+MIPRUDP:<Source IP>,<Source Port><socket ID>,<Left>,<Data>

The following table shows the +MIPRUDP parameters.

Table 3-160: +MIPRUDP Parameters

<Parameter>	Description
Source IP	IP of the source
Source Port	Port of the source
Socket ID	1,2,3,4 - Number of valid sockets.
Left	Size of received Data still left in protocol stack.
Data	Data string received with 0-F hexadecimal digits. String ends with a <CR>.

Example

```
+MIPRUDP: 172.16.3.135,222,2,0,44444444
```

+MIPRTCP, Receive Data from TCP Protocol Stack

This unsolicited event is sent by the G24 to the terminal when data is received from the TCP protocol stack.

Set Command Event

+MIPRTCP: <socket ID>,<Left>,<Data>

The following table shows the +MIPRTCP parameters.

Table 3-161: +MIPRTCP Parameters

<Parameter>	Description
Socket ID	1,2,3,4 - Number of valid sockets.
Left	Size of received Data still left in protocol stack.
Data	Data string received with 0-F hexadecimal digits. String ends with a <CR>.

Example

+MIPRTCP: 3,0,7171

+MIPSTAT, Status Report

This unsolicited event is sent to the terminal indicating a change in status. Currently there are two possible sources of failure, a broken logical connection or a broken physical connection.

Syntax

+MIPSTAT: <socket_ID>,<n>[,<number_of_acknowledged_bytes >]

The following table shows the MIPSTAT parameters.

Table 3-162: MIPSTAT Parameters

<Parameter>	Description
<n>	0 - ACK indication 1 - Broken protocol stack.
<number_of_acknowledged_bytes >	Total number of bytes that were acknowledged

Example

+MIPSTAT: 1,2

MIPXOFF, Flow Control - Xoff

This command is the unsolicited response that the G24 sends to the terminal to stop sending data when it does not have enough memory to process new +MIPSEND requests. The G24 uses the accumulating buffer prior to pushing data into the protocol stack. This memory resource is protected by a Xoff_upper watermark.

Event

+MIPXOFF: <Socket ID>

Example

+MIPXOFF: //The G24 detects that the accumulating buffer 1 has reached its Xoff watermark.

From this point, the terminal is not allowed to send data, until it receives the +MIPXON command.

MIPXON, Flow Control - Xon

This command is the unsolicited event that the G24 sends to the terminal when it detects that it has free memory in the accumulating buffer and can process new +MIPSEND requests, after the +MIPXOFF event.

Event

+MIPXON: <Socket ID>

Example

+MIPXON: 1 //The G24 pushed the data into the protocol stack on socket 1 and is able to handle more data from the terminal.

MIPCONF - Configure Internal TCP/IP stack

This command allows to configure TCP stack parameters, such as retransmissions number, upper and bottom limits of retransmission timeout, close delay. It can be used to configure TCP socket parameters before socket activation or when the socket is in active state. Configuration values will be stored in G24 until power circle.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+MIPCONF=<socket>[,[<retr_num>],[<min_TO>],[<max_TO>],[<max_close_delay>][,<is_nack_ind_req>]]**	**OK** **or:** **+CME ERROR: <err>**	The Set updates TCP stack configuration parameters.

Command Type	Syntax	Response/Action	Remarks
Read	**+MIPCONF?**	**+MIPCONF: 1,<retr_num>,<min_TO>,<max_TO>, <max_close_delay>,<is_nack_ind_req> <CR><LF>** **+MIPCONF: 2,<retr_num>,<min_TO>,<max_TO>, <max_close_delay>,<is_nack_ind_req> <CR><LF>** **+MIPCONF: 3,<retr_num>,<min_TO>,<max_TO>, <max_close_delay>,<is_nack_ind_req> <CR><LF>** **+MIPCONF: 4,<retr_num>,<min_TO>,<max_TO>, <max_close_delay>,<is_nack_ind_req>**	he read command returns current settings of TCP stack parameters.
Test	**+MIPCONF=?**	**+MIPCONF: (1-4),(1-5),(1-10),(10-600),(1-75),(0-2)**	The Test command returns the possible parameters values. Time values can be inserted with resolution of 100 milliseconds.

Table 3-163: +MIPCONF Parameters

Parameter	Description
< socket >	Number of configured TCP socket (1 to 4)
< retr_num >	Number of retransmissions (1 to 5)
< min_TO >	Bottom limit to retransmit timeout (100 ms to 1 sec.)
<max_TO>	Upper limit to retransmit timeout (1 sec. to 60 sec.)
<max_close_delay>	Closing delay required by RFC 793 (100 ms to 7500 ms)
<is_nack_ind_req>	NACK/ACK TCP indication feature. Activating this parameter enables G24 to report the user, in case of losing a TCP connection, what data was received by the remote TCP layer. 0 - feature inactive. 1 - NACK indication active. 2 - ACK indication active. • Power Up - 0 • Default value - previously set value This parameter resets after power cycle.

Example

at+mipconf=2,5,10,600,75,2

OK

at+mipopen=2,0,"66.249.87.99",80,0

OK

+MIPOPEN: 2,1

at+mipsets=2,10

+MIPSETS: 0

OK

at+mipsend=2,"474554202F20485454502F312E300D0A486F73743A207777772E676F6F676C652E636F6D0D0A0D0A"

+MIPPUSH: 2,0,40

+MIPSEND: 2,0,1372

OK

+MIPXOFF: 2

at+mipsend=2,"474554202F20485454502F312E300D0A486F73743A207777772E676F6F676C652E636F6D0D0A0D0A"

+MIPSEND: 2,1,1372

OK

+MIPSTAT: 2,0,30

+MIPXON: 2

+MIPSTAT: 2,0,40

+MIPRTCP: 2,530,485454502F312E312033303220466F756E640D0A4C6F636174696F6E3A206874

74703A2F2F7777772E676F6F676C652E636F2E696C2F63786665723F633D505245462533443A544D2533443131313935

+MIPRTCP: 2,450,31343833323A5325334467384A637631426A5458472D30636A5926707265763D

2F0D0A5365742D436F6F6B69653A20505245463D49443D3639303762623837353138626632333373A43523D313A544D3D

+MIPRTCP: 2,370,3131313935313433833323A4C4D3D3131313935313433833323A533D644F656476

7A6C34765F7059475A384A3B20657870697265733D53756E2C2031372D4A616E2D323033382031393A31343A30372047

+MIPRTCP: 2,290,4D543B20706174683D2F3B20646F6D61696E3D2E676F6F676C652E636F6D0D0A436F6E74656E742D547970653A20746578742F68746D6C0D0A5365727665723A204757532F322E310D0A436F6E74656E

+MIPRTCP: 2,210,742D4C656E6774683A203231370D0A446174653A205468752C203233204A756E20323030352030383A32303A333220474D540D0A436F6E6E656374696F6E3A20636C6F73650D0A0D0A3C48544D4C3E3C

+MIPRTCP: 2,130,484541443E3C5449544C453E333032204D6F7665643C2F5449544C453E3C2F484541443E3C424F44593E0A3C48313E333032204D6F7665643C2F48313E0A54686520646F63756D656E7420686173206D

+MIPRTCP: 2,50,6F7665640A3C4120485245463D22687474703A2F2F7777772E676F6F676C652E636F2E696C2F63786665723F633D505245462533443A544D25334431313139353134383323A5325334467384A637631

+MIPRTCP: 2,0,426A5458472D30636A5926616D703B707265763D2F223E686572653C2F413E2E0D0A3C2F424F44593E3C2F48544D4C3E0D0A

+MIPSTAT: 2,1,40

NOP - Compatible

IGNORED (Compatible Only) Commands

The following commands return OK, but do not execute any operation. They are only used to provide backward compatibility.

Command	Description
F	Selects the line modulation standard
L	Monitors the speaker loudness
M	Monitors the speaker mode
N	Enables auto mode
P	Selects pulse dialing
T	Selects tone dialing
W	Wait for dial tone
Y	Disconnects on long space
&G	Selects the guard tone
&J	Jack type selection
&L	Leased line operation
&M	Asynch/synch mode connection
&P	Selects pulse dialing
&Q	Communications mode options
&R	Selects the CTC controls
&S	Defines the DSR behavior
&T	Selects tone dialing
\A	Sets the maximum MNP block size
\G	Sets the use of the Xon/Xoff flow control
\J	Adjusts the terminal auto rate
\K	This command is supported for backward compatibility only, and has no effect.
\N	Displays the link type
%C	Enables/disables data compression
\B	Transmits break to remote
\K	Breaks control
+CBAND	Changes band frequencies

Fax Class 1

Facsimile machines were developed for sending digitized documents over the General Switched Telephone Network (GSTN) These facsimile terminals are in widespread use around the world. The operation of facsimile terminals has been standardized in Recommendations T.4, T.6 and T.30. The cellular network also supports the facsimile service within the cellular network and also with the GSTN network. The G24 is configured as an external "facsimile DCE", connected to the terminal by a standard serial port (for example, Recommendation V.24), using serial data interchange. The G24 supports Fax Class 1, with a few exceptions, marked as "Not supported" in the table below. The SW flow control is mandatory (using the DC1/ DC3 characters). (ITU - T.31section 5.3)

The following table shows the Fax Class 1 command summary.

Command	Description
+FCLASS	Selects, reads or tests the Service Class (Note 1)
+FTS = <Time>	Stops/Pauses the transmission
+FRS = <Time>	Waits for silence
+FTM = <MOD>	Transmits data with <MOD> carrier
+FRM = <MOD>	Receives data with <MOD> carrier
+FTH = <MOD>	Transmits HDLC data with <MOD> carrier
+FRH = <MOD>	Receives HDLC data with <MOD> carrier
+FAR = <off/on>	Adaptive reception control
+FCL = <time>	Carrier loss timeout
+FDD = <value>	Double escape character replacement control
+FIT = <time>, <action>	Terminal inactivity timeout
+GMI?	Reports manufacturer ID
+GMM?	Reports model ID
+GMR?	Reports revision ID
+IFC	Local terminal-G24 flow control
+IPR	Local terminal-G24 serial port rate
A	Answers
D <string>	Dials
H	Hangs up
+FPR	Sets the request baud rate.

Fax Commands

+FCLASS, Select Mode

The G24 facsimile service maintains a parameter for identification and control of facsimile services, "+FCLASS". When the terminal wants to establish a FAX connection, it must set the G24 to Service Class 1 operation prior to answering or originating a call. This is done by setting +FCLASS = 1.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+FCLASS=<n>**	**OK** **(Puts the G24 into a particular mode of operation.)** **+CME ERROR: <err>**	The Set command sets the G24 facsimile service class from the available choices.
Read	**AT+FCLASS?**	**+FCLASS: <n>** **OK** **+CME ERROR: <err>**	The Read command reads the current service class setting of the G24.
Test	**AT+FCLASS=?**	**(list of supported <n>s)** **OK** **+CME ERROR: <err>**	The Test command returns a list of service classes available from the G24.

The following table shows the +FCLASS parameters.

Table 3-164: +FCLASS Parameters

<Parameter>		Description
<n>	0	Data modem (for example, Recommendation V.25 ter)
	1	Service Class 1 fax

Example

AT+FCLASS=?
+FCLASS: 0,1
OK
AT+FCLASS?
+FCLASS: 0
OK
AT+FCLASS=1
OK

+FTS, Transmit Silence

This command causes the G24 to stop any transmission. The G24 then waits for the specified amount of time, and sends the OK result code to the terminal.

Command Type	Syntax	Response/Action	Remarks
Set	**AT+FTS = <Time>**	**OK** **or:** **+CME ERROR: <err>**	The Set command causes the terminal to stop any transmission.

The following table shows the +FTS parameters.

Table 3-165: +FTS Parameters

<Parameter>	Description
<Time>	The time the terminal waits, in 10 millisecond intervals 0-255 Number of milliseconds

Example

```
At+fclass=1
OK
Atd035658584
CONNECT 9600
OK
AT+FTS=20
OK
```

+FRS, Receive Silence

This command causes the G24 to wait for silence and to report back an OK result code when silence has been present on the line for the specified amount of time. The command terminates when the required amount of silence on the line is detected or when the terminal sends the G24 a character other than <DC1> (11h) or <DC3> (13h), which is discarded. In either event, the OK result code is returned to the terminal.

Command Type	Syntax	Response/Action	Remarks
Set	**+FRS = <Time>**	**OK** **or:** **+CME ERROR: <err>**	The Set command specifies the amount of time the line must be silent.

The following table shows the +FRS parameters.

Table 3-166: +FRS Parameters

<Parameter>	Description
<Time>	The duration of the silence, in 10 millisecond intervals. 0-255 Number of milliseconds.

Example

At+fclass=1
OK
Atd035658584
CONNECT 9600
OK
At+frs=50
OK //The G24 sends the OK after silence for 10*50 milliseconds

+FTM, Transmit Data

This command causes the G24 to transmit data to the remote party using the modulation selected in <MOD>. The G24 sends the data stream received from the terminal without any framing.

Transmission Using the Transparent Data Command

The DLE character, (0x10), is used as a special character to precede command characters. The character pairs <DLE><command> are used to convey commands or status information between the terminal and the G24.

- Terminal to G24 streams (Encoding)
  - When the terminal needs to send a <DLE> character in the data stream, it sends two sequential <DLE> characters to the G24.
  - When the terminal needs to send two sequential <DLE> characters in the data stream, it sends the <DLE><SUB> characters instead.
  - When the terminal sends the terminator sequence <DLE> <ETX>, the data stream is terminated.
- G24 to terminal streams (Decoding):
  - The terminal decodes the input stream and removes all character pairs beginning with <DLE>.
  - The terminal recognizes <DLE><ETX> as the data stream terminator.
  - The terminal recognizes and replaces <DLE><DLE> by a single <DLE> in the data stream.
  - The terminal recognizes and replaces <DLE><SUB> by a single <DLE><DLE> in the data stream.

When the G24 receives the +FTM command, it immediately returns an OK result code. When the terminal receives the OK from the G24, it can start sending the data stream using the transparent

data command encoding. When the G24 decodes the terminating sequence, it returns a CONNECT.

Command Type	Syntax	Response/Action	Remarks
Set	**+FTM = <MOD>**	**OK** **or:** **+CME ERROR: <err>**	The Set command causes the G24 to transmit data using the modulation selected in <MOD>.
Test	**+FTM=?**	**(list of supported <MOD>s)** **OK** **or:** **+CME ERROR: <err>**	

The following table shows the command modulation select codes.

Table 3-167: Command Modulation Select Codes - Modulation Parameters

<MOD> Value	Modulation	TrainTime	Rate (bit/s)	Required
24	Rec. V.27 ter		2 400	
48	Rec. V.27 ter		4 800	
72	Rec. V.29		7 200	
96	Rec. V.29		9 600	

Example

AT+FCLASS=1
OK
ATD035658584
CONNECT 19200
AT+FRH=3
OK
CONNECT 19200
AT+FTH=3
OK
(The terminal sends DATA. The G24 decodes and packs it into the HDLC frame and sends it to the remote party)
CONNECT 19200 //G24 detected termination sequence <DLE><DTX>.
AT+FTM=?
+FTM: 24,48,72,96
OK
AT+FTM=96//Terminal selected mode 96
CONNECT 19200
(Terminal sends data stream encoded of the fax document)
OK//G24 detected termination sequence <DLE><DTX>.

+FRM, Receive Data

This command causes the G24 to receive data from the remote party using the modulation specified in <MOD>.

When the G24 receives the +FRM command it immediately returns a CONNECT result code. When the terminal receives the CONNECT from G24, it can start receiving the data stream using the transparent data command decoding. (Refer to Table 3-167, on page 3-246.)

When the G24 receives the +FRM command, it checks the line for a carrier. If the G24 detects a carrier, it sends a CONNECT to the terminal, and starts receiving the fax page.

Upon data stream termination, the G24 sends the termination sequence to the terminal. Afterwards, if the G24 detects a loss of carrier, it sends a "NO CARRIER", otherwise it sends OK.

Command Type	Syntax	Response/Action	Remarks
Set	**+FRM = <MOD>**	**CONNECT** **Data stream <DLE><ETX>** **OK**	The Set command causes the G24 to enter the receive mode using the modulation specified in <MOD>
Test	**+FRM=?**	**(list of supported <MOD>s)** **OK** **or:** **+CME ERROR: <err>**	

The following table shows the command modulation select codes.

Table 3-168: Command Modulation Select Codes -Modulation Parameters

<MOD> Value	Modulation	TrainTime	Rate (bit/s)	Required
24	Rec. V.27 ter		2 400	
48	Rec. V.27 ter		4 800	
72	Rec. V.29		7 200	
96	Rec. V.29		9 600	

+FTH, Transmit DATA with HDLC Frame

This command causes the G24 to transmit data framed in the HDLC protocol, using the modulation mode selected, to the remote party.

For encoding and decoding information refer to “Transmission Using the Transparent Data Command” on page 3-245.

After the entering active session mode (G24 sent CONNECT to the terminal), the terminal can perform one of the following:

- If the terminal sends additional data, the G24 transmits another frame
- If the terminal sends only <DLE><ETX> (a null frame), the G24 turns off the transmit carrier and sends the CONNECT result code to the terminal
- If five seconds elapses from the time the G24 reports the OK result code without any additional data transmitted from the terminal, the G24 turns off the transmit carrier, returns to command mode, and sends the ERROR result code to the terminal.

Command Type	Syntax	Response/Action	Remarks
Set	**FTH = <MOD> (Send data stream <DLE><ETX>)**	**CONNECT OK or: NO CARRIER**	The Set command causes the G24 to transmit data framed in HDLC protocol using the modulation mode selected.

Note: MOD = 3 (Clause 2/V.21) rate 300 bps, is mandatory.

If the G24 detects a carrier after the FTH command, it sends a CONNECT to the terminal. If not, it sends "NO CARRIER".

The following table shows the command modulation select codes.

Table 3-169: Command Modulation Select Codes - Modulation Parameters

<MOD> Value	Modulation	TrainTime	Rate (bit/s)	Required
24	Rec. V.27 ter		2 400	
48	Rec. V.27 ter		4 800	
72	Rec. V.29		7 200	
96	Rec. V.29		9 600	

Example

AT+FCLASS=1
OK
ATD035658584
CONNECT 19200
AT+FRH=3
CONNECT 19200
(Terminal sends TSI frame data, as described in ITU-T30 with terminating sequence)
CONNECT 19200 //The G24 detected the terminating sequence
(Terminal sends DCS frame data, as described in ITU-T30 with terminating sequence and drops the carrier)
OK

+FRH, Receive DATA with HDLC Frame

This command causes the G24 to receive HDLC framed data using the modulation mode selected in <MOD>, and deliver the next received frame to the terminal.

If the G24 detects the selected carrier with an HDLC flag, the G24 send the CONNECT result code to the terminal, otherwise it sends "NO CARRIER".

The G24 sends the FCS octant to the terminal. The terminal may ignore the FCS.

Upon receipt of the CONNECT from G24, the terminal can start receiving the data stream using the transparent data command decoding. (Refer to "Command Modulation Select Codes - Modulation Parameters" on page 3-246).

