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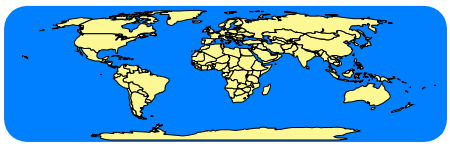
Personal Networks Group



Motorola Applications Global Network (MAGNET)

The Hayes AT Command Set

With

Motorola Handsets

(Standard Commands)

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1 Introduction

The purpose of this manual is to be a guide to standard AT commands for GSM Mobile Equipment and commands available for the Motorola handsets for use by Motorola Customers both internal and external. It is a basic reference to the usage of the AT command set of the Communicate GSM data adapters of Motorola handset variants, and is one of the family of Motorola device Command Set documents, the other members of which are:

HATC TS002: Fax Command Set
HATC TS003: GPRS Command Set.

1.1. Command Entry

There are a few rules about the entry of commands:

All commands (apart from A/ and +++) start with AT or at. The commands in a command string (apart from A/ and +++) are executed only after the return or enter key is pressed.

Use all upper or lower case letters, not a combination.

The maximum number of characters in a command string is 128. Multiple commands can be concatenated onto a single command line.

The backspace or delete keys can usually perform command editing.

If a parameter is missed from a command, a zero is implied. e.g. ATH implies ATH0.

Spaces can be entered into a command string to increase clarity.

Ctrl-x can be used to abort a command line input.

2 Compatibility

Some commands listed will have the phrase "***GSM - no action, compatibility only***" written after them. This is because the command is accepted in the same fashion as other Communicate modems but has no effect either because it has no meaning in the GSM environment or may need to be included in future developments of the product family.

3 Alphabetic Listing of Industry Standard AT Commands

3.1. AT Commands

AT This is the prefix for all commands except A/ and +++. When entered on its own, the data adapter will respond "OK".

A/ Repeat the last command issued to the data adapter unless the power was interrupted or the data adapter reset. A/ is not followed by CR.

+++ The escape sequence to transfer from Data Mode to Command Mode without disconnecting from the remote data adapter. After a pause the data adapter will respond with OK. Register S2 can be used to alter the escape character from +, the factory default, to any hexadecimal value in the range 0 to 255.

A Answer immediately. This causes the data adapter to answer the inbound call.

Bn Selects the communications standard used by the data adapter.
GSM - no action, compatibility only. Any value for n accepted.

Cn Carrier control.
GSM - no action, compatibility only. Only n=1 accepted.

D Dial command. The dial command causes the data adapter to enter originate mode and act as an auto dialler for connection to other data adapters or fax machines. The usual format is ATDnx..x where n is a Dial Modifier and x is a number. The following are valid numbers: 0123456789*#ABC. Dial modifiers are used to alter the manner in which the data adapter dials:

L Redial last number.
P Use pulse dialling.
GSM - no action, compatibility only.

S=n Dial stored telephone number n (0-3), previously stored using the &Zn=x..x command.
T Use tone dialling.
GSM - no action, compatibility only.
+ International dialling prefix. Allows the international access code to be omitted from dial string.

Any character received from the DTE during the call establishment phase is will cause the call attempted to be terminated.

En Echo command characters.
0 Characters are not echoed to the DTE.
1 Characters are echoed to the DTE (default).

Fn Select line modulation standard.
GSM - no action, compatibility only. Allowed values for n are 0, 1, 3, 4, 5, 6, 7, 8, 9 and 10.

Hn Hook switch control. This command is used to clear a connection.
0 Place the data adapter on hook.

In Identification. Requests the data adapter to display information about itself.

0 "960"
1 "000"
2 "OK"
3 Microcode revision level
4 Product description
5 "016"
6 Hardware specification

Ln Loudspeaker volume.
GSM - no action, compatibility only. Allowed values for n are 0, 1, 2 and 3.

Mn Speaker control. Note that serially connected products have no speaker.

0 Speaker turned off
1 Speaker on until a carrier is detected (default)
2 Speaker always on
3 Speaker off during and after dialling and on during answering until carrier is detected

Nn Automode enable. Selection of the line modulation method.
GSM - no action, compatibility only. Any value for n is accepted.

On Enter data mode. This is used to return to data mode using an existing connection. If there is no connection an error is reported.

0 Switch from command mode to data mode.
(Any value for n accepted).

P Set pulse dial.
GSM - no action, compatibility only.

Qn Data adapter responses.
0 Data adapter responses are sent to the DTE (default).
1 Data adapter responses are NOT sent to the DTE.

