# 1MRS119000
# Plug-in Modem

## Operator´s manual



**ABB**

**1MRS119000**
# Plug-in Modem
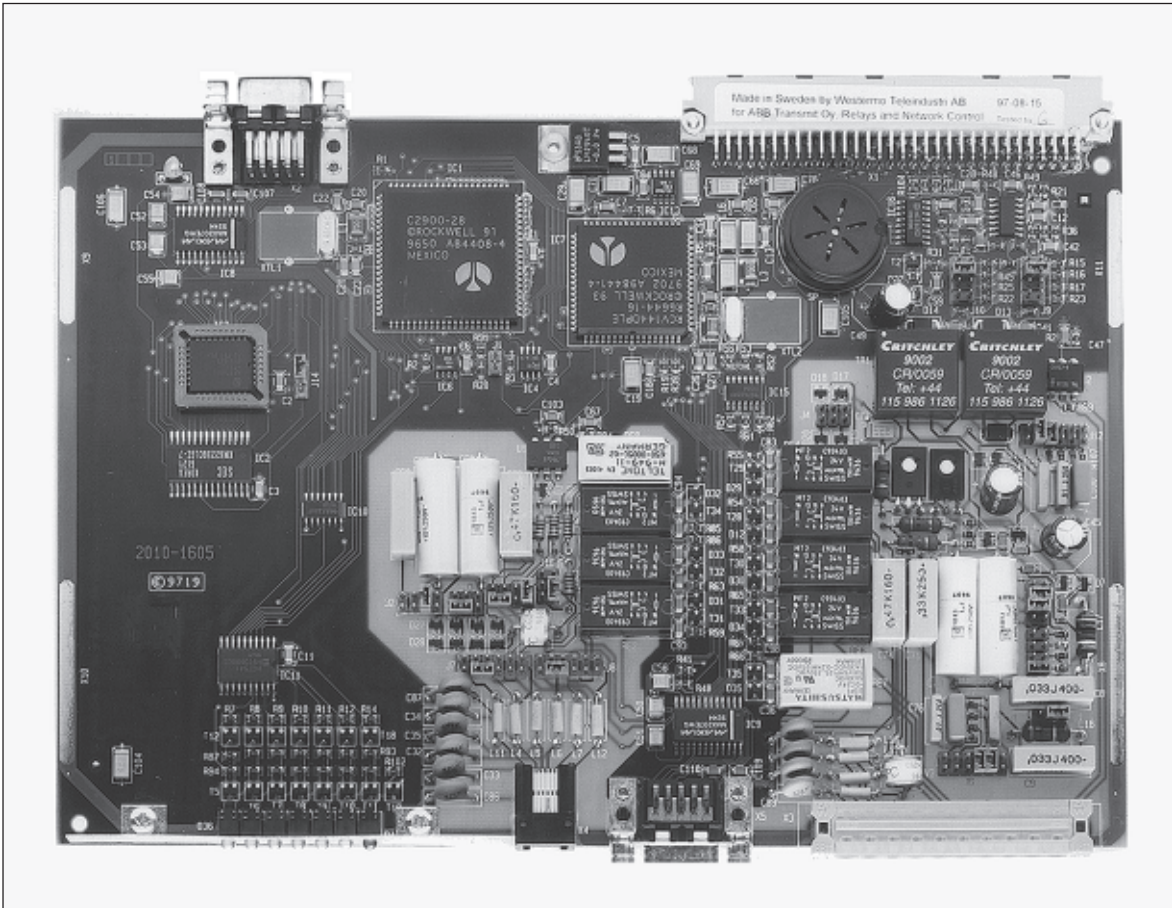
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## Contents

# 1.0 General

## 1.1 Introduction

The 1MRS119000 modem board is a multifunctional plug-in modem board which can be used together with several distribution automation products of ABB Transmit Oy. Via the local public telephone network or leased lines the modem provides data communication at up to 14400 bps. Furthermore, the modem can be connected to several types of radios for communication via a radio-operated network.

This optional modem board is used for communication between aremotely contrlled unit or a protection relay and a host computer. It is only delivered as part of such systems. The modem board takes care of the data communication from station-level equipment to the host computer via a public telephone network, leased lines or a conventional radio network.

The modem is designed according to the following international ITU-T recommendations for data signalling rates up to 14400 bps:

ITU-T V.21         300 bps
ITU-T V.22         1200 bps
ITU-T V.22bis      2400 bps
ITU-T V.23         1200/75 bps
ITU-T V.32         4800/9600 bps
ITU-T V.32bis      14400 bps

The line interface fulfils the NET 4 (ETS 300 001, second edition, April 1994) specification for the agreed countries: "Attachments to Public Switched Telephone Network (PSTN); General technical requirements for equipment connected to an analog subscriber interface in the PSTN".

The AT command set is used for configuration of both the telephone modem and the radio modem. Configuration is done via the RS 232 serial interface with help of a PC/ Terminal (DTE).

The remote configuration of the modem offers users network management capabilities. The user can configure the modem at remote sites from local modems, without having to visit the local stations or rely on the service personnel to follow instructions.

## 1.2 Type marking

The type marking of the modem consists of a type number, a temperature range code and a country code. The type number is 1MRS119000-_ _ _. The one-letter temperature range code and the two-letter country code specify the service temperature range and the destination country where the modem is to be installed. The country code is needed to make sure that the public line part of the modem has been approved for use in the destination country. The status of approval per country can be inquired from ABB Transmit Oy or ABB's local customer centre.

Example of the type marking:

```
1MRS119000 -AFI
|              | |
|              | | Country code      FI = Finland
|              |
|              Temperature range   A = +5…+50°C
|                                  B = -20…+60°C
Type number
```

Country codes are:

| | | | |
|---|---|---|---|
| AR = Argentina | AT = Austria | AU = Australia | BE = Belgium |
| BR = Brazil | CA = Canada | CH = Switzerland | CO = Colombia |
| CZ = Czech republic | DE = Germany | DK = Denmark | EE = Estonia |
| EG = Egypt | ES = Spain | FI = Finland | GB = Great Britain |
| GR = Greece | HK = Hong Kong | HU = Hungary | ID = Indonesia |
| IE = Ireland | IL = Israel | ID = Indonesia | IT = Italy |
| MX = Mexico | MY = Malaysia | NL = Netherlands | NO = Norway |
| NZ = New Zealand | PH = Philippines | PL = Poland | PT = Portugal |
| SA = Saudi Arabia | SE = Sweden | SG = Singapore | SI = Slovenia |
| TR = Turkey | TW = Taiwan | RU = Russia | VE = Venezuela |
| ZA = South Africa | | | |

## 1.3 Features

DTE Interface: an RS232 serial interface with hardware handshaking, connected to two 9-pin female D-connectors.

Line interface: a transformer-coupled telephone line interface with tone and pulse dialling. The line interface can be used in both 2-wire and 4-wire dial-up and leased line connections.

Radio interface: a combined interface for connecting either a leased line, or a radio transceiver.

Both the Line interface and Radio interface can be used for communication over leased lines.

Indication LEDs: The seven LEDs show the operation status of the modem.

Designed for operation in distribution automation environment.

## 1.4　Technical specifications

### 1.4.1　LED indicator functions

Total 7 LEDs:

| | | |
|---|---|---|
| LIN | Modem connected to line (off hook), connected to line relay control signals | Green |
| RNG | Indicates a true ringing signal | Green |
| TXD | Transmitted data. Connected to the modem TxD signal | Green |
| RXD | Received data. Connected to the modem RxD signal. | Green |
| CD | Carrier detect. | Green |
| RTS | Request to send. | Green |
| IRF | Internal Fault detected by the watchdog. Normally off. | Red |

### 1.4.2　Interface connectors

| Connector | Type | Function |
|---|---|---|
| X1 | 64-pin Euro | power supply |
| X2 | 9-pin D-connector | RS 232 serial interface |
| Xn.1 | RJ12 | public telephone network |
| Xn.2 | 9-pin D-connector | RS 232 serial interface |
| Xn.3 | 10-pin | leased line / radio |

Loudspeaker on-board, adjustable sound volume

### 1.4.3　Telephone line interface

Modes Dial up, 2-or 4- wire leased or fixed line, Xn.1/1-6

ITU-T recommendations:

| | |
|---|---|
| ITU-T V.21 | 300 bps |
| ITU-T V.22 | 1200 bps |
| ITU-T V.22bis | 2400 bps |
| ITU-T V.23 | 1200/75 bps |
| ITU-T V.32 | 4800/9600 bps |
| ITU-T V.32bis | 14400 bps |

### 1.4.4　Private line

| | |
|---|---|
| Input sensitivity | -43 to dBm, Xn.3/1-2 or 3-4. |
| Output level | software adjustable, -2 to -17 dBm, Xn.3/1-2. |
| Modem configuration | AT commands and S registers, Jumper settings |

## 1.4.5 Radio interface

| | |
|---|---|
| Modes | Radio, 2- or 4-wire private line |
| Input sensitivity | -43 dBm, Xn.3/1-2 or 3-4. |
| Output level | software/automatic adjustable,-2 dBm ... -17 dBm, Xn.3/1-2. |
| Subcarrier detector | 12 - 60 V forward voltage, 0.3 - 1.8 mA. |
| | 6 V maximum backward voltage. Xn.3/9-10. |
| TX/RX switch (PTT) | relay operated (5 A, 30 Vdc, 250 Vac), Xn.3/6-8. |
| TX/RX delay | adjustable between 30 and 2000 ms |
| Modem configuration | AT commands and S registers |

## 1.4.6 DTE

| | |
|---|---|
| Interface | 2 x RS232 in parallel, X2 and Xn.2. |
| Data speed | Auto detection between 300 - 38 400 bit/s |
| Data format | Auto detection between: |
| | 7 or 8 data bits |
| | odd, even or no parity |
| | 1 stop bit |

## 1.4.7 Power consumption

| | |
|---|---|
| 5 V | typical 165 mA, max 250 mA |
| 24 V | passive typical 26 mA, active typical 45 mA, max. 60 mA |

## 1.4.8 Environmental conditions

| | |
|---|---|
| Ambient temperature range | |
| - normal | +5…+50℃ |
| - extended | -20…+60℃ |
| Storage temperature range | -40…+125℃ |
| Relative humidity | 15…90%, non-condensing |

## 1.4.9 Mechanical dimension

| | |
|---|---|
| Size | 160 x 233.4 mm (E2), component high max 16 mm. |

The modem is approved and manufactured by Westermo Teleindustri AB,
640 40 Stora Sundby, Sweden.

