

GSM Modem

XM1510S Quick Start Manual

AT Commands Short Form

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1. First steps first

1.1 Checklist for first Tests

STEP	Instruction
1	Test SIM-card with a handy, decide if you want to use a PIN-code or not and note it.
2	Connect Hardware (5V-supply, RS-232-interface with 5V-levels, Antenna, SIM-card)
3	Set serial-port baud-rate of DTE to 115200 baud, 8n1, hardware-handshake (Soft-handshake not supported). The module should react already to AT-Commands, even if it is not connected to a network. If it is not reacting, try also 9600 baud. After getting responses from modem, set it to autobaud with 'AT+IPR=0' and store the setting with 'AT&W'.
4	If no SIM-PIN-code is needed, the module should be connected to the network some seconds after power-up. (With the command 'AT+CPIN?' you can test if the Module requires PIN. Response 'SIM PIN' for yes, 'READY' for no.) If a PIN is used, enter it with 'AT+CPIN="..."'. The module answers with 'OK' and connects to network. It uses the providers in the 'preferred-operators-list' (see AT commands interface guide).
5	Check the connection status of the modem. It can be seen by the flashing LED (Pin 29 of Socket) and the response "+CREG: 1,1" (After issuing the command 'AT+CREG=2').
6	The reception-quality can be seen with 'AT+CSQ'. A reception level of at least 10 to 15 is needed for safe operation.
7	Configure the module for your needs (baud rate, information commands etc., see below) Set data-mode to V110 9600 baud with 'AT+CBST=71,0,1' and configure the other side of communication to the same. Set 'ATS0=2' at the other side.
8	Call the other side by 'ATD.....'.
9	If the other side calls you, set 'ATS0=2' before, so the module will answer after 2 rings.
10	For a test-voice-call, you could call a telephone or a portable phone with 'ATD....;' (Semicolon for voice mode). A headset can be connected to the module to speak to the other side.
11	Send an SMS to a portable. See following example: AT+CMGS="0764359988" <CR> Call me today <ctrl-Z>
12	Send DTMF tones to a phone. 'AT+VTS=1' sends digit '1'. Only one digit can be transmitted with this command, so you have to repeat it to send longer numbers.

1.2 Initialisation-Steps:

The AL7024S can store a set of parameters (please see also command "AT&W" in the "AT command manual"). The RS232 interface parameters can also be stored. Our Socket Modems AL7024S are preset to "AT+IPR=115200" baud rate". You should think about the initialisation-steps that should be made every time the AL7024S is powered-up. For details see also chapter 5.2 in the "Developer's Guide".

- Power-up the AL7024S Socket-Modem
- Pull-down the Reset-pin for at least 800ms.
- Eventually adjust RS232-parameters.
- Send "AT" to modem and wait for response.
- If SIM-Pin is required, enter it with AT+CPIN="xxxx"
- Configure the modem to your required application:

Examples:

AT+CMEE, AT+CR, AT+CRC, ATV, AT+CREG, AT+CGREG.

(AT+CREG indicates Network-status).
Set default-storage for phone book and SMS.

For using Microphone- and Speaker-pins, you should set:

AT+MAPATH=1,2 / AT+MAPATH=2,2,1

- For data connections the following commands / parameters are always needed:

AT+CBST	→ for protocol-selection
AT+MIPCALL	→ for TCP/IP
AT+MIPOPEN	→ for TCP/IP
AT+CGDCONT	→ for GPRS

If you want to use GPRS with Windows, you should set AT+CGDCONT

2. Data applications

2.1 Analog V.32 Data Connection (CSD)

Make a data connection from the GSM modem to an Analog modem using the V.32 modulation standard with 9600 bps.