Sr Read from or write to an S register.

r? Read the value of register r.
r=x Set the value of register r to x, x is a decimal value in the range 0 to 255.

T Set tone dial.
GSM - no action, compatibility only.

V Defines the response format of the data adapter, which may be either numeric or textual.

0 Numeric responses.
1 Textual responses (default).

Wn Error correction message control.

0 Upon connection the data adapter reports the DTE speed (default).
1 Upon connection the data adapter reports the line speed, the error correction protocol and the DTE speed in that order.
2 Upon connection the data adapter reports the DCE speed.

Xn Defines the response set used by the data adapter.

0 OK, CONNECT, RING, NO CARRIER, NO ANSWER and ERROR.
1 As X0 plus CONNECT x, where x is the DTE speed.
2 As X1 plus NO DIALTONE.
3 As X2 plus BUSY.
4 As X3 plus CARRIER x, PROTOCOL: and COMPRESSION:, where x is the line speed (default).

Yn Long space disconnect.
GSM - no action, compatibility only. Any value for n is accepted.

Zn Reset the data adapter to a user stored configuration.

0 Restores user configuration 0.
1 Restores user configuration 1.

3.2. AT& Commands

&Cn Determines the data adapter control of DCD behaviour.

0 DCD is forced on at all times.
1 DCD indicates the connection status (default).

&Dn Data adapter reaction to DTR signal.

0 DTR transitions are ignored.
1 Data adapter returns to command mode, without dropping the line, after a ON to OFF DTR transition.
2 Data adapter hangs up, inhibits auto-answer and returns to command mode after a ON to OFF DTR transition (default).
3 Data adapter resets and returns to command mode after a ON to OFF DTR transition.

&Fn Recall factory defaults.

&Gn Select guard tone.
GSM - no action, compatibility only. Any value for n is accepted.

&Jn Telephone jack control.
GSM - no action, compatibility only. Allowed values for n are 0 and 1.

&Kn This command defines the flow control method between the DCE and DTE.

0 Disables flow control.
3 Enables RTS/CTS flow control (default).
4 Enables XON/XOFF flow control.
5 Enables XON/XOFF flow control.
6 Enables both RTS/CTS and XON/XOFF flow control.

&Ln Leased line operation.
GSM - no action, compatibility only. Any value for n is accepted.

&Mn Asynchronous/synchronous mode selection.

0 Selects normal asynchronous operation. (See &Q0).

&Pn Select pulse dial make/break ratio.
GSM - no action, compatibility only. Allowed values for n are 0, 1, 2 and 3.

&Qn Selects asynchronous mode.

0 Normal asynchronous operation (no error correction).
5 Error corrected operation (default).
6 Same as 0.

&Rn Selects how the data adapter controls CTS.
GSM - no action, compatibility only. Allowed values for n are 0 and 1.

&Sn Defines the behaviour of DSR.

0 DSR always active (default).
1 Same as 0.

&V View the current active configuration and stored profiles.

&Wn Store the active profile in memory. This is used to store user configurations for later use.

0 Store current (active) configuration as profile 0.
1 Store current (active) configuration as profile 1.

&Xn Select synchronous clock.
GSM - no action, compatibility only. Any value for n is accepted.

&Yn Select profile for use after reset or power-up.

0 Select profile 0 (default).
1 Select profile 1.

Zn=x Store a telephone number x in location n. n = 0-3, x is up to 36 digits and can include all the dial modifiers described in the ATD section. To dial the number use the ATDS=n command.

3.3. AT\ Commands

\An Select maximum MNP block size. The adapter will operate an MNP error corrected link using a maximum transmit block size controlled by the parameter supplied.

0 64 characters.
1 128 characters.
2 192 characters.
3 256 characters (default).

\Bn Transmit break to remote. Any value for n is accepted. This command has no effect.

\Gn Set the use of XON/XOFF flow control between data adapters in normal mode. Accepted values for n are 0 and 1. This command has no effect.

\Jn Enable DTE auto rate adjustment.
GSM - no action, compatibility only. Allowed values for n are 0 and 1.

\Kn Break control. Any value for n is accepted. This command has no effect.

\Nn Defines the link type used.

0 Standard operation, no error correction.
1 Same as 0.
2 Reliable MNP operation. Failure to negotiate an error corrected link results in the data adapter hanging up.
3 Auto-reliable operation: MNP operation if the remote data adapter is MNP compatible, standard if not (default).
4 Same as 3.
5 Same as 2.

\S Show the status of the commands and S-Registers in effect.

3.4. AT% Commands

%Cn Enable/disable data compression. Data compression can only be performed on an error corrected link. Data compression is not currently available on non-transparent connections.