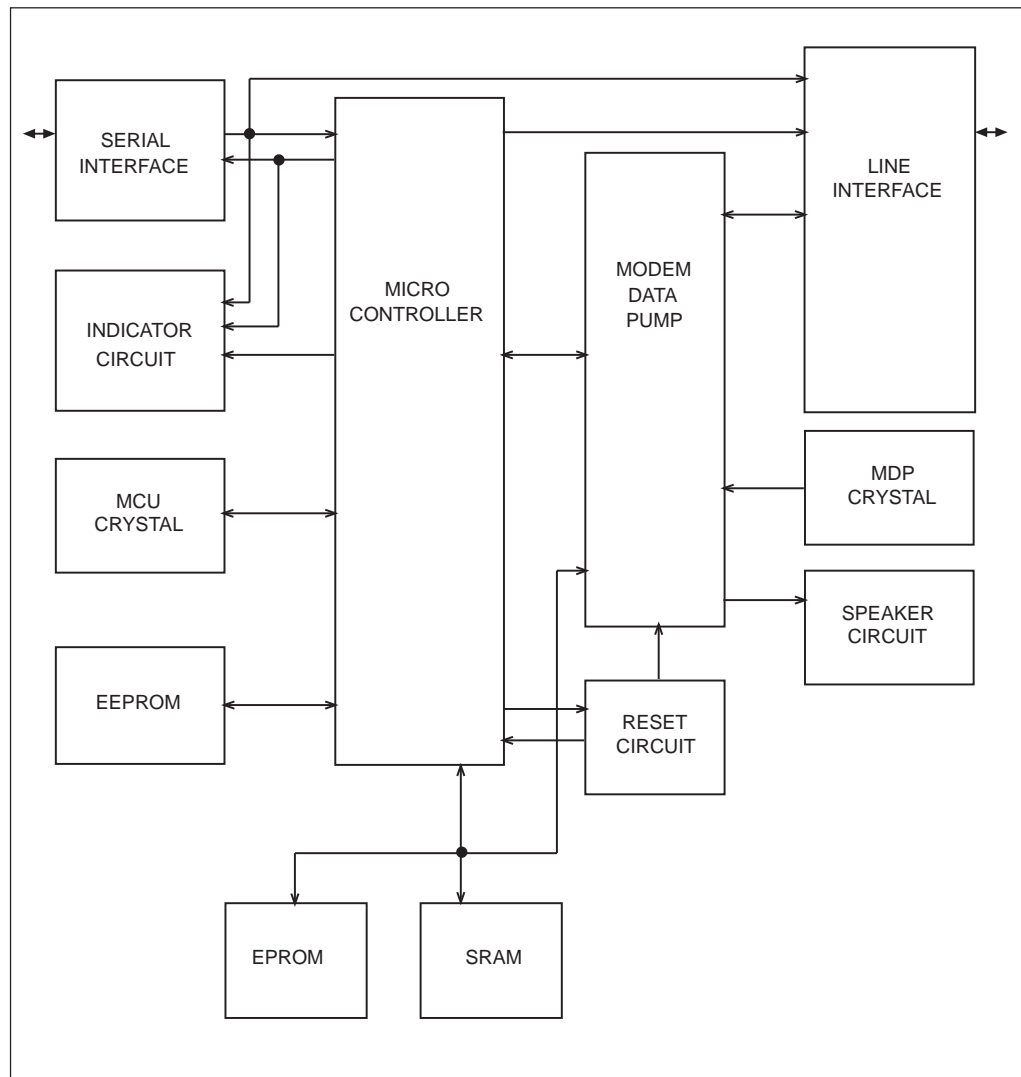## 1.5       Block diagram



*Fig. 1. Block diagram*

## 1.6 Power supply and booting

The plug-in modem board is an optional unit for ABB Transmit Oy protection and control products. The modem is powered by the equipment it is used in and does not need a separate external power supply.

Modem settings are stored in non-volatile memory on the modem board and read after powering up. For certain settings, the microcontroller to which the modem is connected, sends initialisation strings after power-up of the unit.

The supply voltages are: +5Vdc ±2% / 165 mA for the electronics
+24Vdc ±10% / 45 mA for the relays and LEDs

## 1.7 LED indicators

Communication to and from the modem, as well as the modem operation status can be checked with help of seven diagnostic LED indicators.

The LED indicators are:

| | | |
|---|---|---|
| LIN | Modem connected to line (off hook), connected to the line relay control signals | Green |
| RNG | Indicates a true ringing signal. | Green |
| TXD | Transmitted data. Connected to the modem TxD signal | Green |
| RXD | Received data. Connected to the modem RxD signal. | Green |
| CD | Carrier detect. | Green |
| RTS | Request to send. | Green |
| IRF | Internal Fault detected by the watchdog. Normally this LED is off. | Red |

## 1.8 On-board controls

The 1MRS119000 is designed on a single printed circuit board (PCB). The board contains 11 series of jumpers for country-specific settings. The jumpers can only be reached after removing the PC board from the rack it normally is mounted in.

The jumpers are not allowed to change by users because of country-specific rules and approvals.

## 1.9 Loudspeaker

An on-board piezoelectric loudspeaker is provided, mainly for testing purposes. For normal, silent operation, the loudspeaker can be switched off, or set to a low volume by altering certain settings. Refer to the chapter 'Command Overview'.

# 2.0 Installation and connection

## 2.1 Introduction

The installation of the 1MRS119000 consists mainly of making the physical connections between the modem and the telephone network, leased line, fixed lines or radio equipment. The power supply connection and the connection for data transfer to and from the microcontroller (protective relay, I/O unit) are made after the modem board has been properly inserted. Mounting of the modem board is described in the manual of the equipment it is part of. A separate connector is provided to connect the modem to a PC using a standard RS232 cable. This connector is only used for setting up the modem and for service. Setting up the modem can also be done remotely.

Installation procedure:

1. Insert the PC board properly into the rack. As the modem board normally is ordered as part of other distribution automation equipment, this is done by the factory.

2. Connect the modem to the dial-up lines, leased line or radio equipment. For setting up the modem, connect a PC temporarily to the modem board.

3. Attach the auxiliary supply and check the operation of the modem with help of the LED indicators.

4. Verify that the modem settings are in conformance with the network configuration and match with the settings of the modem used at the host computer. Check for error correction, baud rate, data compression, etc. See the chapter 'Command overview' for a detailed description on the available modem commands.

5. Verify self-test results. See chapter 'Self-test'.

6. Check the modems operation in the network.

## 2.2 Connectors

All connectors are directly mounted on the modem board. The connector name, type of connectors and their functions are as follows:

| Connector | Type | Function |
|-----------|------|----------|
| X1 | 64-pin Euro | power supply |
| X2 | 9-pin D-connector | RS 232 serial interface |
| Xn.1 | RJ12 | public telephone network |
| Xn.2 | 9-pin D-connector | RS 232 serial interface |
| Xn.3 | 10-pin | leased line / radio |

n is the card slot number for the modem board.

Connectors X2 and Xn.3 are connected in parallel. For a description of the pin configuration of each connector, refer to chapter 'Technical Specifications'.

### LED indicators

LIN   Modem connected to line (off hook), connected to the line relay control signals
RNG   Indicates a true ringingsignal, connected to the micro controller
TXD   Tranmitted data, connected to modem's TxD-signal
RDX   Received data, connected to modem's RxD-signal
CD    Carrier detect, connected to the micro controller
RTS   Ready To Send, connected to the micro controller
IRF   Internal Fault detected by the watchdog. Led is normally off.

Xn.1, RJ-12 Telephone line

Xn.2, RS-232 connector

Xn.3, radio and leased line connector
1  TX_LINEA, 2-wire connection and 4-wire transmit.
2  TX_LINEB, 2-wire connection and 4-wire transmit.
3  RX_LINEA, 4-wire receive data.
4  RX_LINEB, 4-wire receive data.
5  Not connected
6  RADIO_ONA, Radio ON relay, normally open contact.
7  RADIO_ONC, Radio ON relay, common.
8  RADIO_ONB, Radio ON relay, normally closed contact.
9  SCUELCH STATEA, Radio subscriber detect (+).
10 SCUELCH STATEB, Radio subscriber detect (–).