Modem A-Side: GSM Modem AL7024S
Modem B-Side: Analog Modem AL4094S with V.32 (9600bps)

Connection setup from A-side to B-side:

Phase	A-Side	B-Side
0	Hardware Reset	Hardware Reset
Init	AT&F0 AT+CPIN="xxx" AT+CBST=7,0,1 AT&W	AT&F0 ATS0=2
Link setup	ATDXXXXX CONNECT	RING RING CONNECT
Data Link	Send/Rec. Data →	Send/Rec. Data →
Terminate Link	Send: +++ Rec.: OK Send: ATH Rec.: NO CARRIER	NO CARRIER

Connection setup from B-side to A-side:

Phase	A-Side	B-Side
0	Hardware Reset	Hardware Reset
Init	AT&F0 AT+CPIN="xxx" AT+CBST=7,0,1 AT+CSNS=4 AT+FCLASS=0 ATS0=2 AT&W	AT&F0
Link setup	RING CONNECT	ATDTXXXXXXX CONNECT
Data Link	Send/Rec. Data →	Send/Rec. Data →
Terminate Link	Send: +++ Rec.: OK Send: ATH Rec.: NO CARRIER	NO CARRIER

2.2 ISDN V.110 Data Connection (CSD)

Make a data connection from the GSM modem to an ISDN modem using the V.110 ISDN standard with 9600 bps.

Modem A-Side: GSM Modem AL7024S
Modem B-Side: ISDN Modem AL5068S with V.110 (9600bps)

Connection setup from A-side to B-side:

Phase	A-Side	B-Side
0	Hardware Reset	Hardware Reset
Init	AT&F0 AT+CPIN="xxxx" AT+CBST=71,0,1 AT&W	AT&F0 ATS0=2 ATB0 ATN4
Link setup	ATDXXXXXXXXX CONNECT	INCOMING CALL FROM (V.110)
Data Link	Send/Rec Data →	Send/Rec Data →
Terminate Link	Send: +++ Rec.: OK Send: ATH Rec.: NO CARRIER	NO CARRIER

Connection setup from B-side to A-side:

Phase	Modem A-Side	Modem B-Side
0	Hardware Reset	Hardware Reset
Init	AT&F0 AT+CPIN="xxxx" AT+CBST=71,0,1 AT+CSNS=4 AT+FCLASS=0 ATS0=2 AT&W	AT&F0 ATB0 ATN4 AT&W
Link setup	RING CONNECT	ATDTXXXXXXXXX CONNECTED V.110
Data Link	Send/Rec Data →	Send/Rec Data →
Terminate Link	Send: +++ Rec.: OK Send: ATH Rec.: NO CARRIER	NO CARRIER

2.3 GSM Data Connection (CSD)

Make a data connection from the GSM modem to another GSM modem using the CSD transparent standard with 9600 bps.

Modem A-Side: GSM Modem AL7024S
 Modem B-Side: GSM Modem AL7024S

Connection setup from A-side to B-side:

Phase	A-Side	B-Side
0	Hardware Reset	Hardware Reset
Init	AT&F0 AT+CPIN="xxxx" AT+CBST=7,0,1 (default) AT&W AT+CSNS=4,0	AT&F0 AT+CPIN="xxxx" AT+CBST=7,0,1 (default) AT&W AT+CSNS=4,0 ATS0=2
Link setup	ATDXXXXXXX CONNECT	RING CONNECT
Data Link	Send/Rec. Data →	Send/Rec. Data →
Terminate Link	Send: +++ Rec.: OK Send: ATH Rec.: NO CARRIER	NO CARRIER

Remark: Tested with Swisscom SIM and network

3. Most useful AT-Commands

We have selected for you the most useful AT-Commands. They are taken from the *“Developer’s Guide/ Motorola G24 AT Commands”*, which will serve you as a manual. The selection is not complete, but it gives you an easier startup with the AL7024S socket modem.

The page references refer to the *“Developer’s Guide”* edition July 2006.