After the FCS octets are transferred, the G24 marks the end of the frame with the characters <DLE> <ETX>, and reports the status of the frame reception to the terminal, as follows:

- If the frame was received correctly (FCS is OK), the G24 returns the OK result code.
- If the frame was received in error (FCS is not OK, or carrier lost, or data lost due to data overflow), the G24 returns the ERROR result code, and the terminal should discard the frame.

After the status result code, the G24 accepts new commands from the terminal.

Command Type	Syntax	Response/Action	Remarks
Set	**+FRH = <MOD>**	**CONNECT** **or:** **NO CARRIER**	The Set command causes the G24 to receive HDLC framed data using the modulation mode selected in <MOD>, and deliver the next received frame to the terminal.

Note: MOD = 3 (Clause 2/V.21) rate 300 bps, is mandatory.

+IFC, Terminal-G24 Local Flow Control

This parameter controls the operation of the local flow control between the terminal and the G24 during the data state when V.42 error control is used, or when fallback to non-error control mode is specified to include buffering and flow control. It accepts two numeric subparameters:

- <DCE_by_DTE>: Specifies the method to be used by the terminal to control the flow of received data from the G24.
- <DTE_by_DCE>: Specifies the method to be used by the G24 to control the flow of transmitted data from the terminal.

The implementation of this parameter is mandatory if V.42 error control or Buffered mode is provided in the G24. If not, it is optional. G24s which do not implement circuit 106 and/or circuit 133 do not need to support the value 2 for the corresponding subparameter.

Command Type	Syntax	Response/Action
Set	**AT+IFC=[[<DCE_by_DTE>,[DTE_by_DCE>]]]**	**OK** **+CME ERROR: <err>**
Read	**AT+IFC?**	**+IFC: <DCE_by_DTE>,<DTE_by_DCE>**
Test	**AT+IFC=?**	**+IFC: (list of supported <DCE_by_DTE>s, list of supported <DTE_by_DCE>s)**

The following table shows the <DCE_by_DTE> and <DTE_by_DCE> parameters.

Note: <DCE_by_DTE> and <DTE_by_DCE> of the same value only are supported.

Table 3-170: <DCE_by_DTE> and <DTE_by_DCE> Parameters

<Parameter>	Description
<DCE_by_DTE>	0 None 1 DC1/DC3 on circuit 103. Do not pass DC1/DC3 characters to the remote DCE. 2 Circuit 133 (ready for receiving). 3 DC1/DC3 on circuit 103 with DC1/DC3 characters being passed through to the remote G24 in addition to being acted upon for local flow control. 4-127 Reserved for future standardization. Other Reserved for manufacture-specific use. The default is 2. DC1 is IA5 1/1. DC3 is IA5 1/3.
<DTE_by_DCE>	0 None 1 DC1/DC3 on circuit 104. 2 Circuit 106 (clear to Send/Ready for Sending). 3-127 Reserved for future standardization. Other Reserved for manufacture-specific use. The default is 2. DC1 is IA5 1/1. DC3 is IA5 1/3.

Example

```
AT+IFC=?
+IFC: (0-3),(0-2)
OK
AT+IFC?
+IFC: 2,2
OK
AT+IFC=2,2
OK
```

+FPR, Fax Serial Port Rate

This command sets the request baud rate. +FPR command is implemented as additional syntax to the standard +IPR command in order to inter-work with existing Facsimile DTE.

Command Type	Syntax	Response/Action	Remarks
Set	**+FPR=<n>**	**OK** **or:** **+CME ERROR: <err>**	The set command changes the baud rate of G24 to the requested value. The specified rate takes effect following the issuing of any result code(s) associated with the current command line. The UART is configured to the specific requested baud rate.
Read	**+ FPR?**	**+FPR: <n>** **OK** **Or** **+FPR:255** **OK**	The read command returns the actual baud rate. The Report 255 is output in cases where setting baud rate is not supported by FPR command.
Test	**+ FPR=?**	**+FPR: (list of supported <n>s)** **OK** **or:** **+CME ERROR: <err>**	The test command returns the possible ranges of <n>s.

The following table shows the +FPR parameter.

Table 3-171: +FPR Parameter

<Parameter>		Description
<n>	0	Automatic baudrate
	1	Set baudrate to 2400
	2	Set baudrate to 4800
	4	Set baudrate to 9600
	8	Set baudrate to 19200
	10	Set baudrate to 38400
	18	Set baudrate to 57600
	20	Set baudrate to 115200

Example

Example -
at+fclass=1
OK
at+fpr=8
OK
at+fpr?
+FPR: 8
OK
At+ipr=300
Ok
At+fpr?
+FPR:255
OK
at+ipr?
+IPR: 19200
OK
at+fclass=0
OK
at+ipr?
+IPR: 19200
OK
at+fpr?
+CME ERROR: operation not allowed

at+fpr=?
+CME ERROR: operation not allowed

RS232 Multiplexer Feature

The MUX provides multiple logical communication channels between the DTE and G24 over one physical RS232 connection. This service enables the DTE device to run multiple applications (such as GPRS, CSD, SMS and voice calls) while communicating simultaneously with the G24.

MUX Details

Protocol Versions

3G TS27.010 v.3.3.0 (2000-03)

System Overview

The MUX service in the G24 provides multiple virtual channels for the DTE that can communicate simultaneously with the G24. This service allows the DTE to have channels for command and network indications while other channels are used for data sessions. This service is available when MUX software entities exist on both the DTE and the G24. These MUX entities communicate with each other and provide data connection management, which includes establishment, control, release and data transfer between matching channels in the DTE and G24.

Note: MUX over 232 is a software module. No PCB hardware changes are required at either the G24 or DTE side.

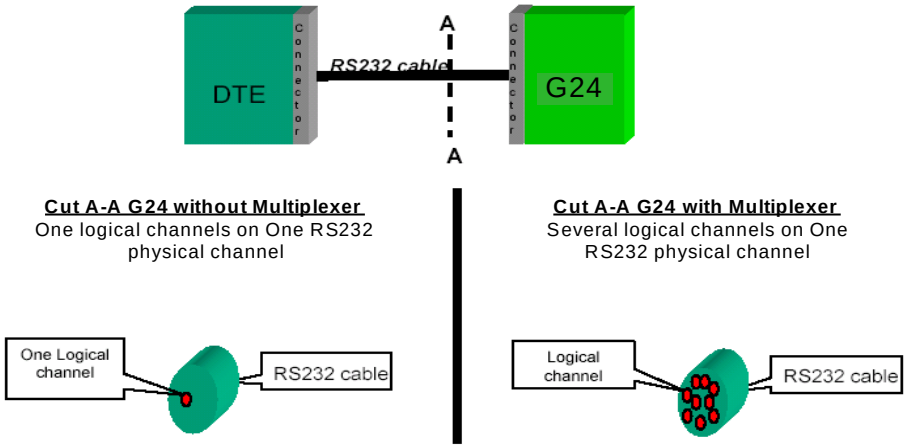


Figure 3-12: G24 with and without MUX

Product Architecture

The following figure shows the former architecture (PREMUX).

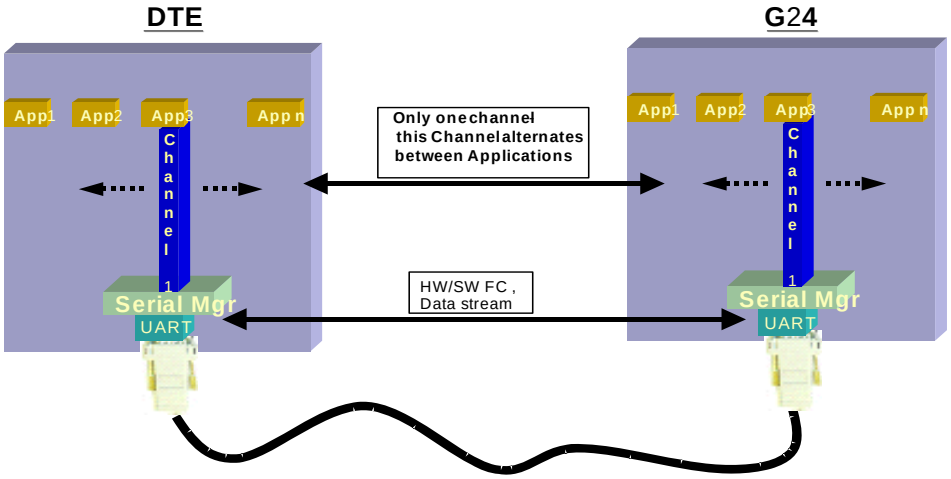


Figure 3-13: PREMUX Architecture

The following figure shows the current product architecture (MUX).

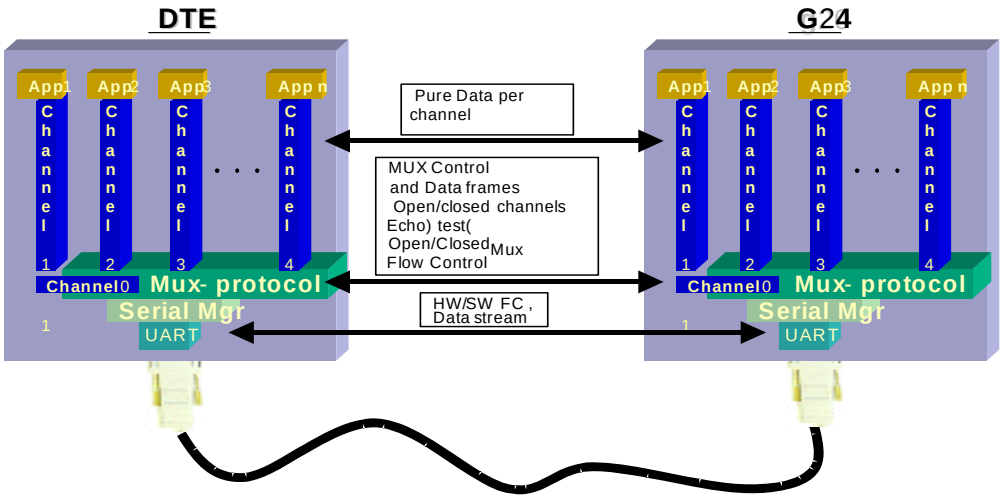


Figure 3-14: Current MUX Architecture

MUX States Overview

The G24 MUX module has three states:

- PREMUX
- MUX-Init
- MUX

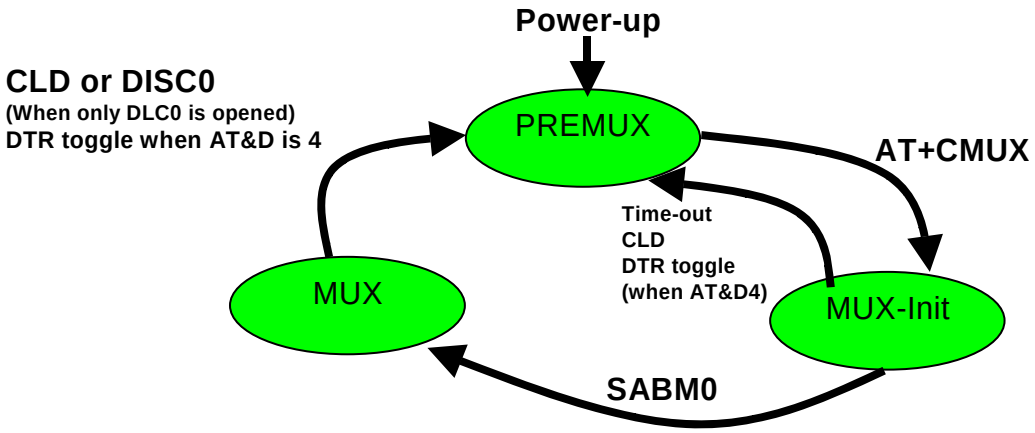


Figure 3-15: MUX States

PREMUX State

Once the GRLC logical communication channel between the DTE and G24 has been established, the RS232 cable is connected and the DTE device is ready to communicate.

MUX-Init State

This is an in-between state during which the G24 and DTE move from PREMUX to MUX.

Note: In this state there are no G24 indications or AT commands such as RING indicator (RI), and so on.

MUX State

In this state, the DTE and G24 communicate with the MUX 27.010 protocol stack over RS232.

Supported 27.010 Protocol Services

The following table lists the services defined in the 27.010 protocol that are supported by the MUX feature.

Service	Description
Start Up	Used to start the multiplexer operation over the serial channel.
DLC Establishment Services	Used to open virtual multiplexer channels.
Data Services	

Service	Description
Power Control Services	Includes both sleep and wakeup services. This service will be supported in future versions.
DLC Release Services	Used to disconnect a DLC exclude control channel (DLCO).
Close Down Services (CLD, DISCO, Exception situations)	Used to terminate multiplexer operation on the serial channel and resume GRLC operation (returns to PREMUX state).
Control Services	Includes services at the MUX entity level and at the specific DLC level. MUX Entity Level services (channel 0): 1. Test ServiceUsed to test the communication link between two MUX entities. 2. Flow Control ServiceIssued by the MUX entity as a result of its buffer state. The initial state of the MUX entity is with data flow enabled. Specific DLC Level services (all DLC except 0): 1. DLC Control Parameter Used to control a specific DLC. Service (MSC)A specific DLC HW modem status is reflected by logical (SW) means. A Modem Status Command (MSC) is used to control specific DLC modem signals and flow control, as a substitute for the HW lines in PREMUX. Initial values are expected to mirror the HW values in PREMUX. Note: The MSC break signal is not supported. 2. Non-supported Command Response (NSC)
Unsupported Control Services	PN, RPN, RLS, SNC (27.010 options)

UART Flow Control

The following sections describe UART flow control in the MUX.

UART Hardware Flow Control

G24 supports automatic UART hardware flow control.

UART Software Flow Control

Software flow control is supported only in MUX advanced mode. It is not supported in basic mode.

MUX UART Port Speed

Auto baud rate detection is disabled in the MUX. To set the UART baud rate, the G24 uses the <port speed> parameter in +CMUX command. If the parameter is absent, the MUX uses the same baud rate that was in PREMUX state.

+CMUX, MUX Startup Command

This command is used to enable/disable the GSM MUX multiplexing protocol stack. When the G24 receives a valid +CMUX command, it returns OK and changes its state to MUX-Init. If the parameters are left out, the default value is used.

Command Type	Syntax	Response/Action	Remarks
Set	**+CMUX=<mode>[,<subset>[,<port_speed>[,<N1>[,<T1>[,<N2>[,<T2>[,<T3>[,<k>]]]]]]]]**	**+CME ERROR: <err>**	The Set command requests the G24 to open the MUX stack with various parameters. This command works only in PREMUX state.
Read	**+CMUX?**	**+CMUX: <mode>, [<subset>], <port_speed>,<N1>, <T1>, <N2>, <T2>, <T3>+CME ERROR: <err>**	The Read command displays the current mode and settings. This command works only in MUX state.
Test	**+CMUX=?**	**+CMUX: (list of supported <mode>s),(list of supported<subset>s),(list of supported <port_speed>s),(list ofsupported <N1>s),(list of supported <T1>s),(list ofsupported <N2>s),(list of supported <T2>s),(list ofsupported <T3>s),(list of supported <k>s)**	The Test Command displays a list of supported modes and parameters. This command works in both PREMUX and MUX states.

The following table shows the +CMUX parameters.

Table 3-172: +CMUX Parameters

<Parameter>	Description
<mode>	MUX mode: 0 Basic 1 Advanced
<subset>	Defines how the MUX control channel is set up. The virtual channel is set up according to this setting. 0 UIH frames used only
<port_speed>	Transmission rate: 1 9600 bit/sec 2 19200 bit/sec 3 38400 bit/sec 4 57600 bit/sec 5 115200 bit/sec
<N1>	Maximum frame size: 31 256 The default value is 31 in Basic mode, 64 in Advanced mode.
<T1>	Acknowledgement timer (in units of 10 ms). 1-255 Default value is 10 (100 ms)
<N2>	Maximum number of retransmissions. 0-100 Default value is 3
<T2>	Response timer for the DLC0 (in unit of 10 ms). <T2> must be longer than <T1>. 2-255 Default value is 30 (300 ms)
<T3>	Wake up response timer (in seconds). 1-255 Default value is 10.

Note: Due to non-ERM, the <k> parameter is not supported.

MUX Modes

The <mode> parameter in the +CMUX command determines whether the MUX protocol works in Basic mode or Advanced mode, including the transparency mechanism. When the G24 changes states from PREMUX to MUX-Init, the G24 opens the MUX stack in the selected mode.

In Advanced mode the following requirements apply:

- The length field is no longer be a part of the new frame structure.
- A transparency mechanism.
- XON/XOFF flow control is available.

MUX Customer Open Source Code Packet

The MUX is provided with an open source code packet to help speed the development process and reduce the incompatible interpretations of the protocol specifications. This source code packet is saved in the VOBS and supports both Basic and Advanced modes.

When implementing the MUX feature, the user should have the MUX entity installed with the product. The following two MUX integration options are available to the user:

- MIP (Mux Integration Packet): The user receives the source code, which is provided by Motorola, with known APIs for the MUX. The MIP is a Motorola open source code packet for the GSM 27.010 protocol with API functions provided for the user.
- MUI (Mux User Implementation): The GSM 27.010 protocol is implemented by the user. The MUI is the user implementation device for the GSM 27.010 protocol.

APIs

There are five API user integrations, as follows:

- Open service
- Close service
- Sending Data service
- Receiving Data service
- MUX service test, MSC, FC and so on (refers only to the control channel)

MUX Channels (Information Data Link Control - IDLC)

The following sections describe the MUX channels.

Basic MUX Channel Definitions

- Each MUX channel functions as a regular RS232 connection that follows ETSI 07.07 and ITU V.25 ver standards. However, there are some limitations, as described in this paragraph.
- The G24 IDLC channel switches to Data mode as specified in ETSI 07.07 [4].
- When the MUX protocol layer releases the IDLC channel, any GPRS/DATA session or established call is hung up. Only active voice calls remain connected.
- AT command requests by an IDLC may result in an ERROR, while in PREMUX state the same request would never have returned an ERROR. This may happen because the addressed resource in the G24 is busy with a second IDLC request. For example, if two channels send the AT+CLIP? command, which addresses the GSM engine, only one channel receives the +CLIP: response, while the other receives an ERROR.

Channel Priorities

The control channel has the highest priority. All other IDLCs have the same priority.

Note: All control frames are processed before any other channels. IDLC frame validation is also performed after all control frames are processed.

Multiple Channel Configuration

The configurations listed below are recommended to achieve maximum use of parallel channels with minimum conflicts.

Two Channel Configuration

- DLC1 – Data channel dedicated to CDS
- DLC2 – ACCH (AT command channel; includes all AT commands except CDS related commands)

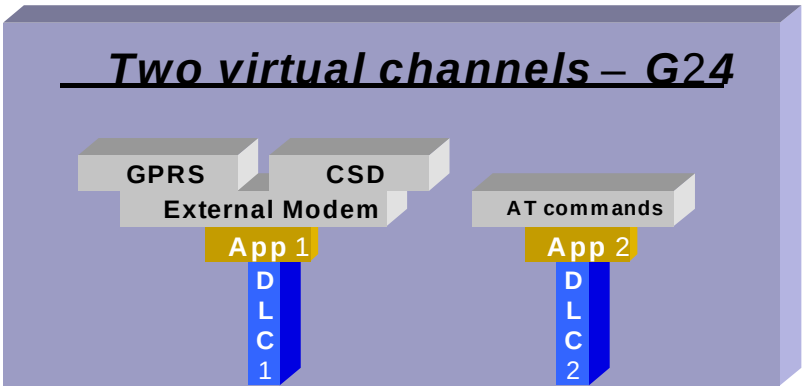


Figure 3-16: Two-channel Configuration

Note: Between data sessions, DLC1 is IDLE (in command mode).