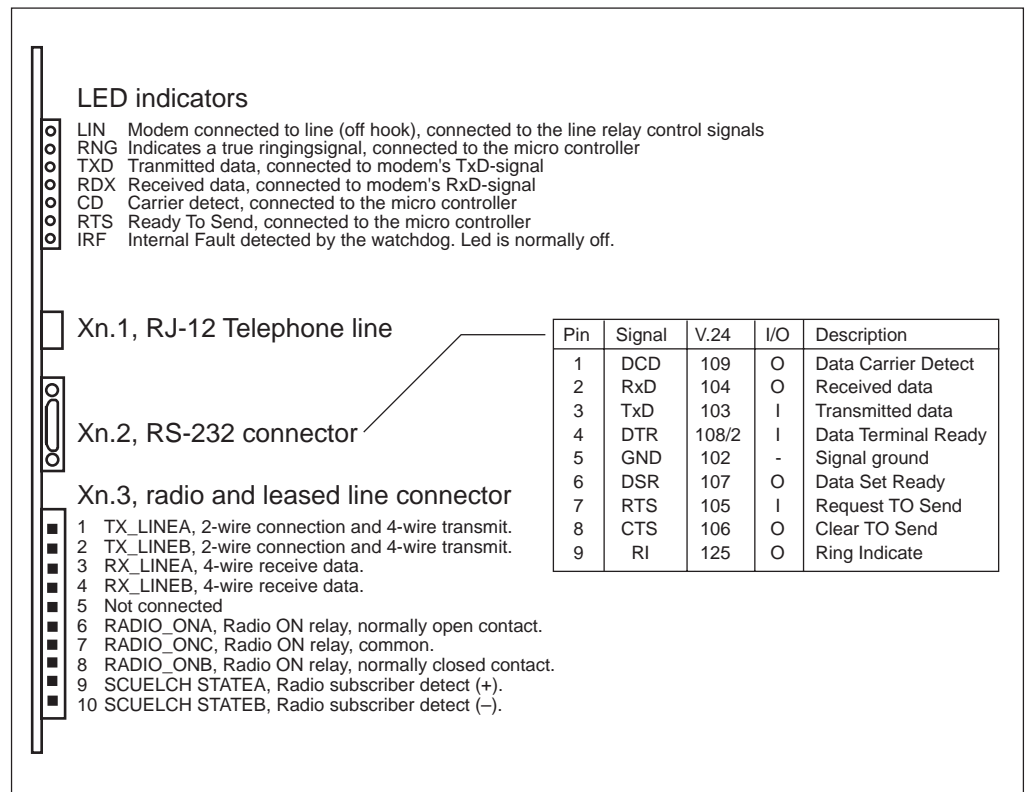| Pin | Signal | V.24 | I/O | Description |
|-----|--------|------|-----|-------------|
| 1 | DCD | 109 | O | Data Carrier Detect |
| 2 | RxD | 104 | O | Received data |
| 3 | TxD | 103 | I | Transmitted data |
| 4 | DTR | 108/2 | I | Data Terminal Ready |
| 5 | GND | 102 | - | Signal ground |
| 6 | DSR | 107 | O | Data Set Ready |
| 7 | RTS | 105 | I | Request TO Send |
| 8 | CTS | 106 | O | Clear TO Send |
| 9 | RI | 125 | O | Ring Indicate |

*Fig. 2. Connection view*

As the cables to be used for connecting the modem to the telephone network, leased lines and radio system depend on local conditions, these are not provided. For connecting a PC to the modem, use a standard RS232.

## 2.3 Jumpers

The jumper settings are for country-specific parameters. They should normally not be changed after delivery of the modem.

## 2.4 Phone line connections

The 1MRS119000 modem is designed for communications over a Public Switched Network Telephone line.

Connection to the phone system is made via an RJ12 type jack (connector Xn.1). Depending on the function of the line, the modem will be connected through one or several line relays. It can be connected to a switched or leased line network, 2-wire or 4-wire transformer coupled line interface and a ring detector opto.

Cables for connecting the modem board to the dial-up lines or leased lines are not provided as the type of cable and attached connector depend on the application. Refer to the technical specifications and pin configurations for attaching the 1MRS119000 modem board to the available lines.

## 2.5 Radio connections

The interface connector Xn.3 is used for connecting the 1MRS119000 modem board to either a leased line or a suitable radio transceiver. For the use of radio equipment extra I/O signals are provided: output relay contacts for switching between send and receive and a receiver subcarrier detection input.

The connection to a radio transceiver strongly depends on the type of radio used. It should be noted that only certain types of radio transceivers are suitable for the transmission of high speed digital data. For attaching the radio transceiver to the modem board, refer to the documentation provided with the radio equipment and refer to the pin configuration of connector Xn.3 given in chapter 'Technical Specifications'.

Cables for connecting the modem-board to the radio equipment are not provided as the type of cable and attached connectors depend on the application and the type of radio used.

Always refer to the technical specifications and pin configurations for attaching the 1MRS119000 modem board to external devices.

## 2.6 Leased and fixed Line connections

Both the phone line and the radio interface can be used for attaching a leased line. In many applications in distribution automation, leased lines, also called dedicated or private lines, are used. The 1MRS119000 modem is designed for use over a 2-wire or 4-wire leased line. No special line conditions are needed and the operation is full-duplex. The leased lines can be connected to the phone line interface connector (Xn.1, see previous section) or to the radio interface connector Xn.3.

Cables for connecting the modem board to leased lines are not provided as the type of cable and attached connectors depend on the application.
Always refer to the technical specifications and pin configurations for attaching the 1MRS119000 modem board to external devices.

## 2.7      Connection examples
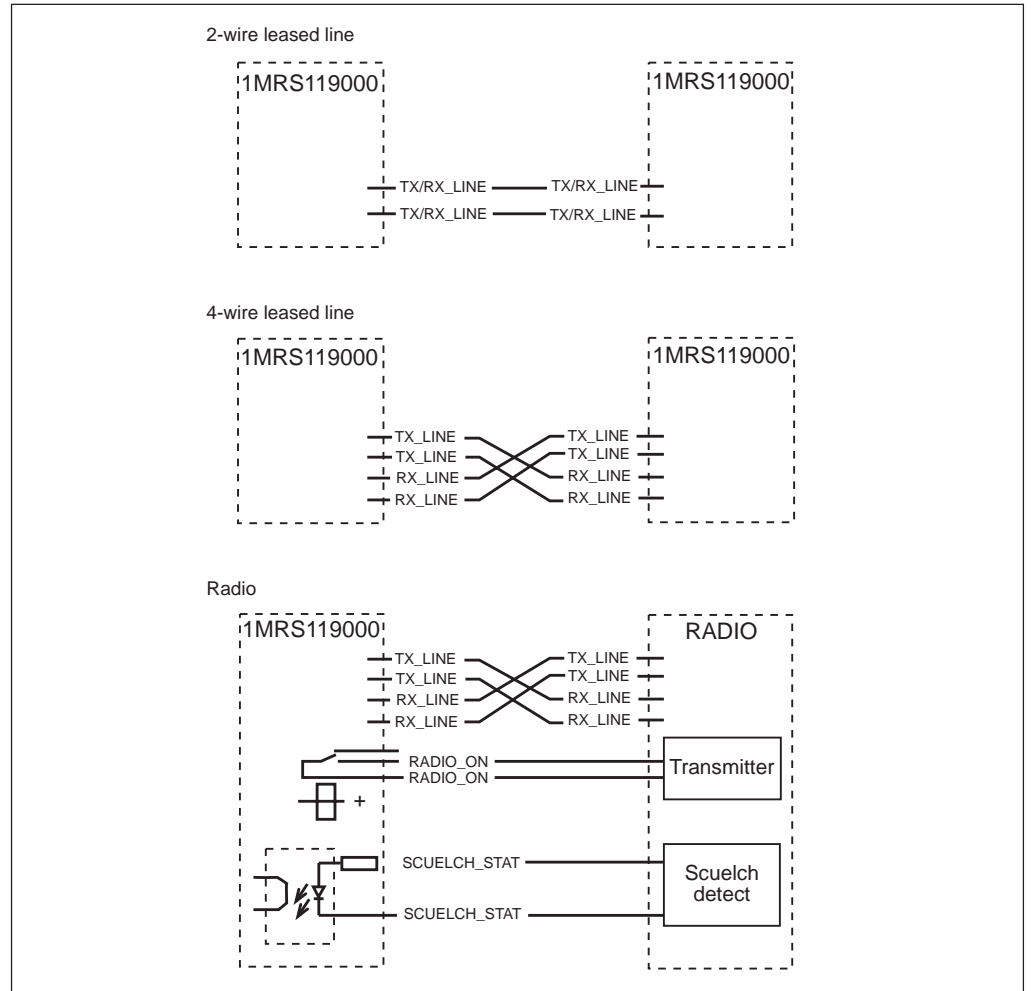


## 2.8      Common configuration strings

| Mode | Connector | Initialisation string originate | Answer |
|---|---|---|---|
| Dial up: | Xn.1 | AT&FDnnnn | AT&FS0=1 |
| 2-wire fixed line | Xn.1 | AT&F&L1D | AT&F&L1A |
| 2-wire fixed line | Xn.3 | AT&F&L1&J1D | AT&F&L1&J1A |
| 4-wire fixed line | Xn.1 | AT&F&L1&H1D | AT&F&L1&H1A |
| 4-wire fixed line | Xn.3 | AT&F&L1&J1&H1D | AT&F&L1&J1&H1A |
| 4-wire radio V.23 HDX | Xn.3 | AT&F&E1%F3&L1&J1&H1D | AT&F&E1%F3&L1&J1&H1A |

| | | |
|---|---|---|
| AT | &F | Set factory default, |
| | Dnnnn | Dial number nnnn |
| | S0=1 | Auto answer after 1 ring signal |
| | &L1 | Fixed line synchronisation enabled |
| | &L0 | Normal dial-up connection |
| | D | Set modem as originate |
| | A | Set modem as answering |
| | &J1 | Set line to radio screw connector |
| | &J0 | Set line to telephone connector |
| | &H1 | 4-wire line |
| | &H0 | 2-wire line |
| | &E1 | Radio subcarrier control enabled |
| | &E0 | Radio subcarrier control disabled |
| | %F3 | Set V23 half duplex 1200/1200 |

Key in the telephone number instead of nnnn

13

## 2.9 DTE connection

During commissioning, all settings to the modem board 1MRS119000 are made using a DTE (terminal or Personal Computer running e.g. a terminal emulation program). The DTE is to be connected to the 9-pin female connector Xn.2 via a standard RS 232 cable. If you use your own cable, always check that the cable matches the pin configuration of the modem board and DTE. Refer to the technical specifications for further details.

Connector Xn.2 has the same functionality as connector X2 on the rear side of the modem board. Connector X2 is used for the data communication between the modem and the microcontroller of the distribution automation equipment in which the modem is used. The two serial interface connectors can only be used one at the time. The modem board has a built-in serial interface using the data formats from: 1 start bit, 7 data bits, no parity and 1 stop bit, up to: 1 start bit, 8 data bits, 1 parity and 1 stop bit.