0 Disables data compression.
1 Enable MNP5 data compression.
2 Enable V42bis data compression.
3 Enable both MNP5 and V42bis data compression (default).

%En Enable/disable auto retrain.

GSM - no action, compatibility only Allowed values for n are 0 and 1.

%R Displays all the S registers is the system.

3.5. AT+C Commands

The following commands are described more fully in the ETSI specification GSM 07.07.

+CBST=x,0,y Set the bearer service type.

x takes the following values:

0 Autobauding

(non-transparent only).

1 300 bps V.21.
2 1200 bps V.22.
3 1200/75 bps V.23.
4 2400 bps V.22bis.
5 2400 bps V.26ter.
6 4800 bps V.32.
7 9600 bps V.32
65 300 bps V.110.
66 1200 bps V.110.
68 2400 bps V.110.
70 4800 bps V.110.
71 9600 bps V.110.

y takes the following values:

0 Transparent connection (default).
1 Non-transparent connection (uses RLP).

+CBST? Query the bearer service type. The response is in the form:

+CBST: x, 000, y

+CR=x Set service reporting.

x takes the following values:

0 Disable reporting (default).
1 Enable reporting.

Service reporting result codes take precedence over and replace those which are normally given as a consequence of the settings of the X and W commands. The supported result codes are:

+CR: ASYNC Asynchronous transparent
+CR: REL ASYNC Asynchronous non-transparent

+CR? Query service reporting. The response is in the form:

+CR: x

+CRC=x Set cellular result codes.

x takes the following values:

0 Disable cellular result codes (default).
1 Enable cellular result codes.

The cellular result codes are presented in place of the incoming call RING result code. The supported cellular result codes are:

+CRING: ASYNC Asynchronous transparent
+CRING: REL ASYNC Asynchronous non-transparent
+CRING: FAX Facsimile

+CRC? Query cellular result codes. The response is in the form:

+CRC: x

+CMEE? Query mobile equipment error reporting level. The response is in the form:

+CMEE: x

+CRLP=w,x,y,z

Set the radio link protocol parameters, where w is 61, x is 61, y is 48 and z is 6. In other words only the default values may be set.

+CRLP? Query current radio link protocol parameters. The response is in the form:

+CRLP: w,x,y,z

The negotiated values are reported if queried during a connection.

+CPAS Query phone activity status. The response is in the form:

+CPAS: x

where x can take the following values:

0 Ready.
1 Unavailable.

+CGMI Query phone manufacturer.

+CGMM Query phone model.

+CGSN Query phone serial number.

+CGMR Query phone revision.

+CSTA=x Set type of address, where x is the desired type of address (see GSM 04.08 subclause 10.5.4.7). Typical values for x are:

129 Type of number unknown (default).
145 International number.

Using this command causes registers S47 and S49 to be set.

+CSTA? Query type of address. The response is in the form:

+CSTA: x

and is constructed by combining the contents of registers S47 and S49.

+CEER Query extended error report. Converts the call failure cause code stored in register S42 into plain English. An example response is:

+CEER: bearer service unavailable

4 S-Registers

S-registers allow control over specific data adapter operations. Some contain a numeric value, others are bit mapped. When bit mapped, each bit of the register controls a specific function: for further details refer to the glossary. The registers are described by the register number, the range of values which can be entered and the default value.

Register Number	Range	Default	Description
S0	0-255	0	Auto-answer. Assigning a value from 1 to 255 in register S0 tells the data adapter how many rings that must occur before it can automatically answer incoming calls. The factory setting of 0 turns off the automatic answer feature.
S1	0-255	0	Ring count (read only)
S2	0-255	43	Escape code character
S3	0-127	13	Carriage return character
S4	0-127	10	Line feed character
S5	0-32	8	Backspace character
S6	0-255	4	Wait for dial-tone. ***GSM - no action, compatibility only***
S7	0-255	50	Wait time for carrier. Register S7 tells the data adapter how many seconds to wait for a remote data adapter's carrier signal before hanging up. The register value can be increased if the data adapter does not detect a carrier within the specified time. If the data adapter 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.
S8	0-255	4	Pause time for comma. ***GSM - no action, compatibility only***
S9	0-255	6	Carrier detect response time. ***GSM - no action, compatibility only***
S10	0-255	14	Carrier loss time. The time the adapter will wait, in tenths of a second, before acting on a change in state of line carrier (as conveyed in the V.110 or L2R status bits).
S11	0-255	0	DTMF tone duration. ***GSM - no action, compatibility only***
S12	0-255	40	Time, in 50ths of a second, until OK displayed after entering command mode by escape sequence.
S14	0-255	170	Bitmap register where bit 1 reflects the En setting, bit 2 reflects the Qn setting and bit 3 reflects the Vn setting.
S21	0-255	48	Bitmap register where bits 3 and 4 reflect the &Dn setting and bit 5 reflects the &Cn setting.
Register Number	Range	Default	Description