Four-channel Configuration

- DLC1 – GRLC or Logger
- DLC2 – ACCH
- DLC3 – GPRS
- DLC4 – CSD

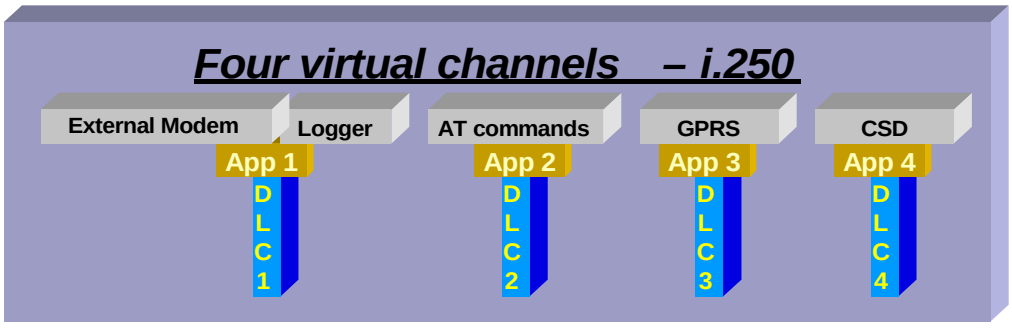


Figure 3-17: Four-Channel Configuration

Note: Between sessions, the Data and GPRS channels are IDLE (in command mode).

DLC1 Explanation:

An external host interface is used as a regular G24 RS232 channel, without MUX capabilities. It is highly recommended to enable this channel when the others are in IDLE state. One purpose of adding this channel is to give outside users who cannot see the other three channels, which are used as internal channels, the option of using the product (such as a Palm computer with a built-in G24) as purely a modem, without its other benefits. Such a product could also use this channel as the G24 logger channel.

The purpose of the additional UART is to have a DTE processor bypass, enabling an external device (such as a PC, and so on) to be connected to this UART for receiving G24 services. When this UART is available, it can be used for Logger debugging by doing the following:

1. Connecting the additional UART to a PC COM port.
2. Sending the +CLOG command.
3. Receiving the log data into a binary file.

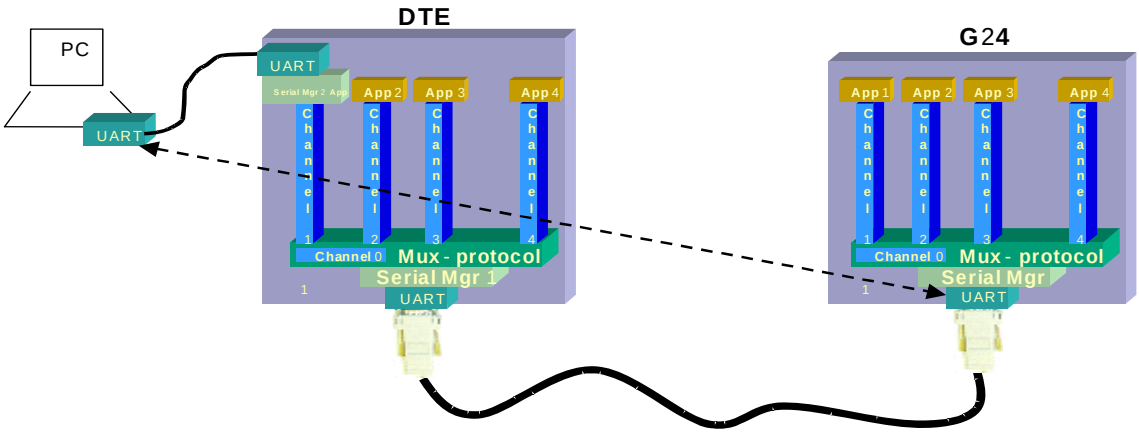


Figure 3-18: Using the Additional UART

Note: In this configuration, the DTE device might try to request multiple CDS services simultaneously. For example, it may try to establish CSD sessions in DLC1 and in DLC4. Such attempts will not work and will have unpredictable corresponding effects.

AT Commands per Channel Configuration

The following table provides the AT commands that are allowed for each channel.

Note: When DTE sends a "Not allowed" AT command to a specific channel the following might occur:

- ERROR response will be returned.
- OK response will be returned, but unexpected behavior will occur later.

Use the following legend for the Profile Definition column in Table 3-173, on page 3-262:

- PCHS: Per channel setting
- PCHS:
  - Unsolicited: Enable/disable unsolicited is per channel
  - Unsolicited - special: Unsolicited can be enabled only in one channel, regardless of what is shown in the following table.

Table 3-173: AT Commands Limitations for 4-Channel Configuration

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS					
$		V				Yes	
%C	V	V	V	V	Ignored		
&C	V	V	V	V		Yes	PCHS
&D	V	V	V	V		Yes	PCHS
&K	V	V	V	V	MUX degenerated	Yes	
&G	V	V	V	V	Ignored		
&J	V	V	V	V			
&L	V	V	V	V	Ignored		
&M	V	V	V	V	Ignored		
&P	V	V	V	V	Ignored		
&Q	V	V	V	V			
&R	V	V	V	V	Ignored		
&S	V	V	V	V	Ignored		
&T	V	V	V	V	Ignored		
&V		V					
&W							
&Y							
?	V	V	V	V		Yes	
\A	V	V	V	V	Ignored	Yes	
\S	V	V	V	V		Yes	
\K	V	V	V	V	Ignored		
\B	V	V	V	V	Ignored		
+++	V csd		V		Not a command	Yes	
+CACM		V				Yes	
+CALM		V				Yes	
+CAMM		V				Yes	
+CAOC		V				Yes	Unsolicited - special

Table 3-173: AT Commands Limitations for 4-Channel Configuration (Cont.)

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS					
+CBAND		V			Ignored		
+CBAUD		V			MUX degenerated	Yes	
+CBC		V				Yes	
+CBST	V csd		V csd			Yes	PCHS
+CCFC		V				Yes	
+CCLK		V				Yes	
+CCWA		V				Yes	PCHS - unsolicited
+CEER		V				Yes	
+CFUN		V				Yes	
+CGACT	V gprs			V		Yes	
+CGCLASS	V gprs			V		Yes	
+CGDCONT	Vgprs			V		Yes	
+CGMI	V	V	V	V		Yes	
+CGMM	V	V	V	V		Yes	
+CGMR	V	V	V	V		Yes	
+CGPRS	V gprs	V		V		Yes	
+CGQMIN	Vgprs			V		Yes	
+CGREG		V				Yes	PCHS - unsolicited
+CGSMS		V				No	
+CGSN	V	V	V	V		Yes	
+CGT		V				Yes	
+CHLD		V				Yes	
+CHUP		V				Yes	
+CIMI		V				Yes	
+CKEV		V				Yes	PCHS - unsolicited
+CKPD		V				Yes	

Table 3-173: AT Commands Limitations for 4-Channel Configuration (Cont.)

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS					
+CLAC		V					
+CLCC		V				Yes	PCHS - unsolicited
+CLCK		V				Yes	
+CLIP		V				Yes	PCHS - unsolicited
+CLIR		V				Yes	
+CLVL		V				Yes	
+CMEE	V	V	V	V		Yes	PCHS
+CMER		V				Yes	PCHS - unsolicited
+CMGD		V				Yes	
+CMGF		V				Yes	PCHS
+CMGL		V				Yes	
+CMGR		V				Yes	
+CMGS		V				Yes	
+CMGW		V				Yes	
+CMSS		V				Yes	
+CMT		V				Yes	PCHS - unsolicited
+CMTI		V				Yes	PCHS - unsolicited
+CMUT		V				Yes	
+CMUX		V				Yes	
+CNMA		V				Yes	PCHS
+CNMI		V				Yes	Unsolicited - special
+CNUM		V				Yes	
+COLP		V				Yes	PCHS - unsolicited
+COPS		V				Yes	
+CPAS		V				Yes	
+CPBF		V				Yes	
+CPBR		V				Yes	

Table 3-173: AT Commands Limitations for 4-Channel Configuration (Cont.)

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS					
+CPBS		V				Yes	PCHS
+CPBW		V				Yes	
+CPIN		V				Yes	
+CPMS		V				Yes	
+CPOL		V				Yes	
+CPUC		V				Yes	
+CPWD		V				Yes	
+CR	V csd		V			Yes	
+CREG		V				Yes	PCHS - unsolicited
+CRLP		V				Yes	
+CRSL		V				Yes	
+CRSM		V					
+CRTT		V				Yes	
+CSCA		V				Yes	
+CSCB		V				Yes	
+CSCS		V				Yes	PCHS
+CSDH		V				Yes	
+CSMS		V				Yes	PCHS
+CSNS	V csd	V	V			Yes	
+CSQ		V				Yes	
+CSSN		V				Yes	PCHS - unsolicited
+CSVM		V				Yes	
+CTFR1	V	V	V	V			
+CUSD		V				Yes	
+FCLASS	V csd		V			Yes	PCHS
+FMI	V csd		V			Yes	PCHS
+FMM	V csd		V			Yes	PCHS
+FMR	V csd		V			Yes	PCHS
+FRH	V csd		V			Yes	PCHS
+FRM	V csd		V			Yes	PCHS

Table 3-173: AT Commands Limitations for 4-Channel Configuration (Cont.)

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS					
+FRS	V csd		V			Yes	PCHS
+FTH	V csd		V			Yes	PCHS
+FTM	V csd		V			Yes	PCHS
+FTS	V csd		V			Yes	PCHS
+GCAP		V				Yes	
+GMI	V	V	V	V		Yes	
+GMM	V	V	V	V		Yes	
+GMR	V	V	V	V		Yes	
+GSN	V	V	V	V		Yes	
+ICF		V			Affects UART; will be degenerated in future releases	Yes	
+IFC	V	V	V	V		Yes	
+IPR	V	V	V	V	MUX degenerated	Yes	
+MAFEAT		V				Yes	
+MAMUT		V				Yes	
+MAVOL		V				Yes	
+MCSAT		V					
+MCSN		V					
+MCST		V				Yes	PCHS - unsolicited
+MCWAKE		V				Yes	
+MDC		V					
+MDSI		V					
+MEGA		V				Yes	
+MFS		V					

Table 3-173: AT Commands Limitations for 4-Channel Configuration (Cont.)

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS					
+MIPCALL				3	Command is not supported within MUX	Yes	
+MIPCLOSE						Yes	
+MIPFLUSH						Yes	
+MIPOPEN						Yes	
+MIPPUSH						Yes	
+MIPSEND						Yes	
+MIPSETS						Yes	
+MKPD		V				Yes	PCHS - unsolicited
+MMAR		V				Yes	
+MMGL		V				Yes	
+MMGR		V				Yes	
+MMICG		V				Yes	
+MPCM		V					
+MPDPM		V				Yes	
+MRST	V	V	V	V			
+MSCTS		V				Yes	
+MTCTS		V				Yes	
+MTDTR		V				Yes	
+MTKE		V				Yes	
+MTKM		V				Yes	
+MTKP		V				Yes	Unsolicited - special
+MUPB		V				Yes	PCHS - unsolicited
+VTD		V				Yes	

Table 3-173: AT Commands Limitations for 4-Channel Configuration (Cont.)

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS					
+VTS		V				Yes	
A	V	V	V	V	Answers only a "self" ringing call. Refer to the RING definitions at the end of the table.	Yes	
A/	V	V	V	V	Obvious	Yes	
AT	V	V	V	V	Obvious	Yes	
ATS97	V	V	V	V			
DL	V	V	V	V	Refer to the D definitions at the end of the table.	Yes	
E	V	V	V	V		Yes	PCHS
F	V	V	V	V	Ignored	Yes	
H	V	V	V	V		Yes	
L	V	V	V	V	Ignored	Yes	
M	V	V	V	V	Ignored	Yes	
N	V	V	V	V	Ignored	Yes	
O	V		V	V		Yes	
P		V			Ignored		
Q	V	V	V	V		Yes	
S0	V	V	V	V		Yes	PCHS
S102	V	V	V	V		Yes	
S12	V csd		V			Yes	PCHS
S2	V csd	V	V	V		Yes	PCHS
S24	V	V	V	V		MUX degener-at ed	
S3	V	V	V	V		Yes	PCHS

Table 3-173: AT Commands Limitations for 4-Channel Configuration (Cont.)

	IDLC-1	IDLC-2	IDLC-3	IDLC-4	Comment	PREMUX Support	Profile Definition
	External	AT + Voice Call + SMS					
S4	V	V	V	V		Yes	PCHS
S5	V	V	V	V		Yes	PCHS
S7	V	V	V	V		Yes	PCHS
S94	V	V	V	V		Yes	
S96	V	V	V	V		Yes	
S97	V	V	V	V			
T	V	V	V	V	Ignored		
V	V	V	V	V		Yes	PCHS
X	V	V	V	V		Yes	PCHS
Y	V	V	V	V	Ignored		
Z	V	V	V	V		Yes	
+CGATT	V gprs	V		V		Yes	
+CGQREQ	V gprs			V		Yes	
+CRC	V	V	V			Yes	PCHS
+CRING	V	V	V			Yes	
RING - CSD Call (data/fax)	V csd		V			Yes	
RING - Voice Call		V				Yes	
RING - MT GPRS Alert					Also not supported by the network	No	
D*99#	V			V gprs	GPRS External	Yes	
D Voice Call		V				Yes	
D CSD Call	V csd		V			Yes	

Notes:

- RING Alert: When the call type is unrecognized, it is considered as a voice call. In such a case, RING will be sent to IDLC-2 only.
- When IDLC-1 (External modem) is active, no operation should be made in IDLC-3 and IDLC-4. When IDLC-3 or IDLC-4 are active, no operation should be made in IDLC-1.
- In the case of a 2-channel configuration (IDLC1 = External modem + GPRS + CSD; IDLC2 = AT and VC), the IDLC-1 commands that are allowed comprises the combination of the above DLC-1, IDLC-3 and IDLC-4 columns.

Multiple Channel Definitions

The following table provides various multiple channel definitions.

Table 3-174: Multiple Channel Definitions

Term	Description
Command response	A response to a command is delivered back to the channel from which the command was sent.
Unsolicited indication	Unsolicited indications are sent only to the channel that enabled them. Enabling indications where it is not allowed may cause unexpected results. Exception: Some of the indications can be enabled only in one specific channel. For more information, refer to Table 3-173, “AT Commands Limitations for 4-Channel Configuration,” on page 3-262.
AT+CMUX command	Any G24 IDLC receiving an AT+CMUX command returns an ERROR response – +CMEE: "operation not allowed".
Common settings for all channels	Settings that are not stored in the IDLC modem profile, but that are set in one of the G24 components. Any modification to these settings overrides the previous settings in all the other channels. For example, Database settings (phonebook, Flex, audio settings, network (SIM) settings, and so on. For this reason, parallel commands are not allowed in more than one channel. All the settings that are private for each channel (can be different in different channels) are mentioned in the Profile Definition column in Table 3-173, “AT Commands Limitations for 4-Channel Configuration,” on page 3-262.

GPRS Definitions

- A GPRS session is suspended when a voice/CSD call is connected to the G24. The GPRS session is resumed when the voice/CSD call is disconnected. The voice/CSD call can be dialed when the GPRS session is either in online DATA mode or online COMMAND mode.
- A GPRS session cannot be started (ERROR returned) when there is an active or established Voice/CSD call.
- Simultaneous GPRS sessions of any kind (internal and/or external) are not supported.

Note: While G24 is operating network-related AT commands, such as SMS or Supplementary Services, GPRS session behavior will be the same as for Voice/CSD call, but for brief moments only.

IDLC Modem Profile in MUX State

Definitions

- Modem profile – G24 modem settings such as s-registers and flex values.
- GRLC profile – GRLC (PREMUX) settings such as s-registers and flex values.
- GRLC default profile – GRLC (PREMUX) settings on power up.
- When a new channel is established (open IDLC) its modem profile will be the GRLC default profile.
- When the G24 returns to PREMUX state from either MUX or MUX-INIT states, its modem profile is the GRLC default profile.
- The two requirements above have an exception regarding the UART configuration – the settings for UART port speed and flow control (AT&K and AT+CBAUD/AT+IPR). These settings are set in PREMUX state only, and will be kept unchanged until the G24 returns to PREMUX state. If an IDLC tries to change the settings it receives an OK response, but the real value is NOT changed. When the G24 is in MUX state, these two settings have either the values that were defined in PREMUX, or the value set by the AT+CMUX command. If a value was set with the AT+CMUX command, it is retained even after returning to PREMUX state.

Chapter 4: Using the Commands

Setting Up the G24 (Power On and Initial Actions)

There are three phases of connectivity for the G24:

- Init General

  In this phase, the G24 is asked to provide basic information which ensures that the phone is functioning properly.
- Enabling the SIM
- Registering the SIM on a network in order to see that wireless access is functioning properly.

After these three phases are completed, G24 is ready for action and you can send/receive voice calls, circuit switched data and GPRS.