The modem recognises the DTE data format (baud rate, number of data bits, etc.) automatically after typing AT followed by a <CR> (carriage return), as long as the DTE data formats are within the above mentioned range. Preferably, the DTE data formats should be the same as the communication settings of the secondary substation equipment in which the modem is used. The communication between the modem and the DTE is always half duplex.

## 2.10 Mounting

The modem board is only delivered as part of ABB Transmit Oy's secondary substation equipment and is therefore mounted by the factory. For altering jumper settings and for service reasons, the modem board might have to be removed from the rack in which it is normally mounted. The position of the modem board in the rack is described in the manuals of the concerned secondary substation equipment.

Remove or place the modem board only when the auxiliary supply voltage is turned off and the telephone line is disconnected. Connect the telephone line after the board is installed in the cabinet.

As the modem and the equipment in which the modem is placed contain ESD sensitive components, always take the necessary precautions to avoid electrostatic discharges before removing or placing any of the printed circuit boards. Disregarding these precautions can cause damage to internal electronics even in the long run.

## 2.11 Powering-up

Before applying the auxiliary voltage, check that the modem board is correctly mounted. Refer to the previous section 'Mounting'.

The modem board is powered through the equipment it is placed in and does not need a separate power supply.

As soon as the auxiliary voltage is applied, the modem performs a self-test, after which it is initialized.

# 3.0　　　　　Command overview

## 3.1　　　　Introduction

AT commands are the means by which the modem is configured. The available commands enable reading and modifying of the modem parameters. This chapter describes the AT commands recognized by the 1MRS119000 modem board. The sections of this chapter describe the command syntax and give a detailed description of the available AT commands and S registers. For a brief description of the commands refer to appendices.

## 3.2　　　　Command syntax

### 3.2.1　　　DTE Commands

The ISO 646 character set (CCITT T.50 International Alphabet 5, American Standard Code for Information Interchange) is used for issuing commands and responses. Only the low-order 7 bits of each character are used for commands or parameters; the high-order bit is ignored. Upper-case characters are equivalent to lower-case characters.

### 3.2.2　　　AT command guidelines

Modem operation is controlled by generic AT commands. These AT commands may be basic AT (i.e., commands preceded by AT, AT&, AT%, AT*, AT\, AT), AT, or AT#), S register (e.g., S6=n), commands. The command syntax and operation guidelines governing each of these command categories are described in the subsequent sections.

### 3.2.3　　　Basic command syntax

Characters within the command line are parsed as commands with associated parameter values. The basic commands consist of single ASCII characters, or single characters preceded by a prefix character, followed by a decimal parameter (e.g., `&D1`). Missing decimal parameters are evaluated as 0.

## 3.3　　　　AT command

### 3.3.1　　　AT command guidelines

The basic AT commands used to control modem operation are defined in this section. These commands are summarised in Appendix A. All these commands may not be available in a specific product depending upon supported data rates and modes. The default values are typical of a fully configured modem supporting all data rates and options. The actual default value is dependent upon modem firmware as defined by the firmware release notes.

### 3.3.2　　　AT Commands, DTE Adaptation

Under AT operation, the serial interfaced modem performs an autobaud/autoparity/autolength function on each AT header entered. The autolength/autoparity facility can detect 7- or 8-bit characters of even, odd, or no parity with one stop bit.

### 3.3.3 AT Command Format

A command line is a string of characters sent from a DTE to the modem (DCE) while the modem is in a command state. A command line has a prefix, a body, and a terminator. Each command line (with the exception of the A/ command) must begin with the character sequence AT and must be terminated by a carriage return. Commands entered in upper case or lower case are accepted, but both the A and T must be of the same case, i.e., "AT" = ASCII 065, 084 or `at` = ASCII 097, 116. The body is a string of commands restricted to printable ASCII characters (032 - 126). Space characters (ASCII 032) and control characters other than CR (ASCII 013) and BS (ASCII 010) in the command string are ignored. The default terminator is the ASCII <CR> character. Characters that precede the AT prefix are ignored. The command line interpretation begins upon receipt of the carriage return character.

Characters within the command line are parsed as commands with associated parameter values. The basic commands consist of single ASCII characters, or single characters preceded by a prefix character (e.g., `&"), followed by a decimal parameter. Missing decimal parameters are evaluated as 0.

The modem supports the editing of command lines by recognizing a backspace character. When modem echo is enabled, the modem responds to the receipt of a backspace or delete by echoing a backspace character, a space character, and another backspace. The hex value to be used for the backspace character is programmable through register S5. Values equal to 0 or greater than 127, or the value which corresponds to the carriage return character, cannot be used for the backspace character. This editing is not applicable to the AT header of a command. A command line may be aborted at any time by entering < cntrl-x > (18h).

The AT sequence may be followed by any number of commands in sequence, except for commands such as Z, D, or A. Commands following commands Z, D, or A on the same command line will be ignored. The maximum number of characters on any command line is 39 (including "A" and "T"). If a syntax error is found anywhere in a command line command, the remainder of the line will be ignored and the ERROR result code will be returned.

Most of the commands entered with parameters out of range will be rejected and the ERROR response will be returned to the DTE.
Commands will be accepted by the modem once the previous command has been fully executed This is normally indicated by the return of an appropriate result code. Execution of commands D and A, either as a result of a direct command or a re-execute command, will be aborted if another character is entered before completion of the handshake.

### 3.3.4 Escape Code Sequence

When the modem has established a connection and has entered on-line data mode, it is possible to break into the data transmission in order to issue further commands to the modem in an on-line command mode. This is achieved by the DTE sending to the modem a sequence of three ASCII characters specified by register S2. The default character is '+'. The timing of the three characters must comply with specific time constraints. There is a guard time before the first character (the pre-sequence time), a guard time following the third character (the post-sequence time), and a guard time-out between the first and second characters and between the second and third characters (the inter-character time). These times are controlled by the value recorded in register S12.

| 3.4 | AT Commands |
|---|---|

The modem will respond to the commands detailed below. Parameters applicable to each command are listed with the command description. The defaults shown for each configuration command are those used in the Rockwell factory profile.

## A/ - Re-execute Command

The modem behaves as though the last command line had been re-sent by the DTE. "A/" will repeat all the commands in the command buffer.

The principal application of this command is to place another call (using the Dial command) that failed to connect due to a busy line, no answer, or a wrong number. This command must appear alone on a command line. This command should not be terminated by a carriage return.

## AT= x - Write to Selected S register

This command writes the value x to the currently selected S register. An S register can be selected by using the ATSn command. All of the S registers will return the OK response if x is a number. Some registers may not be written due to country-specific PTT limitations.

Result Codes:

OK    For all arguments.

## AT? - Read Selected S register

This command reads and displays the selected S register. An S register can be selected by using the ATSn command.

Result Codes:

OK    For all arguments.

## A - Answer

The modem will go off-hook and attempt to answer an incoming call if correct conditions are met. Upon successful completion of answer handshake, the modem will go on-line in answer mode. This command may be affected by the state of Line Current Sense, if enabled. (Most countries do not require Line Current Sense.) The operation is also dependent upon country-specific requirements.

## Bn - CCITT or Bell

When the modem is configured to allow either option, the modem will select Bell or CCITT modulation for a line speed connection of 300 or 1200 bps according to the parameter supplied. Any other line speed will use a CCITT modulation standard. The parameter value, if valid, is written to S27 bit 6. (Also, see ATFn command.)

B0    Selects CCITT operation at 300 or 1200 bps during Call Establishment and a subsequent connection. (Default.)

B1    Selects BELL operation at 300 or 1200 bps during Call Establishment and a subsequent connection.

Result Codes:

OK    n = 0 or 1.

ERROR    Otherwise.

## Cn - Carrier Control

This command is included for compatibility only, and has no effect other than returning a result code. The only valid parameter is 1.

Result Codes:
OK     n = 1.
ERROR     Otherwise.

## Dn - Dial

This command directs the modem to go on-line, dial according to the string entered and attempt to establish a connection. If no dial string is supplied, the modem will go on-line and attempt the handshake in originate mode. In W-class models, the action of going off-hook is affected by the status of the Line Current Sense input, if line current sensing is enabled, and by the blacklist and delayed list.

*NOTE: If the ATD command is issued before the S1 register has cleared, the modem will respond with the NO CARRIER result code. Accordingly, with some country-specific regulations, the modem will answer DELAYED when you are making repeated call attempts, without getting any connection and BLACKLIST will be the answer if you are dialling a forbidden number.*

Dial Modifiers. The valid dial string parameters are described below. Punctuation characters may be used for clarity, with parentheses, hyphen, and spaces being ignored.

0-9     DTMF digits 0 to 9.

*     The 'star' digit (tone dialling only).

#     The 'gate' digit (tone dialling only).

A-D     DTMF digits A, B, C, and D. Some countries may prohibit sending of these digits during dialling.

L     Re-dial last number: the modem will re-dial the last valid telephone number. The L must be immediately after the D with all the following characters ignored).

P     Select pulse dialling: pulse dial the numbers that follow until a "T" is encountered. Affects current and subsequent dialling. Some countries prevent changing of dialling modes after the first digit is dialled.

T     Select tone dialling: tone dial the numbers that follow until a "P" is encountered. Affects current and subsequent dialling. Some countries prevent changing of dialling modes after the first digit is dialled.

R     This command will be accepted, but not acted on.

S=n     Dial the number stored in the directory (n = 0 to 3 or 0 to 19 depending on the modem model). (See &Z.)

!     Flash: the modem will go on-hook for a time defined by the value of S29. Country requirements may limit the time imposed.

W     Wait for dial tone: the modem will wait for dial tone before dialling the digits following "W". If dial tone is not detected within the time specified by S6 the modem will abort the rest of the sequence, return on-hook, and generate an error message.