3.1 RS-232 Commands

Command	AT Manual Pages	Function
AT+IPR / AT+CBAUD	Baud - Rate, p. 197/199	Set baud rate, e.g. AT+IPR=9600 Set auto baud: AT+IPR=0 (Currently, the two commands have same effect, but AT+IPR is saved automatically)
AT+ICF	DTE-DCE char framing, p.210	Set number of bits, parity, stop bit (8,n,1 recommended).
AT&K	DTE-DCE flow control p. 202	Hardware-flow-control, default, recommended.
AT&C	SET DCD signal, p.203	See the <i>“Developer’s Guide”</i> (With these RS-232-signals, you can change from command to data mode, detect modem carrier, release a call etc.)
ATQ	Result code suppression (quiet-mode), p.168	Determines, whether modem sends result codes or not - ATQ0: modem transmits result codes - ATQ1: result codes are suppressed
ATE	Echo, p.171	Determines whether modem echoes characters received by an external application (DTE) - ATE0: characters are not echoed - ATE1: characters are echoed
AT&D	SET DTR signal, p.205	See the <i>“Developer’s Guide”</i> (With these RS-232-signals, you can change from command to data mode, detect modem carrier, release a call etc.)

3.2 Data Commands

Command	AT Manual Pages	Function
AT+CBST	Bearer type selection p. 86	<p>Determines the mode of transmission (protocol) in data connections. Connecting GSM with:</p> <p><u>ISDN:</u></p> <p>AT+CBST=71,0,1 → 9600 baud V.110 AT+CBST=70,0,1 → 4800 baud V.110</p> <p><u>Analog:</u></p> <p>AT+CBST=7,0,1 → V.32 9600 baud AT+CBST=6,0,1 → V.32 4800 baud</p> <p><i>2nd parameter: 0: async (default) 1: sync</i></p> <p><i>3rd parameter: 0: transparent 1 : non-transparent (default)</i></p>
AT&Q	Error-correction for async operation, p. 89	<p>AT&Q0: No error-correction AT&Q5: Async with error-correction (default)</p>
AT+CSNS	Single Numbering Scheme, p.89	<p>Selects bearer when incoming call does not have information about call type.</p> <p>AT+CSNS=0:Voice AT+CSNS=2:Fax AT+CSNS=4:Data</p>
AT+FCLASS	Select mode, p.315	<p>Sets modem into particular operating mode (data or fax)</p> <p>AT+FCLASS=0:Data AT+FCLASS=1:Fax class 1 AT+FCLASS=2:Fax class 2</p>

3.3 General Commands

Command	AT Manual Pages	Function
AT+CFUN	Set phone functionality, p.27	Switch off Tx-circuit or RX or both etc. 2 nd parameter causes Reset. (You can use AT+CFUN=1,1 to force detection of SIM-Card.)
ATD ATD...; ATD>	Dial command, p.60 Make a voice call Dial number of phone-book	The command is used to dial a number and make a connection. ATD+41764445656 dials this number and makes a data call. To make a voice call, dial ATD....; (semicolon at the end of number). You can also dial the special sequences to make call forwarding etc. (see the "Developer's Guide") Example to dial from Phonebook: ATD>SM6 : Dial the 6 th entry of the ADN phonebook Before using the Phonebook, you should set the AT+CPS (Preferred Phonebook Storage).
ATDL	Redial last telephone number, p.63	Redials the last number used in the ATD command
ATA	Answer a call, p.66	When the modem receives a call ("RING") or "+CRING:...", you can accept the call with this command, to establish the connection. (You can set S0 with ATS0=.. to accept the call automatically)
ATH	Hang-up command, p.65	With ATH you can disconnect the connection. If you are in data-mode, you have to change first from data- to command-mode (see the next two commands)
ATO	Back to online mode p.88	Change from command mode to data mode
+++	Back to command mode	Enter "+++" during data mode and the modem changes to data mode.
ATS0	Automatic Answer, p.262	Controls the modem's automatic answering mode. ATS0=0: no automatic answer ATS0=2: answering after 2 rings
AT&W[n]	Save configuration, p.293	Saves active profile to profile-nr. n AT&W saves to profile 0.
AT&F[n]	Restore factory settings, p.266	Restores the profile settings from EEPROM, (from profile n. AT&F is profile 0.
A/	Repeat last command, p.246	Repeats the previous command