The following figures show the phone state transactions:

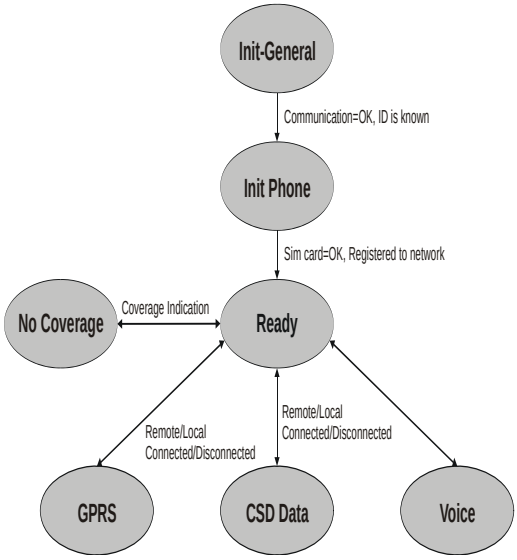


Figure 4-1: Phone State Transactions

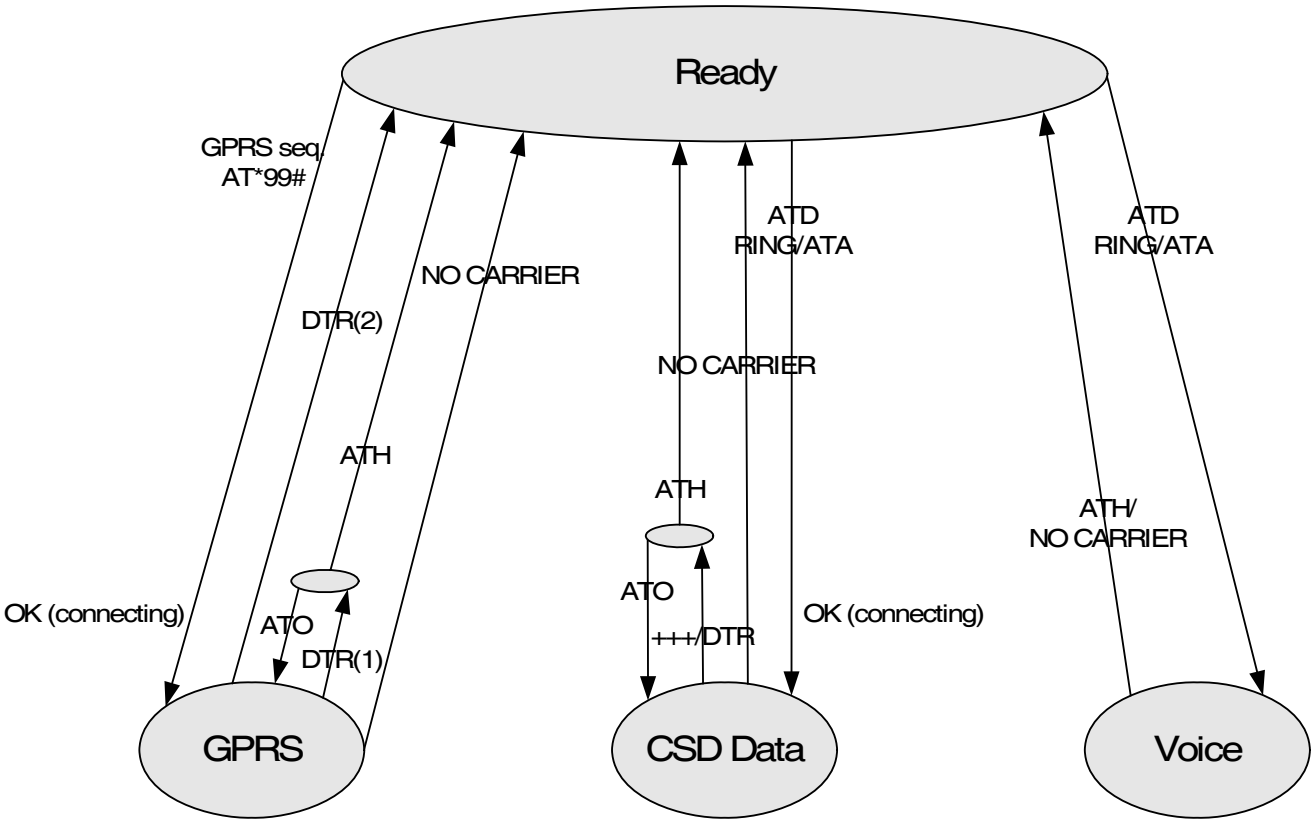


Figure 4-2: Detailed Phone State Transactions

Recommended G24 Initialization after Powerup

Figure 4-3 provides a recommended workflow for initializing the G24 after startup. The following sections explain this workflow in detail.

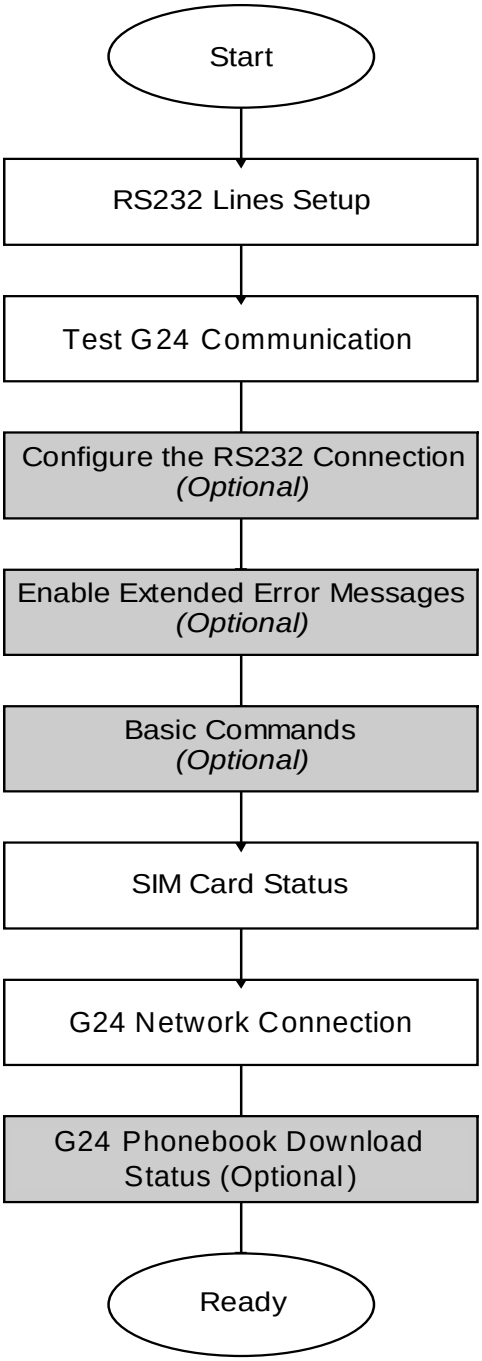


Figure 4-3: Recommended G24 Initialization Workflow

RS232 Lines Setup

There is no dynamic detection. Upon power up, the hardware is detected. If USB is detected, then USB is selected. If USB is not connected, then the RS232 is selected. For a pin description, refer to the G24 Developer's Kit Manual: 6889192V26-A.

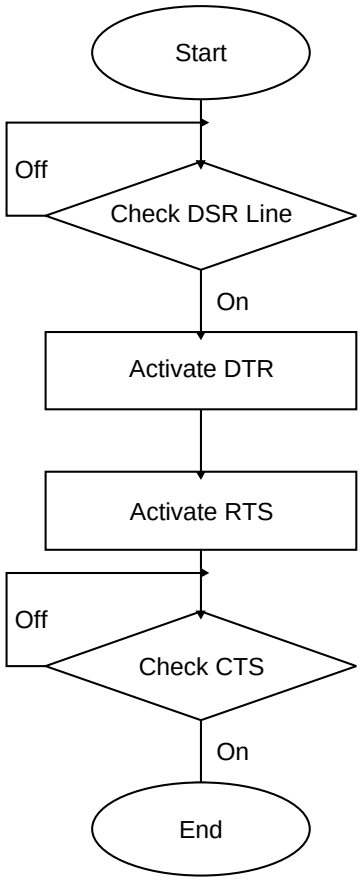


Figure 4-4: RS232 Lines Setup

Test G24 Communication

This is a preliminary step. During this step, the ability to communicate with the G24 using AT commands is tested.

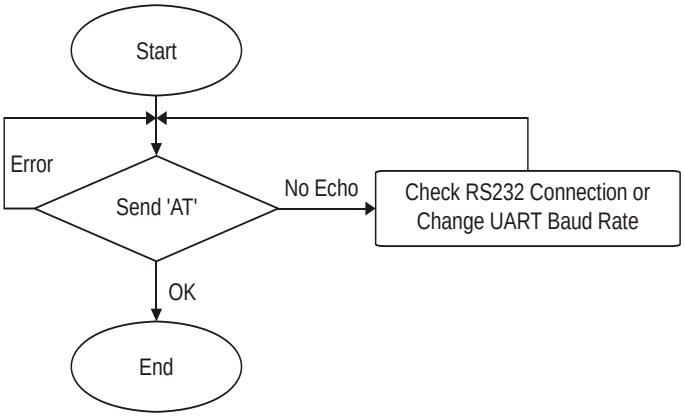


Figure 4-5: Test G24 Communication

Communication example:

AT

ATE1//By default, the echo should be enabled

AT

OK//Confirm that G24 replies with OK

Basic Configuration

These are optional steps. If required, specific RS232 pin behavior can be selected. Extended error notification is recommended for debugging and field-support purposes.

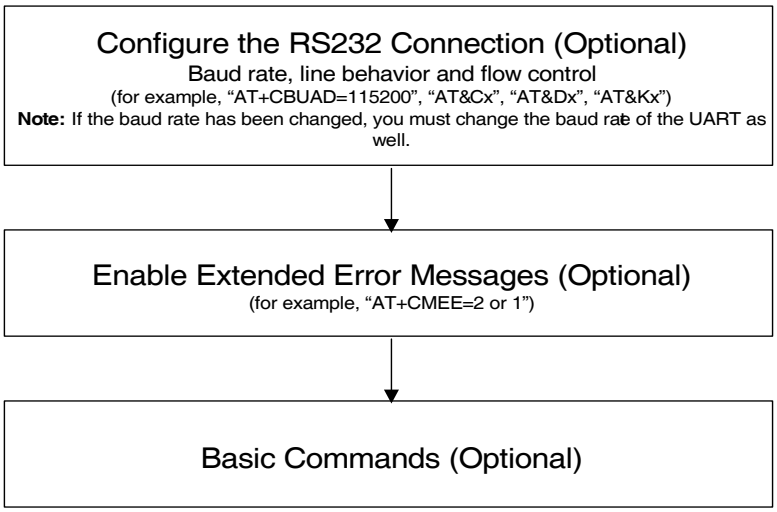


Figure 4-6: Basic Configuration

1. Baud setting example:

```
at+cbaud=6//Setting baud rate for 19200
OK
at+cbaud=19200//Same as issuing this command
OK
```

2. RS232 HW lines configuration: &C(DCD), &D(DTR), &K(flow-control).

```
Default settings should be:
AT&C1
OK
AT&D2
OK
AT&K3
OK
```

3. Modem IDs (optional): +CGMI,+CGMM,+CGMR,+CGSN

```
at+cgmi
+CGMI: "Motorola"
OK
at+cgmm
+CGMM: "GSM900","GSM1800","GSM1900","GSM850","MODEL=G24"
OK
at+cgmr
+CGMR: "G24_G_0C.11.45R"
OK
AT+CGSN//Read the IMEI number of the G24
+CGSN: 448954035283579
OK
```

4. Error messages (optional): +CMEE, +CEER

```
AT+CMEE=2 //Enable +CME ERROR: error messages verbose string
OK
AT+CEER=2//Enable +CEER: call status indication verbose string
OK
```

SIM Card Status

To enable the module to transfer from basic commands to full operational mode, a SIM card must be ready and the PIN enabled.

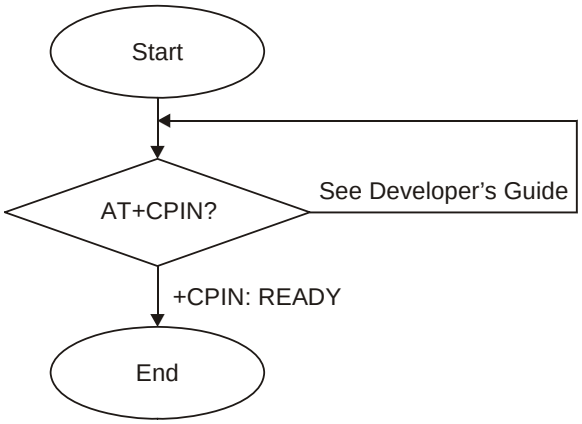


Figure 4-7: SIM Card Status

Note: For a full description of SIM states, see "+CPIN, Enter PIN for Unlocking SIM Card or Enter PUK for Unblocking SIM Card" on page 3-169.

The following steps are part of the SIM card status step:

1. Check SIM security: AT+CPIN?
2. Confirm that the result is +CPIN: READY
3. If the SIM PIN is required, then the following response appears: +CPIN: SIM PIN.
4. Unlock the SIM, if needed: AT+CPIN="XXXX".
   Note: XXXX is the PIN password (4-8 digits long).
5. If the SIM PUK/PUK2 is required, then the following response appears: +CPIN: SIM PUK/PUK2.
6. Unblock the SIM, if needed: AT+CPIN="YYYYYYYY", "ZZZZ".

Note: YYYYYYYY is the PUK/PUK2 password (4-8 digits long).
ZZZZ is the new defined PIN/PIN2 password (4-8 digits long).

G24 Network Connection

In this step, the G24 detects existing networks (the user must register to a specific network).

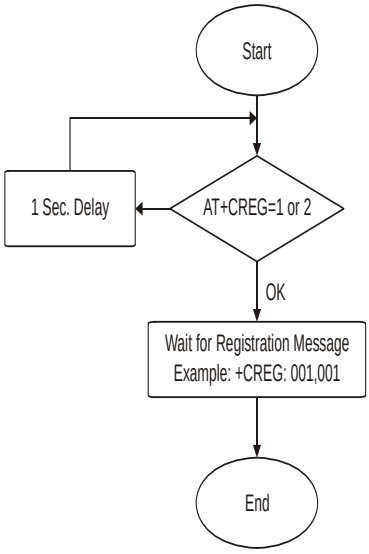


Figure 4-8: G24 Network Connection

1. Registration and call indications example: +CREG, +CLCC

```
AT+CREG=2
OK
AT+CLCC=1
OK
```

2. Get available networks example: +COPS

```
AT+COPS=? //To read all possible operators
+COPS:(002,"ILORANGE","ORANGE","42501"), //G24 answer example
(000,"AT&T Wireless", "AT&T","31038"),
(001,"IL Cellcom","Cellcom","42502"),
(003,"IL-77","IL-77","42577"),,(000,001,002,003,004),
(000,001,002)
```

3. Get registration messages example: +CREG

```
at+cgreg=1
OK
+CREG: 001//G24 example output when it is registered on the home network
Get GSM registration status: +CREG
AT+CREG=2//Get unsolicited GSM registration reports
+CREG: 001,2648, 988b
```

4. Get GPRS registration status example: +CGREG

```
AT+CREG=2//Get unsolicited GPRS registration reports
+CGREG: 001,2648,988b
```

Terminal Synchronization

In this step, the terminal requests the stored phonebook, SMS, and so on, from the G24.

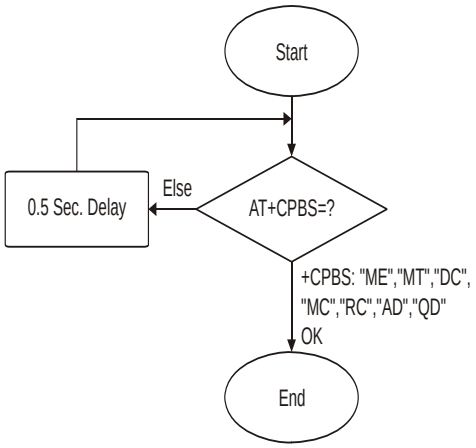


Figure 4-9: Terminal Synchronization

SMS

Managing Stored Messages in the G24 Memory

AT+CPMS="me" //Select NVM as preferred memory storage using the +CPMS command
+CPMS: 11,61,11,61,2,20
OK
AT+CMGF=1// move to TEXT mode
OK
AT+CMGL="ALL" //List all messages in memory storage
+CMGL: 225,"STO UNSENT","054565132"
<Message body>
+CMGL: 223,"STO UNSENT","4565029" //Example of G24 response
<Message body>
+CMGL: 222,"STO SENT","054565029"
<Message body>
+CMGL: 221,"STO SENT","054565132"
<Message body>
+CMGL: 220,"STO UNSENT",""
<Message body>
OK
AT+CMGL="STO UNSENT" //List all messages of a certain type (for example, stored unsent messages)
+CMGL: 225,"STO UNSENT","054565132"
<Message body>
+CMGL: 223,"STO UNSENT","4565029"
<Message body>
+CMGL: 220,"STO UNSENT",""
<Message body>
OK
AT+CMGR=225 //Read any message from the list using its index
+CMGR: "STO UNSENT","054565132"
<Message body>
OK
AT+CMGR=9
+CMS ERROR: invalid index
AT+CPMS="sm"
+CPMS: 2,20,11,61,2,20
OK
AT+CMGR=9
+CMGR: "REC UNREAD","+97254565132",,"05/02/18,"21:22:23+08"
<Message body>
OK
AT+CSDH=1
OK
AT+CMGR=9
+CMGR: "REC UNREAD","+97254565132",,"05/02/18,"21:22:23+08",145,4,0,0,"+97254120032",145,<messsage length>
<Message body>
OK

Setting the Notification Indication for Incoming Messages (Using AT+CNMI)

AT+CNMI=,1 //To receive indications of new incoming MT messages, the second parameter of +CNMI should be set to 1
OK
+CMTI: "SM",4 //When a new MT message is received, the unsolicited response +CMTI will be displayed, denoting the message index
AT+CMGR=4 //Use the new message index to read it
+CMGR: "REC UNREAD","+97254565132",,"05/02/13,07:15:36+08"
<message body>
OK
AT+CMGD=4 //Delete the message after reading it
OK

Another Possible Option for Setting the CNMI Notification Indication

AT+CNMI=,2//To have new incoming MT messages displayed on the terminal, the second parameter of +CNMI should be set to 2
OK
+CMT: "+97254565132","03/3/24,15:38:55"
<message contents>//When a new MT message is received, the unsolicited response +CMT is displayed along with the message
AT+CNMA//To acknowledge receipt of a message, use the AT+CNMA command within 60 seconds of the +CMT unsolicited response
OK

The acknowledged message is not saved in the database. If the +CMT unsolicited response is not acknowledged within 60 seconds, the new message is saved in database.

Setting TEXT Mode Parameters (Using AT+CMGW and AT+CMGS)

AT+CSMP?
+CSMP=17,167,0,0
OK
AT+CMGW="0544565034"
> text is entered <ctrl z>
+CMGW: 141
OK
AT+CSDH=1
OK
AT+CMGR=141
+CMGR: "STO UNSENT","0544565034",,,129,17,0,0,167,"+ 97254120032",145,<messsage length>
<message body>
AT+CSMP= 1,256,0,0
+CMS ERROR: numeric parameter out of bounds

Writing, Saving and Sending Messages (Using AT+CMGW and AT+CMSS)

Writing messages into the database, with or without destination address. In TEXT mode, the header parameters will be set according to CSMP settings:

AT+CMGW//Writing a message without destination address
> message text <ctrl z>
+CMGW: 142
OK
AT+CMGW="054565132"//Writing a message with destination address
> message text <ctrl z>
+CMGW: 143
OK
:
AT+CMSS=143//Send a message to the destination address with which it was stored, using the message index
OK
AT+CMSS=143,"054565029"//Send a message to a destination address, regardless of the destination address with which it was stored (if any), using the message index
OK
AT+CMSS=3,"054565029"//In this way, received messages (stored in the inbox) can also be sent
OK
AT+CSMP=25,"05/03/15,21:22:23+08"
OK
AT+CMGW="0544565034"
A<CTRL+Z>
+CMGW: 129
OK
AT+CMGR=129
+CMGR: "STO UNSENT", "0544565034",,129,25,0,0,"05/03/15,21:22:23+08","+972521100059",145,1
A
OK
AT+CMGF=0
OK
AT+CMGR=129
+CMGR: 2,,1
07917952120100951 9FF0A8150446505430000503051122232800141
at+cmgw=24
> 07917952120100951 9000c917952428650290000AABBAABBAABB010441424344
+CMGW: 146
OK

Sending Messages (Using AT+CMGS)

Sends an SM from the G24 to the network in TEXT mode, the header parameters will be set according to CSMP settings. In text mode (+CMGF=1):

AT+CMGS="054565028" //Writing a message to be sent to specified destination address
>This is the message body <CTRL+Z> //<CTRL+Z> ends the prompt text mode and returns to regular AT command mode
+CMGS: 238 //Message successfully sent. Returns the Message Reference
OK
AT+CMGS="+97254565028",145 //Writing a message to be sent to specified destination address
>message text <CTRL/Z>
+CMGS: 239 //Message successfully sent . Returns the Message Reference
OK

Deleting Messages (Using AT+CMGD)

AT+CMGD=179 //Delete a message using its index
OK
AT+CMGR=179 //The message index is now empty
+CMS ERROR: invalid memory index
Delete a group of messages. Note that deletion of a number of messages may take a short time.
AT+CMGD=1, 1 //Delete all read messages
OK
AT+CMGD= 1,2 //Delete all read and sent messages
OK
AT+CMGD= 1,3 //Delete all read, sent and unsent messages
OK
AT+CMGD= 1,4 //Delete all messages
OK

Call Control

The following figure is a detailed view of the states the G24 goes through for Voice and CSD Data, as shown in Figure 4-2. Note that between the time the OK is received and the actual connection occurs, call state alerts are received.