@     Wait for silence: the modem will wait for at least 5 seconds of silence in the call progress frequency band before continuing with the next dial string parameter. If the modem does not detect these 5 seconds of silence before the expiration of the call abort timer (S7), the modem will terminate the call attempt with a NO AN-SWER message. If busy detection is enabled, the modem may terminate the call with the BUSY result code. If answer tone arrives during execution of this parameter, the modem handshakes.

| & | Wait for credit card dialling tone before continuing with the dial string. If bong is not detected within the time specified by S6, the modem will abort the rest of the sequence, return on-hook, and generate an error message. |
|---|---|
| , | Dial pause: the modem will pause for a time specified by S8 before dialling the digits following ",". |
| ; | Return to command state. Added to the end of a dial string, this causes the modem to return to the command state after it processes the portion of the dial string preceding the ";". This allows the user to issue additional AT commands while remaining off-hook. The additional AT commands may be placed in the original command line following the ";" and/or may be entered on subsequent command lines. The modem will not enter call progress until an additional dial command is issued without the ";" terminator. Use "H" to abort the dial in progress, and go back on-hook. |
| ^ | Toggles calling tone enable/disable: applicable to current dial attempt only. |
| ( ) | Ignored: may be used to format the dial string. |
| - | Ignored: may be used to format the dial string. |
| <space> | Ignored: may be used to format the dial string. |
| <i> | Invalid character: will be ignored. |
| > | If enabled by country-specific parameter, the modem will generate a grounding pulse on the EARTH relay output. |

## En - Command Echo

The modem enables or disables the echo of characters to the DTE according to the parameter supplied. The parameter value, if valid, is written to S14 bit 1.

E0    Disables command echo. (Default.)
E1    Enables command echo.

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

## Fn - Select Line Modulation

This command selects the line modulation according to the parameter supplied. The line modulation is fixed unless Automode is selected. This command interacts with the S37 and the N command. The parameter value, if valid, is written to S37 bits 0-4. To select line modulation, it is recommended that either the F command, or a combination of the S37 and the N command, be used, but not both.

F0    Selects auto-detect mode. Sets N1 and sets S31 bit 1. In this mode, the modem configures for Automode operation. All connect speeds supported by the modem are possible according to the remote modem's preference. The contents of S37 are ignored as is the sensed DTE speed.

F1    Selects V.21 or Bell 103 according to the B setting as the only acceptable line speed resulting in a subsequent connection. Sets N0, sets S37 to 1, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=1.

F2    Not supported.

F3    Selects V.23 as the only acceptable line modulation for a subsequent connection. Originator is at 75 bps and answer is at 1200 bps. Sets N0, sets S37 to 7, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=7.

F4    Selects V.22 1200 or Bell 212A according to the B command setting as the only acceptable line speed for a subsequent connection. Sets N0, sets S37 to 5, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=5.

F5    Selects V.22 bis as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 6, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=6.

F6    Select V.32 bis 4800 or V.32 4800 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 8, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=8.

F7    Selects V.32 bis 7200 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 12, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=12.

Этот setting also allows connection at the Rockwell proprietary 7200 V.32 speed, e.g., with an RC9696/12-based modem.

F8    Selects V.32 bis 9600 or V.32 9600 as the only acceptable line modulations for a subsequent connection. Sets N0, sets S37 to 9, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=9.

F9    Selects V.32 bis 12000 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 10, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=10.

This setting also allows connection at the Rockwell proprietary 12000 V.32 speed, e.g., with an RC9696/12-based modem.

F10   Selects V.32 bis 14400 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 11, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=11.

## Hn - Disconnect (Hang-Up)

This command initiates a hang up sequence.

This command may not be available for some countries due to PTT restrictions.

H0    The modem will release the line if the modem is currently on-line, and will terminate any test (AT&T) that is in progress. Country-specific, modulation specific, and error correction protocol specific (S38) processing is handled outside of the H0 command.

H1    If on-hook, the modem will go off-hook and enter command mode. The modem will return on-hook after a period of time determined by S7.

Result Codes:

OK    n = 0 or 1.

ERROR    Otherwise.

## In - Identification

The modem reports to the DTE the requested result according to the command parameter.

I0    Reports product code (e.g., "1MRSxxxxxx").

I1    Reports a precomputed checksum .

I2    Reports program compilation date.

I3    Reports firmware revision.

I4    Reports copyright notice.

I5    Reports Country Code parameter .

I6    Reports modem data pump model and internal code revision.

Result Codes:

OK    n = 0 to 6.

ERROR    Otherwise.

## Ln - Speaker Volume

The modem sets the speaker volume control according to the parameter supplied. The parameter value, if valid, is written to S22 bits 0 and 1.

L0    Low volume.

L1    Low volume. (Default.)

L2    Medium volume.

L3    High volume.

Result Codes:

OK    n = 0 to 3.

ERROR    Otherwise.

## Mn - Speaker Control

This command selects when the speaker will be on or off. The parameter value, if valid, is written to S22 bits 2 and 3.

M0    Speaker is always off.

M1    Speaker is on during call establishment, but off when receiving carrier. (Default.)

M2    Speaker is always on.

M3    Speaker is off when receiving carrier and during dialling, but on during answering.

Result Codes:

OK    n = 0 to 3.

ERROR    Otherwise.

## Nn - Automode Enable

This command enables or disables Automode detection. The parameter value, if valid, is written to S31 bit 1.

N0    Automode detection is disabled. A subsequent handshake will be conducted according to the contents of S37 or, if S37 is zero, according to the most recently sensed DTE speed.

N1    Automode detection is enabled. A subsequent handshake will be conducted according to the Automode algorithm supported by the modem. This command is equivalent to F0. (Default.)

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

## On - Return to On-Line Data Mode

This command determines how the modem will enter the on-line data mode. If the modem is in the on-line command mode, the modem enters the on-line data mode with or without a retrain. If the modem is in the off-line command mode (no connection), ERROR is reported.

O0    Enters on-line data mode without a retrain. Handling is determined by the Call Establishment task. Generally, if a connection exists, this command connects the DTE back to the remote modem after an escape (+++).

O1    Enters on-line data mode with a retrain before returning to on-line data mode.

Result Codes:
OK    n = 0 or 1 and a connection exists.
ERROR    Otherwise or if not connected.

## P - Set Pulse Dial Default

This command forces pulse dialling until the next T dial modifier or T command is received. Sets S14 bit 5.

As soon as a dial command is executed which explicitly specifies the dialling mode for that particular call (e.g., ATDT...), this command is overridden so that all future dialling will be tone dialled. (See T command.)

This command may not be permitted in some countries.
Result Code:
OK

## Qn - Quiet Results Codes Control

The command enables or disables the sending of result codes to the DTE according to the parameter supplied. The parameter value, if valid, is written to S14 bit 2.

Q0    Enables result codes to the DTE. (Default.)
Q1    Disables result codes to the DTE.

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

## Sn - Read/Write S register

The modem selects an S register, performs an S register read or write function, or reports the value of an S register.

n      Establishes S register n as the last register accessed.

n=v   Sets S register n to the value v.

n?     Reports the value of S register n.

The parameter n can be omitted, in which case the last S register accessed will be assumed. The S can be omitted for AT= and AT?, in which case the last S register accessed will be assumed.

For example:

ATS7 establishes S7 as the last accessed register.

AT = 40 sets the contents of the last register accessed to 40.

ATS = 20 sets the contents of the last register accessed to 20.

If the number "n" is beyond the range of the S registers available, the modem will return the ERROR message. If the result is outside the range permitted for a given S register the values will still be stored, but functionally the lower and higher limits will be observed. Input and output are always in decimal format. Note that some S registers are read-only. In some cases, writing to the S register will appear to be accepted but the value will not actually be written.

Due to country restrictions, some commands will be accepted, but the value may be limited and replaced by a maximum or minimum value.

Minimum, maximum, and default values for S registers may be altered.

## T - Set Tone Dial Default

This command forces DTMF dialling until the next P dial modifier or P command is received. The modem will set an S register bit to indicate that all subsequent dialling should be conducted in tone mode. Note that the DP command will override this command. Clears S14 bit 5.

This command may not be permitted in some countries. (See P.)

Result Code:

OK

## Vn - Result Code Form

This command selects the sending of short-form or long-form result codes to the DTE. The parameter, if valid, is written to S14 bit 3.

V0     Enables short-form (terse) result codes. Line feed is not issued before a short-form result code. (Default.)

V1     Enables long-form (verbose) result codes.

Result Codes:

OK    n = 0 or 1.

ERROR     Otherwise.

## Wn - Connect Message Control

This command controls the format of CONNECT messages. The parameter value, if valid, is written to S31 bits 2 and 3. Note that the Wn command can be overridden by register S95 bits (see S95 description).

W0    Upon connection, the modem reports only the DTE speed (e.g., CONNECT 19200). Subsequent responses are disabled. (Default.)

W1    Upon connection, the modem reports the line speed, the error correction protocol, and the DTE speed, respectively. Subsequent responses are disabled.

W2    Upon connection, the modem reports the DCE speed (e.g., CONNECT 14400). Subsequent responses are disabled.

Result Codes:
OK     n = 0, 1, or 2.
ERROR     Otherwise.

## Xn - Extended Result Codes:

This command selects which subset of the result messages will be used by the modem to inform the DTE of the results of commands.

Blind dialling is enabled or disabled by country parameters. If the user wishes to enforce dial tone detection, a "W" can be placed in the dial string (see D command). Note that the information below is based upon the default implementation of the X results table. Table 3-1 indicates the messages which are enabled for each X value.

X0    Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, and NO ANSWER result codes. Blind dialling is enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported. If dial tone detection is enforced or selected and dial tone is not detected, NO CAR-RIER will be reported instead of NO DIAL TONE. The value 000b is written to S22 bits 6, 5, and 4, respectively.

X1    Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX (XXXX = rate). Blind dialling enabled/disabled by country pa-rameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 100b is written to S22 bits 6, 5, and 4, respectively.

X2    Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO DIALTONE, NO ANSWER, and CONNECT XXXX. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detec-tion is enforced or selected and dial tone is not detected, NO DIAL TONE will be reported instead of NO CARRIER. The value 101b is written to S22 bits 6, 5, and 4, respectively.