3.4 Information Commands

Command	AT Manual pages	Function
AT&V	Display configuration, p.291	Display the modem configuration. (Actual configuration, profile 0, profile 1)
ATI	Request identification information, p.51	Used to see various types of information ATI3: Product title ATI5: Software architecture ATI7: product description
AT+CGMR	Request revision identification, p.47	Display firmware revision number
AT+CGMM	Request model identification, p.46	Display supported frequency bands
AT+CGSN	Request IMEI-Nr. p.47	Display serial-number (IMEI-Nr.)
AT+GCAP	Capabilities list, p.200	Get the list of capabilities
AT+CGCLASS	GPRS mobile station class, p.297	Set the modem to a Class or return current class AT+CGCLASS? : returns current GPRS class AT+CGCLASS="CG":set modem to GPRS only mode
ATV	DCE response format, p.257	Result codes as words or as numbers ATV0: numbers ATV1: words (default)
AT+CMEE	Report Mobile Equipment errors, p.274	Select, if "ERROR" or Error with error-number is displayed AT+CMEE=0: disable Error reports ("ERROR" displayed) AT+CMEE=1: enable Error reports (Error-number displayed)
AT+CEER	Extended Error Report, p. 279	This command gives the reason of failure of the last call-setup or answering-attempt.
AT+CR	Service reporting control, p.110	Reports detailed type of data connection, if enabled. AT+CR=0: extended reports disabled AT+CR=1: extended reports enabled
AT+CRC	Cellular result codes, p.67	Gives more detailed ring information for incoming call. E.g. "+CRING:VOICE" AT+CRC=0: disable extended reports AT+CRC=1: enable extended reports

3.5 Security Commands

Command	AT Manual pages	Function
AT+CPIN	Enter PIN, p.247	<p>This command is used to enter all types of Passwords (CHV1/CHV2/PUK1/PUK2 etc.)</p> <p>AT+CPIN?: Ask modem, which pin is required. If none is required, response is "READY", If normal SIM-pin to switch on modem is required, the response is: "SIM PIN"</p> <p>AT+CPIN="1473" : Enter the SIM PIN 1473. After entering this pin, Modem connects to the network. For use of other pins, see the <i>"Developer's Guide"</i></p>
AT+CLCK	Facility lock, p.253	<p>Lock, unlock and interrogate a modem or network facility. This command is very extensive, you can block or allow all kinds of calls and modes. The following example shows how to enable and disable the SIM pin.</p> <p>AT+CLCK="SC",0,"1473" :disable SIM pin AT+CLCK="SC",1,"1473" :enable SIM pin (with pin 1473)</p>
AT+CPWD	Change password, p.250	<p>Change password AT+CPWD="<fac>","<oldpwd>","<newpwd>" Example: AT+CPWD="SC","1473","5555" :change from 1473 to 55555</p>

3.6 Network Commands

Command	AT Manual pages	Function
AT+CREG	Network registration, p.187	Command gives information about the network registration status. The registration status can be asked once with AT+CREG? or you can enable a continuous indication of the registration status with AT+CREG=1 or AT+CREG=2. Response: +CREG:<mode>,<status>. The status of the registration is 1 if registered to home network, 2 if modem is trying to register and 0 if not trying to register. For more information consult the <i>"Developer's Guide"</i>
AT+COPS	Operator selection, p.191	This command is used to choose a network operator. If the modem does not register to network at startup, try the command AT+COPS=0. It is the command to register automatically to the home network. AT+COPS=? Shows the available network operators. For better explanation of the command consult the <i>"Developer's Guide"</i> .
AT+CPOL	Preferred operator list, p.194	Command to edit the preferred list of network operators on SIM
AT+CSQ	Signal Quality, p.184	Command to measure the received signal quality. A value of about 8-12 is required to make safe connection.
AT+CLIP	Calling Line Identification, p. 70	The number of incoming caller is shown. If in phonebook, the entry is shown.
AT+CLIR	Calling Line Id. Restriction, p. 83	Controls whether own number is shown at called side.