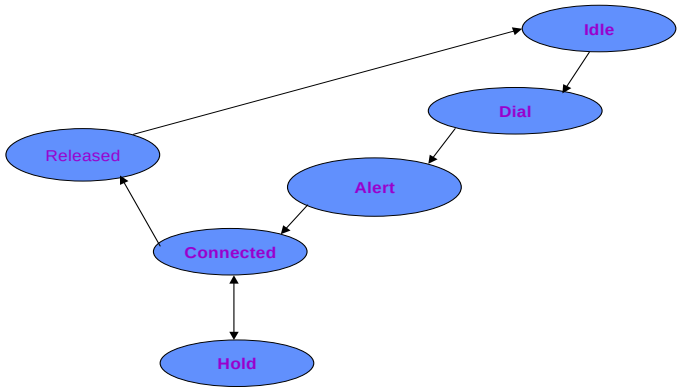


Figure 4-10: Call States

Dialing Using ATD

atd+44 34 56 78; // VOICE call; number includes international access code
OK
OK
atd17085763400; //Second VOICE call
OK
OK//Call to 44345678 is being put on hold
ath//Hang up active call
NO CARRIER
OK
at+chld=0//Hang up held call
NO CARRIER
OK
atd+44 34 56 78 //DATA call
...
OK//Move to online Data state
//ESC sequence back to the Command state. +++ is sent from the terminal (+++ is not displayed)
ath//Hang up data call
NO CARRIER
OK //Data call terminated
at+fclass=1
OK
atd+44 34 56 78//FAX call
...
NO CARRIER //Fax call was terminated by remote side
atd035659260,345,22; //VOICE call with tones sent after connecting

OK
OK
3 4 5//Sent as DTMF tones
... //Pause
2 2 //Sent as DTMF tones
ath//Voice call is hung up
NO CARRIER
OK
atd0356592,60 //DATA/FAX call with comma
//Comma is ignored; 035659260 is dialed
OK

Direct Dialing from Phone Book

This example uses a phone book with these pre-saved items.

at+cpbs?
+CPBS: "MT"//Current phone book is now MT
at+cpbr=1,260//This is a specific example with memory values
+CPBR: 5,"4444",129,"BE"
+CPBR: 6,"+97235659260",145,"eran"
+CPBR: 7,"035659260",129,"eran"
+CPBR: 8,"+97251632603",145,"long"
+CPBR: 9,"5555",129,"B"
+CPBR: 77,"035619942",129,"er"
atd>"long";
OK
OK//Exact match; 051 632603 call dialed; voice call answered
atd>8;
OK
OK//Speed-dial from current phone book; 051 632603 call dialed; voice call answered
atd>"era"
OK
OK//Prefix pattern matched; entry for "eran" was selected; +97235659260 call dialed
atd>"er"
OK
OK// Exact match; overrides prefix match; 03 5619942 call connected
In the next example, the current phone book is changed. The numbers are matched via a specific phone book specified in the command.
at+cpbs="fd"//Change the current phone book to Fix-dialing phone book
OK
atd>"MT"9;
OK
NO CARRIER//Speed-dial number (using ") 5555 call dialed; number is incorrect
atd>MT;
OK
NO CARRIER//Speed-dial number 5555 call dialed, number is incorrect
atd>"MT"17
+CME ERROR: not found //Trying to dial from a non-existent entry
atd>"MT"1117
+CME ERROR: invalid index//Speed-dial number is out of range

Dialing the Last Number Example

atd035658278;
OK
OK
ath
NO CARRIER
OK
atdl //Last called number is "035658278"
ATDL: "035658278"
OK//DATA call
atdl;
ATDL: "035658278"
OK
OK//VOICE call
atdl//Last called number is "035658278,123,78;"
ATDL: "035658278"
OK//DATA call

Voice Call Manipulations

Call Waiting

at+ccwa=1 //Enabling the call waiting on G24
OK
atd9311234567; //Originate a voice call
OK
OK //Voice call connected
(...conversation...)
+CCWA: "+358317654321",145,1,"Bob"//Call-waiting indication received by the G24; Bob is calling
+CCWA: "+358317654321",145,1,"Bob"
at+chld=0 //Release the waiting call
OK
NO CARRIER //Current call is still active

Call Forwarding

at+ccfc=1,3,"0545658278" //Network register UC forward-to of all classes
OK
at+ccfc=1,1 //Network activate UC forward-to of all classes
OK//At this point, the G24 will not receive any calls; all calls will be forwarded by the network to phone number 0545658278
at+ccfc=1,2 //Interrogate reason unconditional of all classes
+CCFC: 1,1,"0545658278",129 //Class voice - UC forwarding is activated
+CCFC: 2,1,"0545658278",129 //Class data - UC forwarding is activated
+CCFC: 4,1,"0545658278",129 //Class fax - UC forwarding is activated
OK

Conference Call

atd051632601; //Dialing the first member of the conference
OK
OK
at+chld=2 //Call hold, switch command
OK //Active call switched to hold
atd035659260; //Calling the second member of the conference
OK
OK
(Dual call state: one call on hold; 2nd is active.)
at+chld=3 //Call link command
OK //Held call is linked to active call
(Active conference of two calls)
at+clcc //Verifying call state through CLCC
//(Verifying call state is optional.)
+CLCC: 1,0,0,0,1,"051632601",129,""
+CLCC: 2,0,0,0,1,"035659260",129,""
ath//Hang up the conference call
NO CARRIER //First member dropped
NO CARRIER //Second member dropped
OK

Data Call

Switching Modes (Data Mode/Command Mode)

atd054565190 //Calling the remote modem
OK
aaaaaaaaaaaa //Receiving binary data from remote side (G24 is in Data mode)
//Sending escape sequence +++ to G24 (the remote side does not treat +++ as escape)
OK//G24 is in Command mode
ati3//Issuing an AT command
Motorola Mobile Phone
OK
ato//Switching back to Binary mode
OK
fffffff//Receiving binary data from remote side
fghhgatfhgfhfhghhfhfhfhgfhffhgfgfhgfhgfhhh
//Sending escape sequence +++ to the G24
ath//Hang up the CSD call (return to Command mode)
OK
NO CARRIER

GPRS

When using the GPRS, it is recommended to implement a "keep alive" mechanism.

The G24 memory resources should not be used as a buffer for the user, the user maintains its own memory and flow control in its own application. The G24 has finite limited resources such as network related, SIM card and phone memory. In general the user should use a single resource at a time. As an example, when G24 GPRS network resources are in an active session, user should not manually detach from the network or place a CSD call etc.

Note: The basic GPRS concept is be “always connected” and there is no charge for being connected (only per real data transferred). GPRS users are advised to connect the GPRS network once in the beginning of a session and remain connected rather then to toggle from online to offline and back in a high rate. In specific cases when this is needed, contact customer care for advice and knowledge base.

Establishing GPRS PDP Context

When using the GPRS network for any IP data, you must be attached to the GPRS network before activating PDP context.

Activating a Saved Profile in G24

AT+CGATT=1//By default, after power-up, the G24 attaches to the GPRS network, if possible (if the network and SIM allow)

AT+CGATT?//Check your connection status

AT+CGDCONT=1,"IP","RTY","123.32.45.9"//Context definition example

Two Ways to Activate PDP Context

Each of the two main ways in which to activate PDP context are described below.

Using the GPRS Wizard Application

1. Double-click the button predefined as the dialer for this provider to automatically establish PDP context. If the G24 was not previously attached to GPRS, it will be attached automatically.
2. Setup configuration.
3. Enter into the wizard, the parameters provided by your operator.
4. Set definitions to allow your http/ftp browser to use the G24 as a port to the Internet.
5. Usage:
   - Open the GPRS Manager.
   - Double-click the dialer icon to select and activate the provider of your choice (multiple providers may be displayed in
     the list).
   - After dialing, your temporary IP address, the GPRS DATA session message will be displayed.
   - Minimize the GPRS wizard window and use your http/ftp browser (Internet Explorer, Netscape).

Using the ATD* Command Set

Request GPRS service 'D':

ATD*99*(CID)#**

The CID (Context ID) includes the APN (defined by the AT+CGDCONT command) to which you want to be connected. This depends on the ability of the SIM card to be attached to the different networks.

The format ATD*99# may also be used. In this case, the G24 will first try to activate a non-empty (predefined) CID. If the attempt fails, the G24 will try the next CID, and so on.

Note: When buffering the terminal message, data in the G24 (both inbound and outbound data), the following apply:

- Turning off the G24 clears any buffered data.
- Removing power from the G24 clears any buffered data.
- Whenever the terminal drops the PPP connection with the G24, via LCP terminate, the buffered data is cleared.
- Whenever the G24 drops the PPP connection with the terminal, with LCP terminate, the buffered data is cleared. LCP termination triggers the termination of the data in the G24 buffer.
- Whenever the G24 drops the PPP connection with the terminal, without an LCP terminate, the buffered data is cleared. Dropping the DTR also clears the buffer.
- When the network sends a deactivation message or a detached message, the G24 buffer is cleared.
- When the G24 transfers data in the uplink and GPRS coverage is lost, the data may flow-off. If the mobile has lost coverage and is unable to send the packets from the terminal to the network, the buffers will continue to store the packets until the buffers are full. The terminal will then be flowed off and the packets will be stored until they can be sent to the GPRS network.
- The amount of time that takes before the user is notified is specified in the T3312 timer that is located in the mobile side. The default delay time of T3312 is 54 minutes, as per the GSM 0408 specification. After 54 minutes, the G24 deactivates the PDP session.

Changing the Character Set

Example

When an SMS messages with the following text: "Motorola G24 OEM Module", is saved inside the G24 at entry 128, you can read it using several character sets.

When the "ASCII" character set is used, the following is received by the terminal:

at+cscs? //Read the current character set
+CSCS: "ASCII"//Currently using ASCII character set
OK
at+cmgr=128 //Read SMS entry 128
+CMGR: "STO UNSENT",""
Motorola G24 OEM Module //The content of SMS entry 128
OK
When the "USC2" character set is used, the following is received by the terminal:
at+cscs?//Read the current character set
+CSCS: "UCS2"//Currently using UCS2 character set
OK
at+cmgr=128
+CMGR: "STO UNSENT",""
004D006F0074006F0072006F006C006100200067003200300020004F0045004D
0020004D006F00640075006C0065 //The content of SM entry 128
OK

The following is an ASCII translation of the SM contents:

004DM
006Fo
0074 t
006F o
0072r
006Fo
006Cl
0061a
0020[space]
0067g
00322
00300
0020 [space]
004FO
0045E
004DM
0020[space]
004DM
006F o
0064d
0075u
006Cl
0065e

As this SMS was originally written in ENGLISH, meaning ASCII letters, each digit quadruplet starts with double zeros (00). When other languages are used, the quadruplets have different values.

Sleep Mode

Note: The notation of TXD and RXD are from the perspective of the terminal unless otherwise specified.

The terminal should activate Sleep mode by sending ATS24=n (n - number of seconds). To disable Sleep mode, send ATS24=0.

Example of G24 Entering Sleep Mode

Terminal-TX: ATS24=n

Terminal-TX: ATxxx

Terminal-Wakeup-In=Inactive//n seconds passed since last command (and other conditions met)

G24-CTS=Inactive//G24 enters Sleep mode

Example of Terminal Wake G24 Sleep Mode

Terminal-Wakeup-In=Active

G24-CTS=Active//G24 exits Sleep mode

Terminal-TX: ATxxx//30 mseconds passed since Terminal-Wakeup-In became active

Example of G24 Wake Terminal Up

G24-CTS=Active//G24 internal event occurred. Incoming call is pending
//G24 exits Sleep mode

G24-Wakeup-Out=Active

G24-TX: RING//T mseconds passed since Terminal-Wakeup-Out became active
(T is defined by ATS102.)

The figure below shows a Sleep mode example when S24 > 0.

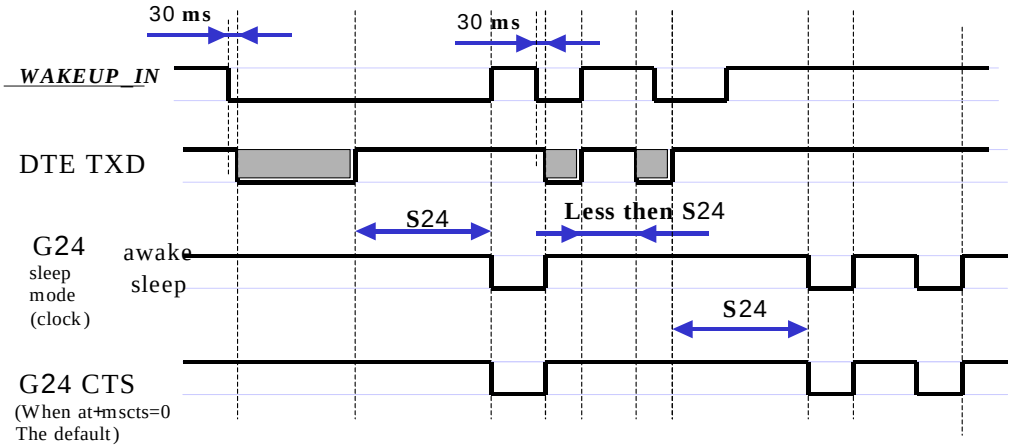


Figure 4-11: Sleep Mode when S24 > 0

TCP/IP

TCP Data Transfer Example

at+mipcall=1,"orange","test","test"
OK
+MIPCALL: 172.17.242.86
at+MIPOPEN=1,1222,"123.245.213.012",1234,0 //Opening socket 1 using TCP protocol, from port 1222, targeting 123.245.213.012 port 1234
OK
+MIPOPEN: 1,1
at+MIPOPEN? //Terminal checking the status of socket to be opened (socket 1 opened OK)
+MIPOPEN: 2 3 4
+MIPSETS=1,340 //Asking the G24 to accumulate 340 bytes on socket 1 prior to sending
+MIPSETS: 0
OK
at+mipsets?
+MIPSETS: 1 340
OK
at+mipsend=1,"444444" //Sent coded "DDD" string
+MIPSEND: 1,1497 //Free storage in the accumulating buffer
OK

Note: This step can be repeated several times until the buffer is full or until the amount of data reaches 340 bytes and data pushed into the stack.

at+MIPSEND?//Checking the size remaining (optional)
+MIPSEND: 1 1497
OK
+MIPPUSH=1//Terminal asks G24 to flush the buffer in socket 1
+MIPPUSH: 0
+MIPCLOSE=1 //Terminal closes the socket
+MIPCLOSE: 1
OK
+MIPCALL=0//Terminal hangs up the link
OK

Multi-point Data Transfer Example

at+mipcall=1,"orange","test","test"
OK
+MIPCALL: 172.17.242.86
at+mipopen=1,1001,"172.17.238.44",1001,0
OK
+mipopen: 1,1
at+mipopen=2,1111,"172.17.238.44",1111,0
OK
+mipopen: 2,1
+MIPSETS=1,200//Asking the G24 to accumulate 200 bytes on socket 1 prior to sending
+MIPSETS: 0
OK

+MIPSETS=2,400 //Asking the G24 to accumulate 400 bytes on socket 2 prior to sending
+MIPSETS: 0
OK
+MIPSEND=1,"444444"
+MIPSEND:1,1497
OK
+MIPSEND=2,"DD"//Passing data to the G24 socket 2
+MIPSEND:2,1499
OK
+MIPPUSH=1 //Terminal asks the G24 to flush the buffer in sockets 1 and 2
+MIPPUSH:0
+MIPPUSH=2
+MIPPUSH:0
+MIPCLOSE=1 //Terminal closes sockets 1 and 2
+MIPCLOSE:1
OK
+MIPCLOSE=2
+MIPCLOSE:2
OK
+MIPCALL=0 //Terminal hangs up the link
OK
+MIPSETS=1,120 //Asking the G24 to accumulate 120 bytes on socket 1 prior to sending
+MIPSETS: 0
OK
+MIPSEND=1,"444444" //Passing 3 bytes of data to the G24 socket 1

Note: Size remaining in socket 1 buffer is 1497 bytes.

+MIPSEND:1,1497
+MIPPUSH=1 //At this point, the terminal can decide on flushing the remainder to the stack

Xoff and Xon Example

In this example, it is assumed that the buffer size is 1500 and that some kind of error happened on the protocol stack.

+MIPSEND=1,"A344343ABC343438980BC...AB4" //Passing data to G24 socket 1
+MIPSEND:1,1200//(Note: Size remaining in socket 1 accumulating buffer is 1200 bytes.)
+MIPSEND=1,"A344343ABC343438980BC...A23"
+MIPSEND:1,0 //(Note: No free space in buffer.)
+MIPXOFF: 1//The G24 detects that the accumulating buffer on socket 1 has no free space to accumulate data and data cannot be sent to the protocol stack.

From this point on, the terminal is not allowed to send data until it receives the +MIPXON command.

+MIPSEND=1,A344343ABC343438980BC...AB4//Terminal disregards the Xoff request of G24 and keeps sending //(Note: The terminal does not stop.)
ERROR 3
+MIPXON: 1//G24 pushed the data into the protocol stack and is able to handle more sends from the terminal

Error in Reopening a Valid Socket

at+mipcall=1,"orange","test","test"
OK
+MIPCALL:123.145.167.230
+MIPOPEN=1,1222,"123.245.213.012",1234,0 //Opening socket 1 using TCP protocol, from port 1222, targeting 123.245.213.012 port 1234
OK
+MIPOPEN:1,1
+MIPOPEN? //Terminal checking the status of socket to be ready
+MIPOPEN: 2 3 4
MIPOPEN=1,12,123.245.213.012,234,0//Terminal tries to reopen socket 1
ERROR

Audio

Scenarios for Setting Up Handset Mode or Handsfree Mode

Handset Mode

AT+MAPATH=1,1 //Set the input path through the microphone
AT+MAPATH=2,1,3 //Set voice and keypad through the earpiece speaker
AT+MAPATH=2,3,12 //Set alerts and rings to go through the transducer
AT+MAFEAT=6,0 //Disable echo cancellation and noise suppression
AT+MAFEAT=1,1 //Enable sidetone

Handsfree Mode

AT+MAPATH=1,1 //Set the input path through the microphone
AT+MAPATH=2,1,15 //Set all tones through the earpiece speaker
AT+MAFEAT=1,0 //Disable sidetone
AT+MAFEAT=6,1 //Enable echo cancellation and noise suppression

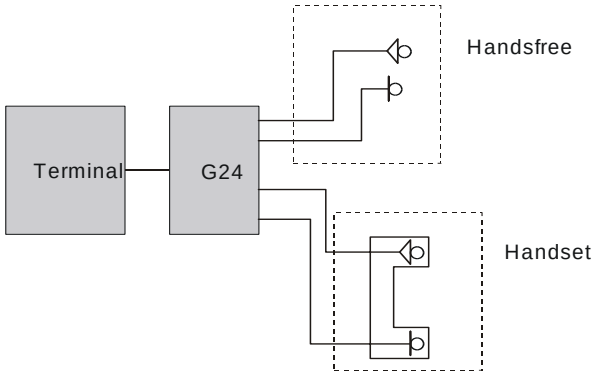


Figure 4-12: Handset or Handsfree Setup

Chapter 5: Tools

Tools Overview

This chapter describes the PC Driver and PC Loader tools provided by the application. PC Driver enables the G24 to be used as a PC external modem for fax communication and for performing GPRS packet data connections. PC Loader is a PC-based software application that enables users to reprogram G24 modules through an RS232 interface.