X3    Enables monitoring of busy tones; sends only OK, CONNECT, RING, NO CAR-RIER, ERROR, NO ANSWER, and CONNECT XXXX. Blind dialling is enabled/ disabled by country parameters. If dial tone detection is enforced and dial tone is not detected, NO CARRIER will be reported. The value 110b is written to S22 bits 6, 5, and 4, respectively.

X4    Enables monitoring of busy tones; sends all messages. The value 111b is written to S22 bits 6, 5, and 4, respectively. (Default.)

Result Codes:
OK     n = 0 to 4.
ERROR     Otherwise.

**Table 3-1. Result Codes**

| Short Form | Long Form | n Value in ATXn Command | | | | |
|:---:|---|:---:|:---:|:---:|:---:|:---:|
| | | 0 | 1 | 2 | 3 | 4 |
| 0 | OK | x | x | x | x | x |
| 1 | CONNECT | x | x | x | x | x |
| 2 | RING | x | x | x | x | x |
| 3 | NO CARRIER | x | x | x | x | x |
| 4 | ERROR | x | x | x | x | x |
| 5 | CONNECT 1200 | 1 | x | x | x | x |
| 6 | NO DIALTONE | 3 | 3 | x | x | x |
| 7 | BUSY | 3 | 3 | 3 | x | x |
| 8 | NO ANSWER | x | x | x | x | x |
| 9 | CONNECT 0600 | 1 | x | x | x | x |
| 10 | CONNECT 2400 | 1 | x | x | x | x |
| 11 | CONNECT 4800 | 1 | x | x | x | x |
| 12 | CONNECT 9600 | 1 | x | x | x | x |
| 13 | CONNECT 7200 | 1 | x | x | x | x |
| 14 | CONNECT 12000 | 1 | x | x | x | x |
| 15 | CONNECT 14400 | 1 | x | x | x | x |
| 16 | CONNECT 19200 | 1 | x | x | x | x |
| 17 | CONNECT 38400 | 1 | x | x | x | x |
| 18 | CONNECT 57600 | 1 | x | x | x | x |
| 22 | CONNECT 75TX/1200RX | 1 | x | x | x | x |
| 23 | CONNECT 1200TX/75RX | 1 | x | x | x | x |
| 24 | DELAYED | 4 | 4 | 4 | 4 | x |
| 32 | BLACKLISTED | 4 | 4 | 4 | 4 | x |
| 40 | CARRIER 300 | x | x | x | x | x |
| 44 | CARRIER 1200/75 | x | x | x | x | x |
| 45 | CARRIER 75/1200 | x | x | x | x | x |
| 46 | CARRIER 1200 | x | x | x | x | x |
| 47 | CARRIER 2400 | x | x | x | x | x |
| 48 | CARRIER 4800 | x | x | x | x | x |
| 49 | CARRIER 7200 | x | x | x | x | x |
| 50 | CARRIER 9600 | x | x | x | x | x |
| 51 | CARRIER 12000 | x | x | x | x | x |
| 52 | CARRIER 14400 | x | x | x | x | x |
| 66 | COMPRESSION: CLASS 5 | x | x | x | x | x |
| 67 | COMPRESSION: V.42 bis | x | x | x | x | x |
| 69 | COMPRESSION: NONE | x | x | x | x | x |
| 76 | PROTOCOL: NONE | x | x | x | x | x |
| 77 | PROTOCOL: LAPM | x | x | x | x | x |
| 80 | PROTOCOL: ALT | x | x | x | x | x |

*Note: An 'x' in a column indicates that the message (either the long form if verbose, or the value only for short form) will be generated when that particular value of 'n' (shown at the top of the column) has been selected by the use of ATXn. If the column is blank, then no message will be generated for that X option. A numeral indicates which less explicit message (verbose or short form) will be output for that X option. (Also, see Section 3.3).*

## Zn - Soft Reset and Restore Profile

The modem performs a soft reset and restores (recalls) the configuration profile according to the parameter supplied. If no parameter is specified, zero is assumed.

Z0    Soft reset and restore stored profile 0.
Z1    Soft reset and restore stored profile 1.

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

## 3.4.1    AT& Commands

### &An - Dial Abort Option

The modem normally aborts the connection negotiation if a character is received from DTE during the connection phase. This command gives the user the option to let the modem ignore incoming characters. The parameter value, if valid, is written to S22 bit 7.

&A0    Enable abort. (Default.)
&A1    Disable abort.

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

### &Bn - DTR Dial Option

This command interprets the OFF to ON transition of the DTR signal from the DTE to enable the modem to dial the telephone number stored with AT&Z0=...... The parameter value, if valid, is written to S27 bits 7.

&B0    No action. (Default.)
&B1    Dial on OFF to ON transition of the DTR signal.

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

### &Cn - DCD Option

The modem controls the DCD output in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bit 5.

&C0    DCD remains ON at all times. (Default.)
&C1    DCD follows the state of the carrier.

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

## &Dn - DTR Option

This command interprets the ON to OFF transition of the DTR signal from the DTE in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bits 3 and 4.

&D0 - DTR drop is interpreted according to the current &Q setting as follows: (Default.)

&Q0, &Q5, &Q6   DTR is ignored (assumed ON). Allows operation with DTEs which do not provide DTR.

&Q4   DTR drop causes the modem to hang up. Auto-answer is not affected.

&D1   DTR drop is interpreted by the modem as if the asynchronous escape sequence had been entered. The modem returns to command state without disconnecting

&D2   DTR drop causes the modem to hang up. Auto-answer is inhibited.

&D3   DTR drop causes the modem to perform a soft reset as if the Z command were received. The &Y setting determines which profile is loaded.

## &En - Radio Subcarrier Option

When this command is activated. The parameter value, if valid, is written to S16 bits 7.

&E0   No action. (Default.)

&E1   Transmission is not granted if radio subcarrier is active. Transmitter relay active

Result Codes:

OK    n = 0 or 1.

ERROR    Otherwise.

## &Fn - Restore Factory Configuration (Profile)

The modem loads the factory default configuration (profile). The factory defaults are identified for each command and in the S register descriptions. A configuration (profile) consists of a subset of S registers.

&F0   Restore factory configuration 0.

&F1   Restore factory configuration 1.

Result Codes:

OK

ERROR    If the modem is connected.

## &Hn - 2-Wire / 4-Wire Control

This command selects 2 or 4-wire line connection. The parameter value, if valid, is written to S14 bit 6.

&H0   2-wire. (Default.)

&H1   4-wire.

Result Codes:

OK    n = 0 or 1.

ERROR    Otherwise.

## &Jn - Telephone Jack Control

This command selects telephone jack or screw connector as the active line connection. The parameter value, if valid, is written S21 bit 1.

&J0   Telephone jack. (Default.)

&J1   Screw connector.

Result Codes:

OK    n = 0 or 1.

ERROR    Otherwise.

## &Kn - Flow Control

This command defines the DTE/DCE (terminal/modem) flow control mechanism. The parameter value, if valid, is written to S39 bits 0, 1, and 2.

&K0   Disables flow control.
&K3   Enables RTS/CTS flow control. (Default for data modem modes.)
&K4   Enables XON/XOFF flow control.
&K5   Enables transparent XON/XOFF flow control.
&K6   Enables both RTS/CTS and XON/XOFF flow control.

Result Codes:
OK     n = 0, 3, 4, 5, or 6.
ERROR     Otherwise.

## &Rn - RTS/CTS Option

This selects how the modem controls CTS. CTS operation is modified if hardware flow control is selected (see &K command). The parameter value, if valid, is written to S21 bit 2.

&R0   CTS acts according to V.25 bis handshake.
&R1   CTS will only drop if required by flow control. (Default.)

Result Codes:
OK     n = 0 or 1.
ERROR     Otherwise.

## &V - Display Current Configuration and Stored Profiles

Reports the current (active) configuration, the stored (user) profiles, and the first four stored telephone numbers. The stored profiles and telephone numbers are not displayed if the NVRAM is not installed or is not operational as detected by the NVRAM test during reset processing.

Result Code:
OK


Example:

AT&V

ACTIVE PROFILE:
B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0 &Y0

S00:002 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:030 S08:002 S09:006
S10:014 S11:255 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S46:138
S48:007 S95:000

STORED PROFILE 0:
B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0

S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:105 S41:003 S46:138 S95:000

STORED PROFILE 1:
B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0

S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:105 S41:003 S46:138 S95:000

TELEPHONE NUMBERS:
0 =    1 =
2 =    3 =
OK

If the NVRAM is not installed or is not operational as detected by the NVRAM test, the following message is displayed:
NVRAM FAILED OR NOT INSTALLED

## &Wn - Store Current Configuration

Saves the current (active) configuration (profile), including S registers, in one of the two user profiles in NVRAM as denoted by the parameter value. This command will yield an ERROR message if the NVRAM is not installed or is not operational as detected by the NVRAM test.

The current configuration is comprised of a list of storable parameters illustrated in the &V command. These settings are restored to the active configuration upon receiving an Zn command or at power up (see &Yn command).

&W0  Store the current configuration as profile 0.
&W1  Store the current configuration as profile 1.

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

## &Yn - Designate a Default Reset Profile

Selects which user profile will be used after a hard reset.

&Y0    The modem will use profile 0.
&Y1    The modem will use profile 1.

Result Codes:
      n = 0 to 1.
ERROR    If n > 1, or if NVRAM  is not installed or is not operational.

## &Zn=x - Store Telephone Number

The modem can store up to 4 or 20 (model dependent) telephone numbers and each telephone number dial string can contain up to 35 digits.

&Zn=x   n = 0 to 3 (modem dependent) and x = dial string. (Requires 256-byte NVRAM.)
&Zn=x   n = 0 to 19 (modem dependent) and x = dial string. (Requires 2048-byte NVRAM.)

Result Codes:
OK    For n + 3 or + 19 (model dependent), and x + 35 digits.
ERROR  If n > 3 or > 19 (model dependent), or x > 35 digits, or if NVRAM  is not installed or is not operational.

## 3.4.2    AT% Commands

### %F - V.23 operation mode

This command sets V.23 operation mode .