S22	0-255	246	Bitmap register where bits 2 and 3 reflect the Mn setting and bits 4, 5 and 6 reflect the Xn setting.
S23	0-255	27	Bitmap register where bits 1, 2 and 3 reflect the DTE baud rate and bits 4 and 5 reflect the DTE parity (serially connected products only).
S25	0-255	5	Sets length of time in hundredths of a second that a change in the DTR status has to persist for before it is recognised.
S27	0-255	9	Bitmap register where bits 0, 1 and 3 reflect the &Qn setting.
S31	0-255	0	Bitmap register where bits 2 and 3 reflect the Wn setting.
S36	0-255	7	Bitmap register where bits 0, 1 and 2 reflect the \Nn setting.
S39	0-255	3	Bitmap register where bits 0, 1 and 2 reflect the &Kn setting.
S40	0-255	192	Bitmap register where bits 6 and 7 reflect the \An setting.
S41	0-255	3	Bitmap register where bits 0 and 1 reflect the %Cn setting.
S95	0-255	0	Bitmap register for extended result codes (overrides Wn setting). 0 = CONNECT shows DCE speed 1 = Add ARQ to CONNECT 2 = Enable CARRIER XXXX 3 = Enable PROTOCOL: XXXX 5 = Enable COMPRESSION: XXXX

4.1. GSM Specific S-Register Extensions

Register Number	Range	Default	Description
S15	0-255	10	For serially connected products only, sets the number of seconds after DTR drops that the self power down sequence is entered. A value of zero disables power down.
S24	0-255	0	For PC Card products, sets the number of idle seconds needed prior to power saving measures beginning.
&k	0-255	7	Copy of +CBST parameter x.
S42	0-255	0	GSM Call clearing code as returned by the network. Refer to GSM 04.08 Table 10.86 Cause Information Element Values
S43	0-255	0	Bitmap register: 2 = +CMEE setting 3 = +CMEE setting 5 = +CBST parameter z setting 6 = +CRC setting 7 = +CR setting
S47	0-4	0	Type of Number being called : 0 = Unknown 1 = International 2 = National 3 = Network Specific 4 = Dedicated PAD
S49	0-5	1	Numbering Plan of called number : 0 = Unknown 1 = ISDN/Telephony 2 = Data 3 = Telex 4 = National 5 = Private

5 Glossary

Asynchronous

A serial data transmission method that uses Start and Stop bits to synchronise reception.

AT Commands

A group of commands that can be sent by a terminal or host computer to control the Data Adapter in Command mode.

Baud

One signalling element per second. This is a measure of the signalling rate on the telephone line. It should not be confused with Bits Per Second (bps) which can differ from the Baud rate.

Bit Mapped Registers

Bit mapping is a technique that allows a single S-Register to hold up to 8 binary variables e.g.:

Reg	*Type*	*Val*	*DefaultFunction*
S14	Bit Mapped	170	Register S14 is a bit-mapped register and provides the following functions: Bit 0 Reserved Bit 1 Echo commands to DTE Bit 2 Responses Bit 3 Word or number responses Bit 4 Reserved Bit 5 Dialling method Bit 6 Reserved Bit 7 Answer/Originate operation

CTS

(V.24 Signal) Clear To Send. This signal is normally used in controlling the flow of data TO the data adapter.(See RTS)

DCD

(V.24 Signal) Data Carrier Detect. This is a signal from the data adapter which indicates that the two ends are connected for data transfer.

DCE

Data Communications Equipment, i.e. a data adapter.

DSR

(V.24 Signal) Data Set Ready. This signal, from the data adapter, indicates the readiness of the card to receive data.

DTE

Data Terminal Equipment, such as a dumb terminal, or a PC running communications software.

DTR

(V.24 Signal) Data Terminal Ready. A signal from the host system to the data card. Can be used to terminate calls.

ETSI

European Telecommunications Standards Institute.

GSM

Global System for Mobile communications.

Modem

Modulator / DEModulator. A device used to convert digital signals to analogue signals and vice versa for transmission and reception of telephone lines.

XON/XOFF

A standard method of controlling the flow of data to and from a data adapter to prevent overflow/overrun conditions.

END OF DOCUMENT