PC Driver

Overview

The G24 can be used as a PC external modem for fax communication and for performing GPRS packet data connections. The G24 USB driver file is required for running a terminal application on the PC. The WinFAX application with the Standard 19200 bps Modem driver is recommended for fax connection. The GPRS Manager application with the Motorola Serial GPRS P2K 57.6 Kbps driver is recommended for GPRS packet data connections.

Fax Communication by Standard 19200 bps Modem

To install the modem driver, follow the procedure below:

1. From the Control Panel, select Modems > Add Modem.
2. Select "Don't detect my modem" and click Next.
3. Select "Standard 19200 bps modem" and click Next.
4. Select the valid com port.
5. Click Finish.

Using WinFAX

To configure the modem in WinFAX, follow the procedure below:

1. Run WinFAX.
2. Select Tools > Program Setup > Modems and Communications Devices > Properties.
3. Set the standard 19200 bps modem to Active.
4. Click Next and select CLASS 1 (Hardware Flow Control) > Next > Finish, Set Default (or other) > OK.
5. In the Modem and Communications Devices Properties window, click Properties.
6. In General > Communications port, set the COM port to which the modem is connected, and initialize it to 19200 bps.

Establishing GPRS PDP Context (Using GPRS Manager)

Installing GPRS Manager on a PC

To install and configure GPRS Manager and the Motorola Serial GPRS P2K 57.6 Kbps driver, follow the procedure below.

1. Run the GPRS Manager setup program.
2. Restart the computer.

Configuring a Dialer Icon

To configure a dialer icon, follow the procedure below.

1. After restarting, verify that G24 is powered up.
2. Run the GPRS Manager Configuration Wizard.
3. In the Wizard, click **Next** to continue to the next configuration step.
4. Read the instructions thoroughly before moving to the next step.
5. Enter the APN (Access Point Name) provided by your operator.
6. Set the definitions to allow your HTTP/FTP browser to use the G24 as a port to the Internet.

Establishing a Connection

To establish a connection, do the following:

1. Open the GPRS Manager.
2. Double-click the dialer icon to select and activate the provider of your choice (multiple providers may be displayed in the list).

Appendix A:Reference Tables

This appendix contains the following sections:

- AT Commands Alphabetical Summary, below
- Character Set Table CS1: (GSM -> UCS-2), page Page -16
- Character Set Table CS2: (ASCII <-> UTF-8), page Page -21
- Character Set Table CS3: (UCS-2 <-> UTF-8), page Page -21
- Character Set Table CS6: (UCS-2 Full Table), page Page -21
- Character Set Table CS7: (ASCII table), page Page -21

Note: Character Set Table CS6: (UCS-2) is provided on CD due to its size.

AT Commands Alphabetical Summary

The following table contains an alphabetical list of all the G24 AT commands.

Table A-1: AT Commands (Alphabetical)

AT Command	Description	Page
$	This command displays a list of all the AT commands supported by the G24.	Page 3-8
%C	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&C	This command determines how the state of the DCD line relates to the detection of the received line signal from the distant end.	Page 3-139
&D	This command determines how the G24 responds when the DTR (Data Terminal Ready) status is changed from ON to OFF during the online data state.	Page 3-140
&F	This command restores the factory default configuration profile.	Page 3-185

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
&G	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&J	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&K	This command configures the RTS/CTS flow control.	Page 3-138
&L	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&M	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&P	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&Q	This command selects the asynchronous mode, and has no effect.	Page 3-34
&R	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&S	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&T	This command is supported for backward compatibility only, and has no effect.	Page 3-241
&V	This command displays the current active configuration and stored user profiles.	Page 3-202
&W	This command stores the user profile.	Page 3-203
&Y	This command displays the default user profile.	Page 3-205
?	This command displays the most recently updated value stored in the S-register.	Page 3-185
\A	This command is supported for backward compatibility only, and has no effect.	Page 3-241
\B	This command is supported for backward compatibility only, and has no effect.	Page 3-241

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
\G	This command sets the use of the software control.	Page 3-184
\J	This command adjusts the terminal auto rate.	Page 3-184
\K	This command is supported for backward compatibility only, and has no effect.	Page 3-241
\N	This command links the type.	Page 3-184
\S	This command displays the status of selected commands and S-registers.	Page 3-184
ATS97	This command indicates whether an antenna is physically connected to the G24 RF connector.	Page 3-145
+CACM	This command resets the Advice of Charge accumulated call meter value in the SIM file, EFACM.	Page 3-46
+CALM	This command handles the selection of the G24's alert sound mode.	Page 3-163
+CAMM	This command sets the Advice of Charge accumulated call meter maximum value in the SIM file, EFACMmax.	Page 3-47
+CAOC	This command enables the subscriber to get information about the cost of calls.	Page 3-44
+CBAND	This command is supported for backward compatibility only, and has no effect.	Page 3-184
+CBAUD	This command sets the baud rate.	Page 3-134
+CBC	This command enables a user to query the battery charger connection.	Page 3-133
+CBM	This unsolicited message forwards the SMS upon its arrival.	Page 3-85
+CBST	This command selects the bearer service and the connection element to be used when data calls are originated.	Page 3-32

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+CCFC	This command enables control of the call-forwarding supplementary service.	Page 3-28
+CCLK	This command reads/sets the G24's current date and time settings.	Page 3-73
+CCWA	This command controls the Call Waiting supplementary service, including settings and querying of the network by the G24.	Page 3-22
+CDEV	An unsolicited indication regarding display changes that is sent to the DTE when the <disp> parameter of the +CMER command is set to 1.	Page 3-211
+CEER	This command returns an extended error report containing one or more lines of information text <report>, determined by the manufacturer, providing reasons for errors. The errors are call clearing codes.	Page 3-198
+CFUN	This command shuts down the phone functionality of smart phones and PDAs with phone capabilities.	Page 3-143
+CGACT	This command activates/deactivates the PDP Context.	Page 3-221
+CGATT	This command attaches the G24 to the GPRS network.	Page 3-221
+CGCLASS	This command sets the GPRS mobile station class.	Page 3-215
+CGDCONT	This command specifies the PDP (Packet Data Protocol) context.	Page 3-216
+CGMI	This command requests manufacturer identification.	Page 3-1
+CGMM	This command requests the model identification.	Page 3-2
+CGMR	This command requests the revision identification.	Page 3-3
+CGPRS	This command indicates whether there is GPRS coverage.	Page 3-225

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+CGQMIN	This command sets the minimum acceptable quality of service profile.	Page 3-218
+CGQREQ	This command returns the requested quality of service profile.	Page 3-220
+CGREG	This command enables/disables the GPRS network status registration unsolicited result code.	Page 3-123
+CGSMS	This command handles the selection of the service or service preference used by the G24 to send mobile-originated SMS messages.	Page 3-110
+CGSN	This command requests the product serial number identification.	Page 3-3
+CHLD	This command controls the Call Hold and Multiparty Conversation supplementary services.	Page 3-24
+CHUP	This command causes the G24 to hang up the current GSM call.	Page 3-35
+CIEV	An unsolicited indication regarding various phone indications that is sent to the DTE when the <ind> parameter of the +CMER command is set to 1.	Page 3-211
+CIMI	This command requests the International Mobile Subscriber Identity number.	Page 3-6
+CKEV	This command causes the G24 to send an unsolicited message when a key is pressed on the G24 keypad, and local key press echo is enabled.	Page 3-210
+CKPD	This command emulates key presses, or virtual keycodes, as if entered from the G24 keypad or from a remote handset.	Page 3-205
+CLAC	This command displays a list of all the AT commands supported by the G24.	Page 3-8

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+CLCC	This command returns a list of all current G24 calls and their statuses, and also enables/disables the unsolicited indication of the call list.	Page 3-40
+CLCK	This command locks, unlocks or interrogates a G24 or a network facility <fac>.	Page 3-173
+CLIP	This command controls the Calling Line Identity (CLI) presentation to the terminal when there is an incoming call.	Page 3-20
+CLIR	This command enables/disables the sending of caller ID information to the called party, for an outgoing call.	Page 3-30
+CLVL	This command sets the volume of the internal loudspeaker (which also affects the key feedback tone) of the G24.	Page 3-151
+CMEE	This command enables/disables the use of result code +CME ERROR: <err> as an indication of an error relating to the functionality of the G24.	Page 3-193
+CMER	This command enables an external accessory to receive key press information from the G24's internal keypad.	Page 3-209
+CMGD	This command deletes messages from the G24 memory.	Page 3-109
+CMGF	This command handles the selection of message formats.	Page 3-78
+CMGL	This command displays a list of SMS messages stored in the G24 memory.	Page 3-91
+CMGR	This command enables the user to read selected SMS messages from the G24 memory.	Page 3-95
+CMGS	This command sends an SM from the G24 to the network.	Page 3-111
+CMGW	This command writes and saves messages in the G24 memory.	Page 3-104
+CMSS	This command selects and sends pre-stored messages from the message storage.	Page 3-102

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+CMUT	This command mutes/unmutes the currently active microphone path by overriding the current mute state.	Page 3-152
+CMUX	This command is used to enable/disable the GSM MUX multiplexing protocol stack.	Page 3-257
+CMT	This unsolicited message forwards the SMS upon its arrival.	Page 3-85
+CMTI	This unsolicited message, including the SMS index, is sent upon the arrival of an SMS.	Page 3-87
+CNMA	This command acknowledges the receipt of a +CMT response.	Page 3-85
+CNMI	This command sends an unsolicited indication when a new SMS message is received by the G24.	Page 3-83
+CNUM	This command returns up to five strings of text information that identify the G24.	Page 3-7
+COLP	This command refers to the GSM supplementary service COLP, Connected Line Identification Presentation, which enables a calling subscriber to get the connected line identity (COL) of the called party after setting up a mobile originated call.	Page 3-57
+COPS	This command enables accessories to access the network registration information, and the selection and registration of the GSM network operator.	Page 3-124
+CPAS	This command returns the current activity status of the G24, for example, call in progress, or ringing.	Page 3-39
+CPBF	This command enables the user to search the currently active phone book for a particular entry, by name.	Page 3-62
+CPBR	This command recalls phone book entries from a specific entry number, or from a range of entries.	Page 3-60

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+CPBS	This command selects the memory that is to be used for reading and writing entries in G24s that contain more than one phone book memory.	Page 3-59
+CPBW	This command enables the user to store a new entry in the phone book, or delete an existing entry from the phone book.	Page 3-63
+CPIN	This command is only relevant for phones that use SIM cards. It unlocks the SIM card when the proper SIM PIN is provided, and unblocks the SIM card when the proper SIM PUK is provided.	Page 3-169
+CPMS	This command handles the selection of the preferred storage area for messages.	Page 3-76
+CPOL	This command is used to edit the list of preferred operators located in the SIM card.	Page 3-127
+CPUC	This command sets the parameters of the Advice of Charge-related price per unit and currency table found in the SIM file, EFPUCT.	Page 3-48
+CPWD	This command sets a new password for the facility lock.	Page 3-171
+CR	This command controls whether or not the extended format of an outgoing call is displayed or not.	Page 3-49
+CRC	This command controls whether to present the extended format of the incoming call indication.	Page 3-18
+CREG	This command enables/disables the network status registration unsolicited result code.	Page 3-121
+CRING	This unsolicited event indicates the type of incoming call.	Page 3-18
+CRLP	This command returns the Radio Link Protocol parameters.	Page 3-120
+CRSL	This command handles the selection of the incoming call ringer and alert tone (SMS) sound level on the alert speaker of the G24.	Page 3-150

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+CRSM	This command enables you to read IMSI, GID1, GID2 and ICC ID data from the SIM card.	Page 3-201
+CRTT	This command plays one cycle of a ring tone, stops the cycle in the middle, and sets the ring tone to be used.	Page 3-165
+CSCA	This command handles the selection of the SCA and the TOSCA.	Page 3-78
+CSCB	This command handles the selection of cell broadcast message types and data coding schemes received by the G24.	Page 3-112
+CSCS	This command selects the G24 character set.	Page 3-4
+CSDH	This command shows the Text Mode parameters.	Page 3-82
+CSMP	This command sets the Text Module parameters.	Page 3-80
+CSMS	This command handles the selection of the SMS service type.	Page 3-75
+CSNS	This command handles the selection of the bearer or teleservice to be used when a mobile terminated single numbering scheme call is established.	Page 3-35
+CSSN	This command handles the enabling and disabling of supplementary service-related, network-initiated, notifications.	Page 3-51
+CSQ	This command returns the signal strength received by the G24.	Page 3-119
+CSVM	This command handles the selection of the number to the voice mail server.	Page 3-65
+CTFR1	This command terminates an incoming call and diverts the caller to the number previously defined in CCFC, or to a voice mail if one exists for the subscriber.	Page 3-38

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+CUSD	This command allows control of Unstructured Supplementary Service Data (USSD), according to GSM 02.90.	Page 3-54
+FAR	This command is supported for backward compatibility only, and has no effect.	Page 3-241
+FCL	This command is supported for backward compatibility only, and has no effect.	Page 3-241
+FCLASS	This command places the terminal in particular mode of operation (data, fax, voice).	Page 3-243
+FDD	This command is supported for backward compatibility only, and has no effect.	Page 3-241
+FIT	This command is supported for backward compatibility only, and has no effect.	Page 3-241
+FMI	This command requests manufacturer identification.	Page 3-1
+FMM	This command requests the model identification.	Page 3-2
+FMR	This command requests the revision identification.	Page 3-3
+FRH	This command causes the G24 to receive HDLC framed data and deliver the next received frame to the terminal.	Page 3-249
+FRM	This command causes the G24 to enter the receive mode.	Page 3-247
+FRS	This command causes the G24 to listen and to report back an OK result code when the line has been silent for the specified amount of time.	Page 3-244
+FTH	This command causes the G24 to transmit data framed in the HDLC protocol.	Page 3-247
+FTM	This command causes the G24 to transmit data.	Page 3-245
+FTS	This command causes the G24 to stop any transmission.	Page 3-244
+GCAP	This command requests the overall capabilities of the G24.	Page 3-137

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+GMI	This command requests manufacturer identification.	Page 3-1
+GMM	This command requests the model identification.	Page 3-2
+GMR	This command requests the revision identification.	Page 3-3
+GSN	This command requests the product serial number identification.	Page 3-3
+ICF	This command determines the local serial port start/stop (asynchronous) character framing used by the DCE when accepting DTE commands and transmitting information text and result codes, whenever these are not done automatically.	Page 3-144
+IFC	This command controls the operation of the local flow control between the terminal and the G24.	Page 3-249
+IPR	This command is responsible for setting and saving the request baud rate.	Page 3-135
+MADIGITAL	This command switches between analog and digital audio modes.	Page 3-162
+MAFEAT	This command controls the various algorithm features, such as sidetone, echo cancel and noise suppress.	Page 3-161
+MAMUT	This command controls the muting/unmuting of all input paths (MIC, HDST_MIC, DIGITAL_RX).	Page 3-160
+MAPATH	This command sets/requests the active input accessory, and the output accessory for each feature.	Page 3-155
+MAVOL	This command enables you to determine a volume setting for a particular feature in a particular accessory.	Page 3-158
+MCSAT	This command enables/disables/exercises SMS alert tone for an arriving SMS.	Page 3-113
+MCSN	This command sets EFmsisdn in the SIM.	Page 3-68

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+MCST	This command displays the current state of the call processing, and also enables/disables the unsolicited indication of any change in the call processing state.	Page 3-42
+MCWAKE	This command requests reports on the status of the GPRS coverage.	Page 3-141
+MDC	This command enables you to select the desired messages to be displayed upon connection of a voice call with a remote party.	Page 3-37
+MDSI	This command enables unsolicited reporting of indications of SIM deactivation and invalidation.	Page 3-66
+MEGA	This command updates the Email Gateway Address.	Page 3-114
+MFS	This command is used to determine how long the G24 waits before attempting to re-register after a registration attempt has failed and the G24 is not registered.	Page 3-129
+MIPCALL	This command creates a wireless PPP connection with the GGSN, and returns a valid dynamic IP for the G24.	Page 3-228
+MIPCLOSE	This command causes the G24 module to free the socket accumulating buffer and disconnect the G24 from a remote side.	Page 3-231
+MIPCONF	This command allows to configure TCP stack parameters, such as retransmissions number, upper and bottom limits of retransmission timeout, close delay.	Page 3-238
+MIPFLUSH	This command causes the G24 module to flush (delete) data accumulated in its accumulating buffers.	Page 3-235
+MIPOPEN	This command causes the G24 module to initialize a new socket and open a connection with a remote side.	Page 3-229

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+MIPPUSH	This command causes the G24 module to push the data accumulated in its accumulating buffers into the protocol stack.	Page 3-234
+MIPRTCP	This unsolicited event is sent to the terminal when data is received from the TCP protocol stack.	Page 3-236
+MIPRUDP	This unsolicited event is sent to the terminal when data is received from the UDP protocol stack.	Page 3-236
+MIPSEND	This command causes the G24 to transmit the data that the terminal provides, using an existing protocol stack.	Page 3-233
+MIPSETS	This command causes the G24 to set a watermark in the accumulating buffer. When the watermark is reached, data is pushed from the accumulating buffer into the protocol stack.	Page 3-232
+MIPSTAT	This unsolicited event is sent to the terminal indicating a change in link status.	Page 3-237
+MIPXOFF	This unsolicited event is sent to the terminal to stop sending data.	Page 3-237
+MIPXON	This unsolicited event is sent to the terminal when the G24 has free memory in the accumulating buffer.	Page 3-238
+MKPD	This command enables accessories to control the press and release of key presses.	Page 3-208
+MMAR	This command changes the status of an SMS message in the G24 memory from "REC UNREAD" to "REC READ".	Page 3-102
+MMICG	This command handles the selection of microphone gain values.	Page 3-164
+MMGL	This command displays a list of SMS messages stored in the G24 memory.	Page 3-91
+MMGR	This command enables the user to read selected SMS messages from the G24 memory.	Page 3-95

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
+MPDPM	This command returns the collective percentage of memory used by the phonebook and datebook in their shared dynamic memory storage.	Page 3-71
+MRST	This command enables customer software to perform a hard reset to the G24 unit.	Page 3-145
+MSCTS	This command defines the behavior of the CTS line when the G24 is in Sleep mode.	Page 3-192
+MTCTS	This command sets the CTS pin of the RS232 to not active (high), waits one second and then returns the CTS to active (low).	Page 3-138
+MTDTR	This command checks and outputs the physical current status of the DTR pin of the RS232.	Page 3-137
+MUPB	This command causes the G24 to send an event when a phone book entry is accessed or modified by the user.	Page 3-212
+VTD	This command handles the selection of tone duration.	Page 3-166
+VTS	This command transmits DTMF tones when a voice call is active.	Page 3-167
A	This command answers an incoming call, placing the G24 into the appropriate mode, as indicated by the RING message.	Page 3-18
A/	This command repeats the last command entered on the terminal.	Page 3-168
AT	This command checks the AT communication and only returns OK.	Page 3-168
D	This command places a voice call on the current network, when issued from an accessory device.	Page 3-11
D*99	This command enables the ME to perform the actions necessary for establishing communication between the terminal and the external PDN.	Page 3-223

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
D>	This command places a voice/fax/data call on the current network by dialing directly from the G24 phone book.	Page 3-13
DL	This command places a voice call to the last number dialed.	Page 3-15
E	This command defines whether the G24 echoes the characters received from the user, (whether input characters are echoed to output).	Page 3-179
F	This command is supported for backward compatibility only, and has no effect.	Page 3-241
H	This command hangs up, or terminates a particular call.	Page 3-16
I	This command requests various G24 information items.	Page 3-6
L	This command is supported for backward compatibility only, and has no effect.	Page 3-241
M	This command is supported for backward compatibility only, and has no effect.	Page 3-241
N	This command is supported for backward compatibility only, and has no effect.	Page 3-241
O	This command returns a phone to the Online Data mode and issues a CONNECT or CONNECT <text> result code.	Page 3-34
P	This command is supported for backward compatibility only, and has no effect.	Page 3-241
Q	This command determines whether to output/suppress the result codes.	Page 3-178
RING	This unsolicited event is received when an incoming call (voice, data or fax) is indicated by the cellular network.	Page 3-18
S102	This S-register sets the value of the delay before sending the data to the terminal.	Page 3-190

Table A-1: AT Commands (Alphabetical) (Cont.)