%F1   75tx/1200rx.
%F2   1200tx/75rx. (Default.)
%F3   1200tx/1200rx half duplex. The carrier is controlled by the lt.)

Result Codes:
OK    n = 0, 1, or 2.
ERROR    Otherwise.


## 3.4.3    AT\ Commands

### \Nn - Operating Mode

This command controls the preferred error correcting mode to be negotiated in a subsequent data connection. This command is affected by the OEM firmware configuration.

\N0   Selects normal speed buffered mode (disables error-correction mode). (Forces &Q6.)

\N1   Serial interface selected - Selects direct mode and is equivalent to &Q0 mode of operation. (Forces &Q0.)

Parallel interface selected - Same as \N0.

\N2   Selects reliable (error-correction) mode. The modem will first attempt an LAPM connection and then an MNP connection. Failure to make a reliable connection results in the modem hanging up. (Forces &Q5, S36=4, and S48=7.)

\N3   Selects auto reliable mode. This operates in the same way as \N2 except the failure to make a reliable connection results in the modem falling back to the speed buffered normal mode. (Forces &Q5, S36=7, and S48=7.)

\N4   Selects LAPM error-correction mode. Failure to make an LAPM error-correction connection results in the modem hanging up. (Forces &Q5 and S48=0.) Note: The -K1 command can override the \N4 command.

\N5   Selects MNP error-correction mode. Failure to make an MNP error-correction connection results in the modem hanging up. (Forces &Q5, S36=4, and S48=128.)

Result Codes:
OK    n = 0 to 5.
ERROR    Otherwise.


### \S - Display Current Configuration

Reports a part of the current (active) configuration in a user-friendly manner
Result Code:
OK

## 3.5 Error detection and data compression commands

### 3.5.1 AT% Commands

#### %C - Enable/Disable Data Compression

Enables or disables data compression negotiation. The modem can only perform data compression on an error-corrected link. The parameter value, if valid, is written to S41 bits 0 and 1.

%C0  Disables data compression. Resets S46 bit 1.
%C1  Enables MNP 5 data compression negotiation. Resets S46 bit 1.
%C2  Enables V.42 bis data compression. Sets S46 bit 1.
%C3  Enables both V.42 bis and MNP 5 data compression. Sets S46 bit 1. (Default.)
Result Codes:
OK    n = 0, 1, 2, or 3.
ERROR    Otherwise.

## 3.6 Special commands

#### &Cn - DCD Option

The modem controls the DCD output in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bit 5.

&C0  DCD remains ON at all times. (Default.)
&C1  DCD follows the state of the carrier.

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

#### &En - Radio Subcarrier Option

When this command is activated, the parameter value, if valid, is written to S16 bits 7.

&E0  No action. (Default.)
&E1  Transmission is not granted if radio subcarrier is active.

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

#### &Hn - 2-Wire / 4-Wire Control

This command selects 2 or 4-wire line connection. The parameter value, if valid, is written to S21 bit 1.

&H0  2-wire. (Default.)
&H1  4-wire.

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

#### &Jn - Telephone Jack Control

This command selects telephone jack or screw connector as the active line connection. The parameter value, if valid, is written S21 bit 1.

&J0    Telephone jack. (Default.)
&J1    Screw connector.

Result Codes:
OK    n = 0 or 1.
ERROR    Otherwise.

### AT Command Result Codes

The modem responds to commands from the DTE and to activity on the line by signalling to the DTE in the form of result codes. The result codes that the modem can send are described below.

Two forms of each result code are available: long-form, an English-like "verbose" response, and short-form, a data-like numeric response (included in parentheses following the long-form). The long-form code is preceded and terminated by the sequence < CR> < LF>. The short-form is terminated by < CR>, only with no preceding sequence.

If result messages are suppressed, nothing is returned to the DTE.

### 0- OK

The OK code is returned by the modem to acknowledge execution of a command line.

### 1- CONNECT

The modem will send this result code upon connecting when:
1. The line speed is 300 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 300 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting, or
3. The range of result code responses is restricted by the X command in such a way that no speed reporting is allowed.

### 2- RING

The modem sends this result code when incoming ringing is detected on the line. What qualifies as a ring signal is determined by country-dependent parameters.

### 3- NO CARRIER

The modem sends this result code when attempting to establish a call if:
1. Ringback is detected and later ceases but no carrier is detected within the period of time determined by register S7, or
2. No ringback is detected within the period of time determined by register S7.

This result code is also used when the modem auto-disconnects due to loss of carrier.
Under X0, if busy tone detection is enforced, this result code is used as a response to the detection of busy or circuit busy. Under X0, if dial tone detection is enforced or selected, this result code is used to indicate that dial tone has not been detected.

### 4- ERROR

The modem returns this result code if the command line contains a syntax error or it is unable to execute a command contained in the command line. It is issued if a command does not exist or if the parameter supplied is outside the permitted range.
Under X0, X1, X2, and X3, this result code is used instead of DELAYED and BLACK-LISTED.

### 5- CONNECT 1200

For X1, X2, XN.1, and X4, the modem sends this result code when:
1. The line speed is 1200 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 1200 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.
(Also, see the W command.)

### 6- NO DIALTONE

For X2 and X4, the modem sends this result code if it has been instructed to wait for dial tone during dialling but none is received.

### 7- BUSY

For X3 and X4, if busy tone detection is enforced, the modem sends this result code when attempting to originate a call if the busy (engaged) signal is detected on the line.

### 8- NO ANSWER

The modem sends this result code when attempting to originate a call if a continuous ringback signal is detected on the line, until the expiration of the timer S7.

### 9- CONNECT 0600

For X1, X2, X3, and X4, the modem sends this result code when:
1. The line speed is 600 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 600 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

### 10- CONNECT 2400

For X1, X2, X3, and X4, the modem sends this result code when:
1. The line speed is 2400 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 2400 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

### 11- CONNECT 4800

For X1, X2, X3, and X4, the modem sends this result code when:
1. The line speed is 4800 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 4800 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

### 12- CONNECT 9600

For X1, X2, X3, and X4, the modem sends this result code when:
1. The line speed is 9600 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 9600 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

### 13- CONNECT 7200

For X1, X2, X3, and X4, the modem sends this result code when:
1. The line speed is 7200 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 7200 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

### 14- CONNECT 12000

For X1, X2, X3, and X4, the modem sends this result code when:
1. The line speed is 12000 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 12000 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

### 15- CONNECT 14400

For X1, X2, X3, and X4, the modem sends this result code when:
1. The line speed is 14400 bps and the modem has been instructed to report the line speed to the DTE upon connecting, or
2. The DTE speed is 14400 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

### 16- CONNECT 19200

For X1, X2, X3, and X4, the modem returns this result code upon connecting when the DTE speed is 19200 bps and the modem has been instructed to report the DTE speed upon connecting.

### 17- CONNECT 38400

For X1, X2, X3, and X4, the modem sends this result code upon connecting when the DTE speed is 38400 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

### 18- CONNECT 57600

For X1, X2, X3, and X4, the modem sends this result code upon connecting when the DTE speed is 57600 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

### 19- CONNECT 115200

For X1, X2, X3, and X4, the modem sends this result code upon connecting when the DTE speed is 115200 bps and the modem has been instructed to report the DTE speed to the DTE upon connecting.

### 22- CONNECT 75TX/1200RX

For X1, X2, X3, and X4, the modem returns this result code upon establishing a V.23 originate connection when the modem has been instructed to report the DCE speed upon connection.

### 23- CONNECT 1200TX/75RX

For X1, X2, X3, and X4, the modem returns this result code upon establishing a V.23 answer connection when the modem has been instructed to report the DCE speed upon connection.

### 24- DELAYED

For X4, the modem returns this result code when a call fails to connect and the number dialled is considered 'delayed' due to country blacklisting requirements.

### 32- BLACKLISTED

For X4, the modem returns this result code when a call fails to connect and the number dialled is considered 'blacklisted'.

### 40- CARRIER 300

The modem returns this result code when a 0-300 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

### 44- CARRIER 1200/75

The modem sends this result code when the V.23 backward channel carrier has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

### 45- CARRIER 75/1200

The modem sends this result code when the V.23 forward channel carrier has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

### 46- CARRIER 1200

The modem sends this result code when a 1200 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

### 47- CARRIER 2400

The modem sends this result code when a 2400 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

### 48- CARRIER 4800

The modem sends this result code when a 4800 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

### 49- CARRIER 7200

The modem sends this result code when a 7200 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

### 50- CARRIER 9600

The modem sends this result code when a 9600 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

### 51- CARRIER 12000

The modem sends this result code when a 12000 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

### 52- CARRIER 14400

The modem sends this result code when a 14400 bps data rate has been detected on the line and carrier reporting has been enabled. (See S95 and Xn.)

### 66- COMPRESSION: CLASS 5

This message is sent to the DTE when the modem has connected in MNP Class 5 and COMPRESSION message reporting has been enabled. (See S95 and Xn.)

### 67- COMPRESSION: V.42 bis

This message is sent to the DTE when the modem has connected in V.42 bis and COMPRESSION message reporting has been enabled. (See S95 and Xn.)

### 69- COMPRESSION: NONE

This message is sent to the DTE when the modem has connected without data compression and COMPRESSION message reporting has been enabled. (See S95 and Xn.)

### 70- PROTOCOL: NONE

This message is sent to the DTE when the modem has connected without any form of error correction, and PROTOCOL message reporting has been enabled. (See S95 and Xn.)

### 77- PROTOCOL: LAPM

This message is sent to the DTE when the modem has connected in the V.42 LAPM mode of error correction, and PROTOCOL message reporting has been enabled. (See S95 and Xn.)

### 80- PROTOCOL: ALT

This message is sent to the DTE when the modem has connected in the MNP mode of error correction, and PROTOCOL message reporting has been enabled. (See S95 and Xn.)