3.7 Audio Commands

The AL7024S Module have a Microphone and a Speaker pin which can be connected to an externally headset. You should set AT+MAPATH according your application. (See below)

Command	AT Manual pages	Function
AT+MAPATH	Sets analog audio paths. P. 231	For the AL7024S, set AT+MAPATH=1,2 (Headset-mic.) and AT+MAPATH=2,2,1 (Headset-spkr for voice.) Set alert, ring etc according your needs.
AT+MAVOL	Volume setting, p.235	See “ <i>developer’s guide</i> ” for details. Only audio-output on AL7020S is connected to headset-speaker.
AT+CMUT	Microphone Mute Control, p.230	Mutes/unmutes currently active microphone-input.
AT+MAMUT	Input devices mute, p. 239	Muting of every input-device can be controlled
AT+MAFEAT	Features Selection, p. 238	Features can be switched-on and off as Echo cancellation Noise cancellation Sidetone
AT+CLVL	Loudspeaker-volume p. 243.	The volume of internal speaker can be controlled.
AT+VTD AT+VTS	Set DTMF Tone Duration, p. 227 Send one DTMF number, P.228	DTMF commands. To send number “1”: AT+VTS=1 Only single digits can be transmitted with this command

3.8 SMS Commands

Command	AT Manual pages	Function
AT+CMGS	Send message, p.178	Send SMS. Example: AT+CMGS="0764537865"<cr> This is test SMS <ctrl-Z>
AT+CNMI	New message indication, p.164	Example: AT+CNMI=2,1,0,0,0 Now, if an SMS is arriving, the following is displayed: AT+CMTI: "SM",2 Meaning: SMS was stored in location 2 of "SM"-memory on SIM-Card. The memory used for receiving SMS can be changed with the AT+CPMS command. (see below)
AT+CMGR	Read message, p.171	Read message from memory selected with AT+CPMS command Example: AT+CMGR=2 : read the second SMS in memory
AT+CMGL	List message, p.169	Read messages from memory selected with AT+CPMS command. Example: AT+CMGL="ALL" list all messages AT+CMGL="REC UNREAD" list unread received msg. There are more possible parameters for this command
AT+CPMS	Preferred Message Storage, p.160	The storage memory for messages can be selected. Example: AT+CPMS="SM" ("SM" being the most usual mem.) For a list of all possible memory areas see "AT Commands Interface Guide", p.70 (AT+CPBS command)
AT+CMGD	Delete message, p.176	Delete message from preferred message storage. Example: AT+CMGD=2 : delete second message AT+CMGD=1,1: delete all read messages For exact use, consult "AT Commands Interface Guide"
AT+CSCA	Service center address, p.162	Enter the phone number of the SMS service center (network operator). E.g.: AT+CSCA="0796664444"

4. Troubleshooting-guide

There is never a simple "no connection". There are many causes for this, which can be excluded step-by-step. If you never had a successful data-connection, you should test first with an analog modem at the other side. Also, if possible, avoid problems with local company-exchanges, using a direct phone-line. This applies specially if you call to a digital "modem" (ISDN-TA). You can test these configurations later. It is also helpful, to test different numbers on both sides. (ISDN/analog, direct/local exchange, mobile phone on called side. Different providers for GSM-Module. It is very recommended to make all tests in both directions, because in many cases of failure, the other direction is working. This helps to find the error.

SIM-card recognized?

SIM-card can be tested by **AT+CPIN?** Answer: **+CPIN: READY**. (Answer **:+CPIN: SIM PIN** : you should enter PIN first).

Verify the signal-quality

with **AT+CSQ?**. (repeat command a couple of times every 10secs.) It should never drop below 10, critical connections could work down to about 7. Find best antenna-location with mobile phone.

Network-attached?

To control that the module is connected to the network, you see the response of **AT+CREG** with the HEX-info about the cell. (First, enable CREG with **AT+CREG=2**)

DTE-baud-rates

Control if on both sides the data-rate of the DTE-DCE connection (of the computer-terminal) is set higher than 9600 (best is 115200 as default for all applications). The GSM-module can stay at autobaud (**AT+IPR=0**). For GPRS, set data-rate to 115200 baud.