AT Command	Description	Page
S24	This S-parameter activates/disables the Sleep mode. If the parameter value is greater than 0, it represent the number of seconds till the G24 enters sleep mode.	Page 3-189
S94	This S-parameter represents the Boolean status, On/Off, of the sidetone feature.	Page 3-153
S96	This S-parameter represents the Boolean status, On/Off, of the echo cancelling feature in the handsfree.	Page 3-154
Sn	This command reads/writes values of the S-registers, and includes registers 1-49.	Page 3-181
T	This command is supported for backward compatibility only, and has no effect.	Page 3-241
V	This command determines the response format of the data adapter and the contents of the header and trailer transmitted with the result codes and information responses.	Page 3-177
X	This command defines the data adaptor response set, and the CONNECT result code format.	Page 3-180
Y	This command is supported for backward compatibility only, and has no effect.	Page 3-241
Z	This command resets the default configuration.	Page 3-186

Character Set Table CS1: (GSM -> UCS-2)

The following table shows the conversion between the GSM and UCS-2 character sets.

Symbol	GSM	(GSM 03.38)
UCS-2	(ISO 10646-1)	@
0x00	0x0040	£
0x01	0x00A3	$

Symbol	GSM	(GSM 03.38)
0x02	0x0024	¥
0x03	0x00A5	è
0x04	0x00E8	é
0x05	0x00E9	ù
0x06	0x00F9	ì
0x07	0x00EC	ò
0x08	0x00F2	Ç
0x09	0x00C7	LF
0x0A	0x000A	Ø
0x0B	0x00D8	ø
0x0C	0x00F8	CR
0x0D	0x000D	Å
0x0E	0x00C5	å
0x0F	0x00E5	Ä
0x10	0x0394	_
0x11	0x005F	Ö
0x12	0x03A6	Ã
0x13	0x0393	Ë
0x14	0x039B	Ù
0x15	0x03A9	Đ
0x16	0x03A0	Ø
0x17	0x03A8	Ó
0x18	0x03A3	È
0x19	0x0398	Î
0x1A	0x039E	1)
0x1B	0x258A	Æ
0x1C	0x00C6	æ
0x1D	0x00E6	ß
0x1E	0x03B2	É
0x1F	0x00C9	SP
0x20	0x0020	!
0x21	0x0021	"
0x22	0x0022	#

Symbol	GSM	(GSM 03.38)
0x23	0x0023	¤
0x24	0x00A4	%
0x25	0x0025	&
0x26	0x0026	'
0x27	0x0027	(
0x28	0x0028	)
0x29	0x0029	*
0x2A	0x002A	+
0x2B	0x002B	,
0x2C	0x002C	-
0x2D	0x002D	.
0x2E	0x002E	/
0x2F	0x002F	0
0x30	0x0030	1
0x31	0x0031	2
0x32	0x0032	3
0x33	0x0033	4
0x34	0x0034	5
0x35	0x0035	6
0x36	0x0036	7
0x37	0x0037	8
0x38	0x0038	9
0x39	0x0039	:
0x3A	0x003A	;
0x3B	0x003B	<
0x3C	0x003C	=
0x3D	0x003D	>
0x3E	0x003E	?
0x3F	0x003F	¡
0x40	0x00A1	A
0x41	0x0041	B
0x42	0x0042	C
0x43	0x0043	D

Symbol	GSM	(GSM 03.38)
0x44	0x0044	E
0x45	0x0045	F
0x46	0x0046	G
0x47	0x0047	H
0x48	0x0048	I
0x49	0x0049	J
0x4A	0x004A	K
0x4B	0x004B	L
0x4C	0x004C	M
0x4D	0x004D	N
0x4E	0x004E	O
0x4F	0x004F	P
0x50	0x0050	Q
0x51	0x0051	R
0x52	0x0052	S
0x53	0x0053	T
0x54	0x0054	U
0x55	0x0055	V
0x56	0x0056	W
0x57	0x0057	X
0x58	0x0058	Y
0x59	0x0059	Z
0x5A	0x005A	Ä
0x5B	0x00C4	Ö
0x5C	0x00D6	Ñ
0x5D	0x00D1	Ü
0x5E	0x00DC	§
0x5F	0x00A7	¿
0x60	0x00BF	a
0x61	0x0061	b
0x62	0x0062	c
0x63	0x0063	d
0x64	0x0064	e

Symbol	GSM	(GSM 03.38)
0x65	0x0065	f
0x66	0x0066	g
0x67	0x0067	h
0x68	0x0068	i
0x69	0x0069	j
0x6A	0x006A	k
0x6B	0x006B	l
0x6C	0x006C	m
0x6D	0x006D	n
0x6E	0x006E	o
0x6F	0x006F	p
0x70	0x0070	q
0x71	0x0071	r
0x72	0x0072	s
0x73	0x0073	t
0x74	0x0074	u
0x75	0x0075	v
0x76	0x0076	w
0x77	0x0077	x
0x78	0x0078	y
0x79	0x0079	z
0x7A	0x007A	ä
0x7B	0x00E4	ö
0x7C	0x00F6	ñ
0x7D	0x00F1	ü
0x7E	0x00FC	à
0x7F	0x00E0	

Character Set Table CS2: (ASCII <-> UTF-8)

The following table shows the conversion between the ASCII and UTF-8 character sets.

ASCII-7bit Byte Encoding	UTF-8 Bit Encoding
00 - 7F	0xxxxxxx

Character Set Table CS3: (UCS-2 <-> UTF-8)

The following table shows the conversion between the UCS-2 and UTF-8 character sets.

UCS2		UTF-8		
Byte Encoding	Bit Encoding	Byte 1	Byte 2	Byte 3
0000 - 007F	000000000xxxxxx x	0xxxxxxx		
0080 - 07FF	00000yyyyyxxxxx x	110yyyyy	10xxxxxx	
0800 - FFFF	zzzzyyyyyyxxxxxx	1110zzzz	10yyyyyy	10xxxxxx

Note: Conversion from the default GSM alphabet to the above character set is straightforward. Conversions of the characters listed below the table are not supplied.

Character Set Table CS6: (UCS-2 Full table)

Character Set Table CS6: (UCS-2) is provided on CD due to its size.

Character Set Table CS7: (ASCII table)

The following table shows the conversion for the ASCII character set.

Decimal	Octal	Hex	Binary	Value	Description
000	000	000	00000000	NUL	(Null char.)
001	001	001	00000001	SOH	(Start of Header)
002	002	002	00000010	STX	(Start of Text)
003	003	003	00000011	ETX	(End of Text)
004	004	004	00000100	EOT	(End of Transmission)

Decimal	Octal	Hex	Binary	Value	Description
005	005	005	00000101	ENQ	(Enquiry)
006	006	006	00000110	ACK	(Acknowledgment)
007	007	007	00000111	BEL	(Bell)
008	010	008	00001000	BS	(Backspace)
009	011	009	00001001	HT	(Horizontal Tab)
010	012	00A	00001010	LF	(Line Feed)
011	013	00B	00001011	VT	(Vertical Tab)
012	014	00C	00001100	FF	(Form Feed)
013	015	00D	00001101	CR	(Carriage Return)
014	016	00E	00001110	SO	(Shift Out)
015	017	00F	00001111	SI	(Shift In)
016	020	010	00010000	DLE	(Data Link Escape)
017	021	011	00010001	DC1	(XON) (Device Control 1)
018	022	012	00010010	DC2	(Device Control 2)
019	023	013	00010011	DC3	(XOFF)(Device Control 3)
020	024	014	00010100	DC4	(Device Control 4)
021	025	015	00010101	NAK	(Negative Acknowledgement)
022	026	016	00010110	SYN	(Synchronous Idle)
023	027	017	00010111	ETB	(End of Trans. Block)
024	030	018	00011000	CAN	(Cancel)
025	031	019	00011001	EM	(End of Medium)
026	032	01A	00011010	SUB	(Substitute)
027	033	01B	00011011	ESC	(Escape)
028	034	01C	00011100	FS	(File Separator)
029	035	01D	00011101	GS	(Group Separator)

Decimal	Octal	Hex	Binary	Value	Description
030	036	01E	00011110	RS	(Request to Send)(Record Separator)
031	037	01F	00011111	US	(Unit Separator)
032	040	020	00100000	SP	(Space)
033	041	021	00100001	!	(exclamation mark)
034	042	022	00100010	"	(double quote)
035	043	023	00100011	#	(number sign)
036	044	024	00100100	$	(dollar sign)
037	045	025	00100101	%	(percent)
038	046	026	00100110	&	(ampersand)
039	047	027	00100111	'	(single quote)
040	050	028	00101000	(	(left/opening parenthesis)
041	051	029	00101001	)	(right/closing parenthesis)
042	052	02A	00101010	*	(asterisk)
043	053	02B	00101011	+	(plus)
044	054	02C	00101100	,	(single quote)
045	055	02D	00101101	-	(minus or dash)
046	056	02E	00101110	.	(dot)
047	057	02F	00101111	/	(forward slash)
048	060	030	00110000	0	
049	061	031	00110001	1	
050	062	032	00110010	2	
051	063	033	00110011	3	
052	064	034	00110100	4	
053	065	035	00110101	5	
054	066	036	00110110	6	
055	067	037	00110111	7	
056	070	038	00111000	8	
057	071	039	00111001	9	
058	072	03A	00111010	:	(colon)
059	073	03B	00111011	;	(semi-colon)
060	074	03C	00111100	<	(less than)

Decimal	Octal	Hex	Binary	Value	Description
061	075	03D	00111101	=	(equal sign)
062	076	03E	00111110	>	(greater than)
063	077	03F	00111111	?	(question mark)
064	100	040	01000000	@	(AT symbol)
065	101	041	01000001	A	
066	102	042	01000010	B	
067	103	043	01000011	C	
068	104	044	01000100	D	
069	105	045	01000101	E	
070	106	046	01000110	F	
071	107	047	01000111	G	
072	110	048	01001000	H	
073	111	049	01001001	I	
074	112	04A	01001010	J	
075	113	04B	01001011	K	
076	114	04C	01001100	L	
077	115	04D	01001101	M	
078	116	04E	01001110	N	
079	117	04F	01001111	O	
080	120	050	01010000	P	
081	121	051	01010001	Q	
082	122	052	01010010	R	
083	123	053	01010011	S	
084	124	054	01010100	T	
085	125	055	01010101	U	
086	126	056	01010110	V	
087	127	057	01010111	W	
088	130	058	01011000	X	
089	131	059	01011001	Y	
090	132	05A	01011010	Z	
091	133	05B	01011011	[	(left/opening bracket)
092	134	05C	01011100	\	(back slash)

Decimal	Octal	Hex	Binary	Value	Description
093	135	05D	01011101	]	(right/closing bracket)
094	136	05E	01011110	^	(caret/circumflex)
095	137	05F	01011111	_	(underscore)
096	140	060	01100000	`	
097	141	061	01100001	a	
098	142	062	01100010	b	
099	143	063	01100011	c	
100	144	064	01100100	d	
101	145	065	01100101	e	
102	146	066	01100110	f	
103	147	067	01100111	g	
104	150	068	01101000	h	
105	151	069	01101001	i	
106	152	06A	01101010	j	
107	153	06B	01101011	k	
108	154	06C	01101100	l	
109	155	06D	01101101	m	
110	156	06E	01101110	n	
111	157	06F	01101111	o	
112	160	070	01110000	p	
113	161	071	01110001	q	
114	162	072	01110010	r	
115	163	073	01110011	s	
116	164	074	01110100	t	
117	165	075	01110101	u	
118	166	076	01110110	v	
119	167	077	01110111	w	
120	170	078	01111000	x	
121	171	079	01111001	y	
122	172	07A	01111010	z	
123	173	07B	01111011	{	(left/opening brace)
124	174	07C	01111100	|	(vertical bar)

Decimal	Octal	Hex	Binary	Value	Description
125	175	07D	01111101	}	(right/closing brace)
126	176	07E	01111110	~	(tilde)
127	177	07F	01111111	DEL	(delete)

Appendix B:MUX

This appendix contains the following sections:

PREMUX State

Entry to State

- When the G24 powers up.

Exit from state:

- When the DTE sends the +CMUX command to the G24 to start the MUX stack and the G24 acknowledges with an OK response. (The MUX-Init state then begins.)

MUX-Init State

This state has two phases:

- The 1st phase is the very short period when the G24 is getting ready to communicate with the DTE over the MUX protocol.
- The 2nd phase is when the G24 is ready and is waiting for the DTE to begin using the MUX protocol by sending a special low-level byte sequence (SABM0 frame).

Entry to state:

- When the G24 receives the +CMUX command and returns a success response (OK).

Exit from state:

- If a timeout occurs due to the failure of the G24 to receive the SABM0 frame after a predefined interval. The G24 then returns to the PREMUX state. The interval is defined to 10 seconds.
- If the RS232 connection is closed, the G24 returns to the PREMUX state.
- After a SABM0 frame is received, the G24 moves on to the MUX state.

MUX State

Entry to state:

- When the G24 receives the SABM0 frame.

Exit from state:

- When the DTE requests the G24 to return to the PREMUX State.

Software Procedures Related to RS232 HW Lines

RI Hardware Line

- PREMUX state: There is no change to the current RI line behavior.
- MUX-Init state: The RI line becomes inactive.
- MUX state: There is no change to the current RI line behavior.

DCD Hardware Line

In MUX and MUX-Init states, the DCD is always inactive. This line is not used within the MUX.

DTR Hardware Line

The procedure upon DTR interrupt is dependent on the AT&D settings in PREMUX state (GRLC profile). In general, the DTR is always active.

If the PREMUX AT&D setting is 4 and the DTR is toggled while the G24 is in MUX or MUX-INIT state, the G24 will return to PREMUX state. Upon its return, the G24 will release any call (GPRS, CSD) except for a voice call.

Note: If the PREMUX AT&D setting was not 4, the G24 ignores the DTR without any operation. The AT&D4 will be supported in future releases.

G24 DTR Interrupt

When G24 changes its state from PREMUX to MUX-Init, the G24 will disable the DTR interrupt (since there is no need to use the DTR line) if its AT&D (of the GRLC profile) value is not 4.

When G24 changes its state to back to PREMUX, it re-enables its DTR interrupt.

DSR Hardware Line (Optional)

The DSR is always active in MUX state.

MUX UART Port Speed

Auto baud rate detection is disabled in the MUX. To set the UART baud rate, the G24 uses the <port speed> parameter in +CMUX command. If the parameter is absent, the MUX uses the same baud rate that was in PREMUX state.

Controlling the UART Port Speed Within MUX State

AT commands such as +CBAUD and +IPR change the virtual baud rate of an IDLC. The AT+CBAUD? or AT+IPR? commands display the virtual baud rate of the specific IDLC. The AT+CMUX? command returns the UART baud rate.

Basic Mode UART Software Flow Control

When the G24 enters MUX state or MUX-Init state and the requested mode is Basic, UART software flow control is disabled. If the AT&K command is set for software flow control, the G24 RS232 serial manager ignores the XON/XOFF characters. When the G24 returns to PREMUX state, it reads the GRS232CFG AT&K value and acts accordingly.

Advanced Mode UART Software Flow Control

When the G24 enters MUX-Init state and the requested mode is Advanced, UART software flow control can be used. The G24 acts according to the AT&K value.

Advanced mode ensures that unplanned XOFF/XON characters are not passed inside the MUX frames by the transparency mechanism.

If the MUX mode is Advanced and AT&K is set for software flow control, the XON/XOFF characters are detected and removed from the lower layers (UART, serial manager).

MUX Modes

The following table describes the differences between each mode in a non-ERM environment.

Table B-1: MUX Mode Differences

Feature	Basic Mode	Advanced Mode
Start flag	0xF9	0x7E
Close flag	0xF9	0x7E
Length field	Yes	No
Data transparency	No	Yes
Frame	UIH (or UI)	UIH (or UI)
Processing cost	Low	High
Recovery of synchronization	Slow	Quick

Note: The length is still required in the information field of the UIH frame.

Advance Mode Transparency Mechanism

There is a set of protected characters that cannot appear between the start and end flags. These characters are protected by the transparency mechanism within the following fields: address, control, information and FCS. This mechanism is detailed in the packing/unpacking subsections that follow.

Table B-2: Protected Characters

Protected Characters	Value	Encoded Value
Flag sequence (SOF, EOF)	0x7e	0x7d, 0x5e
Control escape	0x7d	0x7d, 0x5d
XON	0x11	0x7d, 0x31
XOFF	0x13	0x7d, 0x33

Advance Mode Frame Packing

The transmitter (referring to the sender of a frame) examines the frame between the opening and closing flag sequences (including the address, control and FCS fields) and, following completion of the FCS calculation, does the following:

- When encountering protected characters, complements the 6th bit of the octet (XOR with 0x20).
- Inserts a control escape octet immediately preceding the octet resulting from the above, prior to transmission.

Advance Mode Frame Unpacking

The receiver (referring to the receiver of a frame) examines the frame between the two flag octets. Upon receipt of a control escape octet, and prior to FCS calculation, it does the following:

- Discards the control escape octet.
- Restores the octet that immediately follows by complementing its 6th bit (XOR with 0x20).

MUX State Procedures

Valid channel indexes in MUX state are 0 to 4, where 0 is the index of the control channel and 1-4 are indexes of the information channels (IDLC).

The following table describes the basic procedures (Open/Close/Err) performed when the G24 is in MUX state.

Table B-3: MUX State Procedures

Procedure	Description
Unrecognized Frames/Invalid Frames	The G24 ignores unrecognized and invalid frames.
SABMi Reception – Channel Establishment	Upon receiving a SABMi frame (i = channel index), the G24 checks whether i is within the valid range and is not already established. It them tries to establish the new channel. If the G24 succeeds, it sends a UA frame. If it is not successful, it sends a DM frame.
DISCi Reception – Disconnect Channel	Upon receiving a DISCi frame (i = channel index), the G24 checks whether i is within the valid range and represents an open channel. If so, the G24 attempts to close the channel. If the G24 is successful, it sends a UA frame. If it is not successful, it sends a DM frame. Closing a channel hangs up any active CDSs. However, active voice calls are not hung up, even after the IDLC is closed. Any other AT command can continue to control the voice call.

Table B-3: MUX State Procedures (Cont.)

Procedure	Description
DISC0 Reception – Close MUX	Upon receiving a DISC0 frame, the G24 checks for any open IDLCs. If the only open channel is the control channel, the G24 sends a UA frame to the DTE, returns to PREMUX state (command mode) and sends an OK to the DTE. If there are any open information channels, or if the G24 cannot return to PREMUX state, it sends a DM frame to the DTE. **Note:** After opening the MUX, it should remain open until the G24 is powered down. A close procedure is also supported on the MUX, which enables you to close the MUX, return to PREMUX, and then open the MUX again. Because of this basic concept, you should avoid programming DTE applications to open and close the G24 MUX frequently.
CLD Command – Close Down	Upon receiving a CLD frame, the G24 checks whether there are any open IDLC frames. If the only open channel is the control channel, the G24 sends a UA frame to the DTE, returns to PREMUX state (command mode) and sends an OK to the DTE. If there are any open information channels, or if the G24 cannot return to PREMUX state, it sends a DM frame to the DTE. **Note:** This option will be supported in future releases.

UIH Frames

Unnumbered information (UIH) frames contain only a Header checksum. There are two types of UIH frames:

- Data transfer frames destined to a specific IDLC channel. The G24 MUX distributes the data inside the UIH frame to the relevant IDLC.
- Control frames being sent between the two MUX control channels. Upon receiving a UIH frame, the G24 acknowledges by by sending back the same frame to the DTE with the c/r bit changed.

Test UIH Control Frames

Upon receiving a Test frame, the G24 sends back a test frame response to the DTE. This test mechanism lets the DTE "know" that the G24 MUX is communicating.

MSC UIH Control Frame – Virtual Channel V.24 signals

The MSC frame reflects the current IDLC v.24 signal status. The G24 stores eight statuses for each established IDLC. The signals are divided into two groups:

- M_FC, RI, DCD, CTS, DSR
- D_FC, RTS, DTR

A change in the status of the first group of signals can be made only by the G24. A change in the status of the second group of signals can be made by a specific channel in DTE (IDLC).

When a change is made by the G24 to the status of any of the first group of signals in an IDLC, it sends an MSC frame to the DTE with the new status, as follows:

- **M_FC** – When a G24 IDLC is unable to accept framed messages from the DTE, it changes its M_FC bit to OFF. The G24 then sends an MSC frame with the FC bit set to 0 to the relevant IDLC. When the IDLC is able to accept frames again, it changes its M_FC bit to ON. The G24 then sends an MSC frame with the FC bit set to 1 to relevant the IDLC. By default the M_FC bit is set to 1.
- **RI** – When an IDLC receives an incoming call alert, it updates the RI signal value, similar to what is done in GRLC. The G24 sends the MSC "RI on" frame, followed 1 second later by an MSC "RI off" frame, followed 4 seconds later by another "RI on" frame. This pattern repeats until the incoming call alert is halted.
- **DCD** – Each IDLC changes its virtual DCD according to its specific &C setting (like in GRLC). Upon a change in an IDLC DCD status, the G24 sends the MSC DCD frame. This change in DCD status may is dependent on a change to an &C value.
- **CTS** – The G24 will NOT change its CTS signal status value in any case. The IDLC CTS signal value will always be 1 (ON).
- **DSR** – When an IDLC is opened via the SABMi command, the G24 sends an MSC frame to the DTE. In this MSC frame the DSR bit is set to ON. When an IDLC is closed via the DISCi command, the G24 sends an MSC frame to the DTE. In this MSC frame, the DSR bit is set to OFF.

Note: The first MSC frame sent from G24 to a specific IDLC after a SABMi command keeps its default values, which are: "M_FC on", "RI off", "DCD off", "CTS on" and "FC on".

When a change is made by a DTE-specific IDLC to the status of any of the second group of signals, it sends an MSC frame to the G24 with the new status, as follows:

- **D_FC** and **RTS** – When a DTE IDLC is unable to accept framed messages, it sends an MSC frame with the FC bit set to 0 to the relevant G24 IDLC. Upon receiving such a frame, the IDLC stops data transmission. When the DTE IDLC is able to accept frames again, it sends an MSC frame with the FC bit set to 1 to the relevant IDLC. By default, the M_FC bit is set to 1.
- **DTR** – The G24 passes on to the relevant IDLC the change in its DTR signal. The IDLC reacts to the DTR change according to its AT&D setting (like in GRLC). When an IDLC has its DTR set to OFF, no AT command or data will be conveyed to or from it.

Notes:
- The reception or sending of MSC frames does not affect the G24 hardware RS232 pins.
- The difference between CTS/RTS bit and the FC bit is as follows: FC bit reflects the ability to accept any frames (data and control) while CTS/RTS reflects the ability to accept data frames only.

UIH Control Frame – Aggregate Flow Control

The following table describes the flow control frames sent by the G24 to handle the aggregate flow.

Table B-4: UIH Flow Control Frames

Frame	Description
Send FCoff	When the buffers reach their threshold, the G24 cannot receive additional information, and therefore it transmits the FCoff command. Once this command is sent, the DTE cannot transmit frames except on the control channel (DLC=0).
Send FCon	When the buffers become available, enabling the G24 to receive new information, it transmits this command.
Receive FCoff	When the G24 receives an FCoff frame, it stops transmission of IDLC frames and sends a response frame.
Receive FCon	When the buffers become available, the DTE sends an FCon frame to the G24. The G24 sends a response frame and starts IDLC transmission.

MUX Customer Packet

MUX Customer Open Source Code Packet

Each of the following points represents an API user interface:

- **Point 1:** The RX data is generated by the user ISR. At this point, the data is unpacked and dispatched to the correct API TS0710_rx_handler_api channel.
- **Point 2:** The MIP either generates or triggers an API function for each TS0710_DLC_APP_rx_handler_api() channel.
- **Point 3:** The user wants to send data from the API TS0710_application_send_data channel.
- **Point 4:** The MIP either generates or triggers an API function for sending the API USER_tx_service() frame TX.
- **Point 5:** The Manager is used to close the MUX, open the MUX, and for testing (echo, ping).

The following figure illustrates a MUX user packet, which has a maximum of four virtual channels.

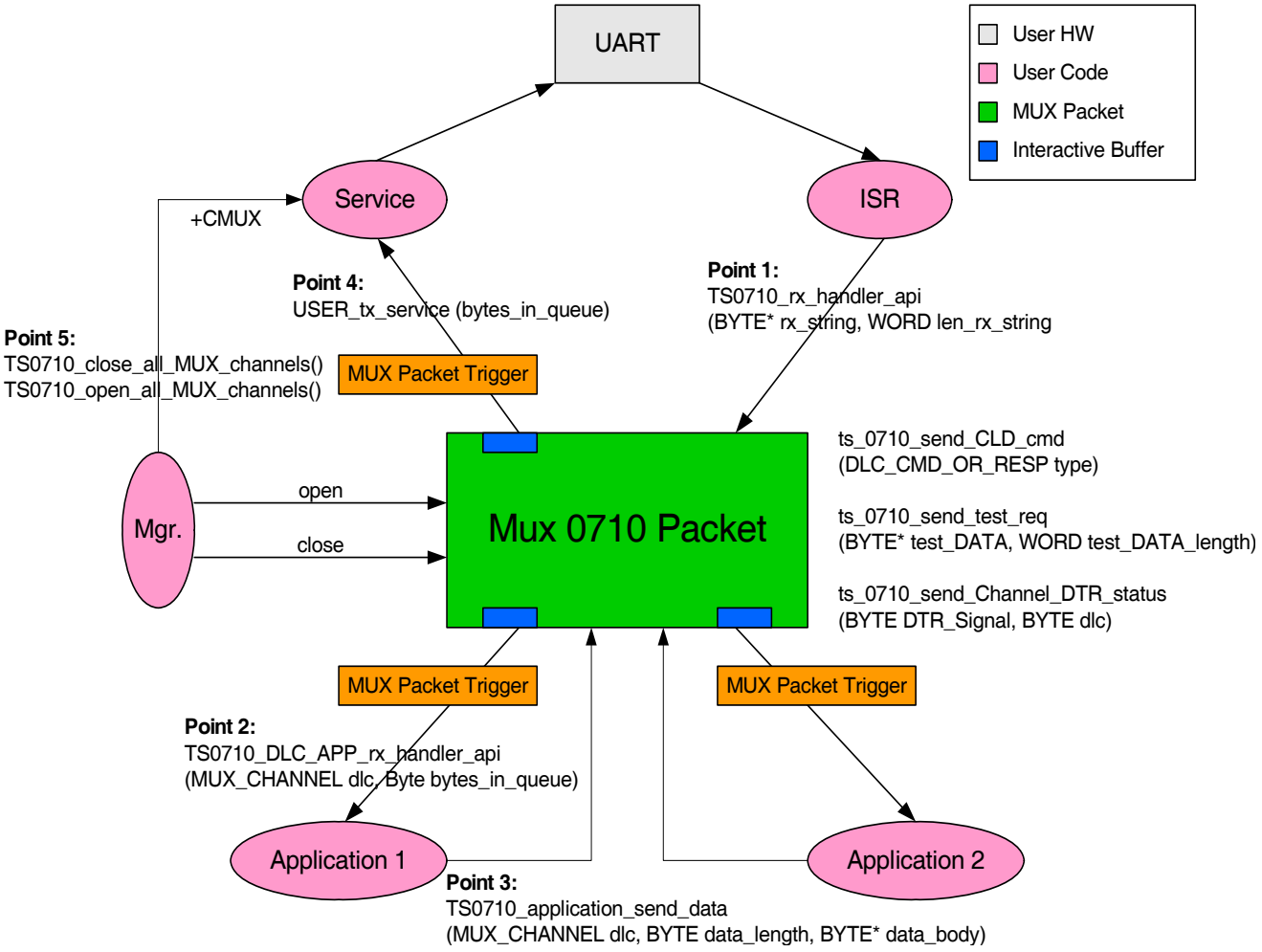


Figure B-1: MUX Integration Packet

APIs

There are five API user integrations, as follows:

- Open service
- Close service
- Sending Data service
- Receiving Data service
- MUX service test, MSC, FC and so on (refers only to the control channel)

Open Service

The API Open Service MIP and MUI procedures are as follows:

- MIP: Use API TS0710_open_all_MUX_channels().
- MUI:

1. Send establish for control channel (27.010 SABM command frame for Channel 0).
2. Wait for ACK (27.010 UA command frame).
3. Send up to four establish command frames for the data channels (27.010 SABM command frame for Channel 1).
4. Wait for ACK frames (27.010 UA command frame).

Close Service

The API Close Service MIP and MUI procedures are as follows:

- MIP:

1. Use API TS0710_close_all_MUX_channels().
2. Wait for all ACKs (27.010 UA command frame).

- MUI:

1. Send release for last opened information channels (27.010 DISC command frame for Channels 1-4).
2. Wait for ACK (27.010 UA command frame).
3. Send release for control channel (27.010 DISC command frame for Channel 0) or 27.010 CLD command frame.
4. Wait for ACK (27.010 UA command frame).

Sending Data Service

The API Sending Data Service MIP and MUI procedures are as follows:

- MIP: Use API TS0710_application_send_data (MUX_CHANNEL dlc, BYTE data_length, BYTE *data_body).
- MUI: Use UIH frame with the data encapsulated for sending Channel 1-4 data.

Receiving Data Service

The API Receiving Data Service MIP and MUI procedures are as follows:

- MIP:

1. Use API BYTE TS0710_rx_handler_api (BYTE* rx_string, WORD len_rx_string) for unpack frames.
2. Use TS0710_DLC_APP_rx_handler_api (MUX_CHANNEL dlc,BYTE bytes_in_queue) for reading the arrival data from the channel buffer void.

- MUI: Create data unpack.

MUX Service Test

Includes MSC, FC, and so on (all to control channel). For the following service functions, refer to Figure B-1

- MIP:

1. Void ts_0710_send_CLD_cmd (DLC_CMD_OR_RESP type).
2. Void ts_0710_send_test_req (BYTE* test_DATA, WORD test_DATA_length).
3. Void ts_0710_send_Channel_DTR_status (BYTE DTR_Signal, BYTE dlc).
4. Void ts_0710_send_test_req (BYTE* test_DATA, WORD test_DATA_length).

MUX Open Service

To open the MUX service:

1. Send the AT+CMUX command to the G24 for initiation of the GSM 27.010 protocol.
2. Wait for the OK response.
3. Open the MUX within ten seconds (otherwise, the G24 will exit the MUX mode and revert back to PREMUX state).

A maximum of five channels can be opened: One channel for control, and four channels for information. Currently there is no service type limitation regarding the information channels. That is, AT commands, GPRS, Voice, Data, and Fax services can go through each of the information channels when only one simultaneous session/call can be established. AT commands from all channels are always allowed.

A minimum of two channels must be opened: The control channel, and data channel.

MUX Close Service

To close the MUX service:

1. Close all CSD/GPRS connections.
2. Close all data channels (DLC - DLC4).
3. Close MUX, or channel 0 (DLC0), or toggle the hardware DTR signal (to be implemented in future releases).

Data Transfer

After all the MUX channels are opened, the user can send and receive data over the four virtual channels (Channels 1 to 4). The user can also send and receive MUX command data on the control channel (DLC0), as when testing for an echo.

Acronyms and Abbreviations

Abbreviation	Full Name
A	
ACCH	AT Command Channel - Used for AT-commands, TCP/IP, Internal-GPRS session, Voice-Call, and SMS applications
AOC	Advice of Charge
APN	Access Point Name
ASCII	A standard seven-bit code character set
ATA	AT command for call answer
ATD	AT command for call originating
ATH	AT command for Hanging-up a call
ATO	AT command to return to Data mode after temporarily exiting by ESC
B	
BM	Broadcast Message
C	
CB	Cell Broadcast
CBM	Cell Broadcast Message
CDS	Call Data Services (External-GPRS session, CSD session, FAX session)
CSD	Circuit-switched Data
CSNS	Single Numbering Call Scheme
CTS	Clear to Send
CTS	RS232 pin used for HW flow control. The MGOM uses this pin to stop data transmission from the DTE (on the TXD pin).
D	
DA	Destination Address
DCD	Data Carrier Detect
DCE	Data Communication Equipment (G24)
DCSs	Data Coding Schemas
DLC	Data Link Connection
DLC0	The multiplexer control channel.
DLCI	Data Link Connection Identifier
DSP	Digital Signal Processor
DSR	Data Set Ready
DSR	MGOM is ON and ready to communicate with the DTE device.
DT	Discharge Time
DTE	Data Terminal Equipment (such as terminals, PCs and so on). Also called Application Processor (AP).

Abbreviation	Full Name
DTMF	Dual-Tone Multi-Frequency
DTR	Data Terminal Ready
E	
EF	Elementary Files
EONS	Enhanced Operator Name String
ERM	Error Recovery Mode
ESC	Exit to Command Mode from Data Mode (usually the +++ sequence)
ETSI	European Telecommunication Standards Institute
F	
FCC	Federal Communications Commission (U.S.)
FO	First Octet
FTA	Full Type Approval
G	
GCF	GSM Certification Forum
GGSN	Gate GPRS Support Node
GPIO	General Purpose Input/Output
GPRS	General Packet Radio Service
GR232CFG	The real RS232 HW lines configuration (in PREMUX).
GRLC	General RS232 Logical Channel - This channel can handle the 07.07/07.05 AT command set (CSD, FAX, GPRS, Voice, Network AT, and so on.)
GSM	Global System for Mobile Communications
H	
HCO	Hearing Carry Over allows Speech Disabled callers who can hear well on the telephone to listen directly to the person they are talking with. The Speech Disabled Relay user types his or her part of the conversation on a TTY. A Communication Assistant (CA) then speaks the typed conversation, word for word, to the standard telephone user.

Abbreviation	Full Name
I	
IC	Integrated Circuit
ID	Identification
IDLC	Information DLC - refers to all the data channels except the control channel.
IMEI	International Mobile Equipment Identification.
ISR	Interrupt Service Routine
ITU	International Telecommunication Union
L	
LCA	Low Cost Architecture
M	
MCC/MNC	Mobile Country Code / Mobile Network Code
ME	Mobile Equipment
MGOM	Motorola G24/g21 GSM OEM Modem, also called Base Band processor.
MIDs	Message IDs (Channels)
MO	Mobile Originated - sets up a call session.
MR	Message Reference
MT	Mobile Terminated - accepts a call session.
MUX	Multiplexer entity
O	
OA	Origination Address
OEM	Original Equipment Manufacturer
P	
P2K	Platform 2000
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PDN	Packet Data Network
PDU	Packet Data Unit
PID	Protocol Identifier
PPP	Point-to-Point Protocol

Abbreviation	Full Name
Q, R	
QoS	Quality of Service
RA	Recipient Address
RI	Ring Indicator
RTS	Request To Send
RTS	RS232 pin used for HW flow control. The DTE uses this pin to stop data transmission from the MGOM (on the RXD pin).
RXD	DTE received data from MGOM.
S	
S-register	Software Resister
SC	Service Center
SCA	Service Center Address
SCTS	Service Center Time Stamp
SIM	Subscriber Identity Module
SM	Short Message
SMS	Short Message Service
SN	Serial Number
ST	Status
SW flow control	ISO/IEC 646 SW flow control (the DC1/XON and DC3/XOFF control characters).

Abbreviation	Full Name
T	
TBD	To Be Defined
TDMA	Time Division Multiple Access
TE	Terminal Equipment
TODA	Type of Destination Address
TOOA	Type of Origination Address
TORA	Type of Recipient Address
TOSCA	Type of SCA
TTY	Tele Typewriter
TXD	DTE transmit data to MGOM
U	
UA	Unnumbered Acknowledgement
UIH	Unnumbered Information, with Only Header Checksum
USB	Universal Serial Bus
V	
VCO	Voice Carry Over. This is available for people who cannot hear but are able to speak clearly. During a VCO relay call, the Deaf or Hard of Hearing caller speaks directly to the person they are conversing with. When that person responds, a Communication Assistant (CA) types back exactly what is said to the screen of the TTY or VCO phone.

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