If your application will work with lower DTE-rates, you can test these settings of **AT+CBST** later, because 9600 is the standard of many modems. (19200/2400/1200 not working always). Set baud-rate on GSM-Module: use **AT+IPR** command.

Regarding hyper-terminal: We made bad experiences with it, sometimes it hangs up and there is no comfort. We use Procomm 4.8 from Symantec, there you can also write very comfortable scripts with window-support. Also as a dumb terminal, it is much more reliable. They have also very good support in one day.

The following steps apply to analog-modems and ISDN-TA's (digital phone-connection).

Exceptions are marked.

Ringing

To test this, call first to a normal telephone and look, if it is ringing. (**ATDxxx;** with semicolon for speech-mode). Call also from telephone to GSM.

(Response **RING** or **INCOMING SPEECH CALL**)

(This is to see, if the GSM-network connects, or if it is a problem with numbering of house-exchange, *or bad configured ISDN-phones*)

Make speech-connection to phone

Do the same and pick the phone up, the GSM should show "**CONNECT (SPEECH)**". In the other direction, wait the GSM-module indicating the ring and enter "**ATA**". Now a **CONNECT** should show up. At this step you can also test a headset connected to the GSM-Module.

Configure both sides for data-transmission:

- Set **ATS0=2** at both sides, so calls are answered after 2 rings.
- Set **AT+CSNS=4** / **AT+FCLASS=0** at GSM Modem (data mode), specially if you want to receive call with GSM.
- Set data-protocol:
- GSM to ISDN-TA: **AT+CBST=71,0,1** (9600 V.110) . Other TA must be set to V.110 (9600 or higher), other protocols don't work.
- GSM to Analog-Modem: **AT+CBST=7,0,1** (V.32 9600 baud) (ev. set analog-modem accordingly).

After the settings, save them with **AT&W**.

If the other side is an ISDN-TA, this needs an MSN-number to be stored. You could disconnect the ISDN-phone used in step above and set the TA to the same MSN as the phone.

Make data-connection

- Connect a speaker or a phone to the analog-line to obtain more information about the progress of the connection.(hear the ring and the progress of connection build-up.)
- Make call in data-mode (**ATD** without semicolon).
- Control, if it is ringing ("**RING**" response), ring on phone or speaker.
- Control, if call is answered (ring stops, data-sounds can be heard. ISDN: connect-response on terminals.) Eventually, connection disconnects again.
Causes:
 - a. analog: Normally the setting of the Analog-modem is not important, but is has to be set to autodetect and the fastest protocol. Alternatively it could also be tested with setting exactly the protocol you will use. (Analog-Modems from xmodus: use the **AT+MS=xxx** command. (Specially if you have troubles calling from Analog to GSM.)
 - b. analog and ISDN: possibly incompatible settings of protocol and speed. If calling to GSM, the GSM should expect a data-call. (Settings **AT+CBST=xxx**, **AT+CSNS=4**, **AT+FCLASS=0**, see above). It is advisable to check with different GSM network-providers and in both calling directions, in our experience this could sometimes solve the problem. For ISDN we had less problems calling from ISDN to GSM. For Analog the direction GSM->Analog caused fewer problems.
 - c. ISDN: additionally there comes the influence of the fixed-networks. Normally the public digital network allows data-transmission, but it could be that the local extension of the company-exchange is not activated for data-transmission. (see error-messages at GSM-side)

Remarks for Swiss Customers

There are some differences between the GSM-Network-providers.

- Generally speaking, we had better results connecting to and from ISDN using SIM-Card from Sunrise.
- On the other hand, with Analog-Modem (V.32) you better use Swisscom. With Sunrise we were only able to originate a V32-call, but not to receive one. Nevertheless, Sunrise informed us, that it should be possible.
- Not tests were made with Orange (coming soon).