## 3.8 S Register

The S registers are summarised in Table 4-1 along with their default values. Registers denoted with an '*' in Table 4-1 may be stored in one of the two user profiles by entering the &Wn command. One of these profiles may be loaded at any time by using the Zn command. Registers or register fields quoted as `reserved` are reserved for current or future use by the firmware, or are permanently overridden by PTT limitations. Call Progress and Blacklisting options.

All bit-mapped registers are read-only. The appropriate AT command which controls the relevant bits in the S register should be used to change the value.

## 3.8.1 Factory defaults

The factory default values are stored in ROM and are loaded into the active configuration at power up or by the ATZn command. In addition, the designated default profile is subsequently loaded, and may change some of the factory default values. The designated default profile can be changed by entering the &Yn command where n is one of the two possible user profiles.

The defaults shown are those used by Rockwell in factory profiles zero and one. These may be overwritten by the OEM prior to placing the firmware in PROM. Minimum and maximum values may also be imposed in response to country PTT requirements.

The default values shown in Table 4-1 may vary by modem firmware configuration. Consult the MCU firmware release notes for exact configuration.

The factory default values may be loaded at any time by entering the &Fn command.

Table 4-1.   S register Summary

| Register | Function | Range | Units | Type* | Default |
|---|---|---|---|---|---|
| S0 | Rings to Auto-Answer | 0-255 | rings | S | 2 |
| S1 | Ring Counter | 0-255 | rings | R | 0 |
| S2 | Escape Character | 0-255 | ASCII | S | 43 |
| S3 | Carriage Return Character | 0-127 | ASCII | | 13 |
| S4 | Line Feed Character | 0-127 | ASCII | | 10 |
| S5 | Backspace Character | 0-255 | ASCII | | 8 |
| S6 | Wait Time for Dial Tone | 2-255 | s | S | 2 |
| S7 | Wait Time for Carrier | 1-255 | s | S | 50 |
| S8 | Pause Time for Dial Delay Modifier | 0-255 | s | S | 2 |
| S9 | Carrier Detect Response Time | 1-255 | 0.1 s | S | 6 |
| S10 | Carrier Loss Disconnect Time | 1-255 | 0.1 s | S | 14 |
| S12 | Escape Prompt Delay | 0-255 | 0.02 s | S | 50 |
| S13 | Reserved | - | - | R | - |
| S14 | General Bit Mapped Options Status | - | - | SR | 128 (80h) |
| S15 | Reserved | - | - | R | - |
| S16 | Test Mode Bit Mapped Options Status (&T) | - | - | R | 0 |
| S17 | Reserved | - | - | R | - |
| S18 | Test Timer | 0-255 | s | S | 0 |

| Register | Function | Range | Units | Type* | Default |
|----------|----------|-------|-------|-------|---------|
| S19 | AutoSync Options | - | - | | 0 |
| S20 | AutoSync HDLC Address or BSC Sync Character | 0-255 | - | S | 0 |
| S21 | V.24/General Bit Mapped Options Status | - | - | SR | 4 (04h) |
| S22 | Speaker/Results Bit Mapped Options Status | - | - | SR | 117 (75h) 58 (3ah) |
| S23 | General Bit Mapped Options Status | | - | SR | |
| S24 | Sleep Inactivity Timer | 0-255 | s | S | 0 |
| S25 | Delay to DTR Off | 0-255 | s or 0.01 s | | 5 |
| S26 | RTS to CTS delay | 0-255 | 10 ms | | 1 |
| S27 | General Bit Mapped Options Status | - | - | SR | 9(09h) |
| S28 | General Bit-Mapped Options Status | - | - | S | 0 |
| S29 | Flash Dial Modifier Time | 0-255 | 10 ms | | 0 |
| S30 | Disconnect Inactivity Timer | 0-255 | 10 s | | 0 |
| S31 | General Bit-Mapped Options Status | - | - | SR | 2 |
| S32 | XON Character | 0-255 | ASCII | | 17 (11h) |
| S33 | XOFF Character | 0-255 | ASCII | | 19 (13h) |
| S34-S35 | Reserved | - | - | | - |
| S36 | LAPM Failure Control | - | - | S | 7 |
| S37 | Line Connection Speed | - | - | S | 0 |
| S38 | Delay Before Forced Hangup | 0-255 | s | | 20 |
| S39 | Flow Control Bit Mapped Options Status | - | - | SR | 3 |
| S40 | General Bit-Mapped Options Status | - | - | SR | 105 (69h) |
| S41 | General Bit-Mapped Options Status | - | - | SR | 3 |
| S42-S45 | Reserved | - | - | | - |
| S46 | Data Compression Control | - | - | S | 138 |
| S48 | V.42 Negotiation Control | - | - | S | 7 |
| S82 | LAPM Break Control | - | - | | 128(40h) |
| S86 | Call Failure Reason Code | 0-255 | - | R | - |
| S91 | PSTN Transmit Attenuation Level | 0-15 | dBm | | 13 (Country dependent) |
| S95 | Result Code Messages Control | - | - | S | 0 |

*   S - Register value may be stored in one of two user profiles with the &W command.
    R - Read only register.

# 4.0 AT command set summary

| | |
|---|---|
| A/ | Re-execute command. |
| A | Go off-hook and attempt to answer a call. |
| B0 | Select V.22 connection at 1200 bps. |
| B1 | Select Bell 212A connection at 1200 bps. |
| C1 | Return OK message. |
| Dn | Dial modifier. |
| E0 | Turn off command echo. |
| E1 | Turn on command echo. |
| F0 | Select auto-detect mode (equivalent to N1). |
| F1 | Select V.21 or Bell 103. |
| F3 | Select V.23 line modulation. |
| F4 | Select V.22 or Bell 212A 1200 bps line speed. |
| F5 | Select V.22 bis line modulation. |
| F6 | Select V.32 bis or V.32 4800 line modulation. |
| F7 | Select V.32 bis 7200 line modulation. |
| F8 | Select V.32 bis or V.32 9600 line modulation. |
| F9 | Select V.32 bis 12000 line modulation. |
| F10 | Select V.32 bis 14400 line modulation. |
| H0 | Initiate a hang-up sequence. |
| H1 | If on-hook, go off-hook and enter command mode. |
| I0 | Report product code. |
| I1 | Report pre-computed checksum. |
| I2 | Report OK. |
| I3 | Report firmware revision, model, and interface type. |
| I4 | Report response programmed by an OEM. |
| I5 | Report the country code parameter. |
| I6 | Report modem data pump model and code revision. |
| Ln | Set speaker volume n= 0, 1, 2, 3 (low, low, medium, high). |
| M0 | Turn speaker off. |
| M1 | Turn speaker on during handshaking and turn speaker off while receiving carrier. |
| M2 | Turn speaker on during handshaking and while receiving carrier. |
| M3 | Turn speaker off during dialling and receiving carrier and on during answering. |
| N0 | Turn off automode detection. |
| N1 | Turn on automode detection. |
| O0 | Go on-line. |
| O1 | Go on-line and initiate a retrain sequence. |
| P | Force pulse dialling. |
| Q0 | Allow result codes to DTE. |
| Q1 | Inhibit result codes to DTE. |
| Sn | Select S register as default. |
| Sn? | Return the value of S register n. |
| =v | Set default S register to value v. |
| ? | Return the value of default S register. |
| T | Force DTMF dialling. |

| | |
|---|---|
| V0 | Report short form (terse) result codes. |
| V1 | Report long form (verbose) result codes. |
| W0 | Report DTE speed in EC mode. |
| W1 | Report line speed, EC protocol and DTE speed. |
| W2 | Report DCE speed in EC mode. |
| X0 | Report basic call progress result codes, i.e., OK, CONNECT, RING, NO CARRIER also, for busy, if enabled, and dial tone not detected), NO ANSWER and ERROR. |
| X1 | Report basic call progress result codes and connections speeds (OK, CONNECT, RING, NO CARRIER (also, for busy, if enabled, and dial tone not detected), NO ANSWER, CONNECT XXXX, and ERROR. |
| X2 | Report basic call progress result codes and connections speeds, i.e., OK, CONNECT, RING, NO CARRIER (also, for busy, if enabled, and dial tone not detected), NO ANSWER, CONNECT XXXX, and ERROR. |
| X3 | Report basic call progress result codes and connection rate, i.e., OK, CONNECT, RING, NO CARRIER, NO ANSWER, CONNECT XXXX, BUSY, and ERROR. |
| X4 | Report all call progress result codes and connection rate, i.e., OK, CONNECT, RING, NO CARRIER, NO ANSWER, CONNECT XXXX, BUSY, NO DIAL TONE and ERROR. |
| Z0 | Restore stored profile 0 after warm reset. |
| Z1 | Restore stored profile 1 after warm reset. |
| &A0 | Connection attempt aborted if a character is received from DET. |
| &A1 | Connection attempt not aborted if a character is received from DET. |
| &B0 | Ignore DTR auto dial. |
| &B1 | Dial a stored number with DTR transition. |
| &C0 | Force DCD active regardless of the carrier state. |
| &C1 | Allow DCD to follow the carrier state. |
| &D0 | Interpret DTR ON-to-OFF transition per &Qn: &Q0, &Q5-6, e modem ignores DTR. &Q4, The modem hangs up. |
| &D1 | Interpret DTR ON-to-OFF transition per &Qn: &Q0, &Q4-6, synchronous escape. |
| &D2 | Interpret DTR ON-to-OFF transition per &Qn: &Q0, &Q4-6, The modem hangs up., Autodial turns off. |
| &D2 | Interpret DTR ON-to-OFF transition per &Qn: &Q0, &Q4-6, The modem performs soft reset. |
| &F0 | Restore factory configuration 0. |
| &F1 | Restore factory configuration 1. |
| &H0 | 2-wire connection. |
| &H1 | 4-wire connection. |
| &J0 | Selects telephone jacket for line connection. |
| &J1 | Selects screw connector for line connection. |
| &K0 | Disable DTE/DCE flow control. |
| &K3 | Enable RTS/CTS DTE/DCE flow control. |
| &K4 | Enable XON/XOFF DTE/DCE flow control. |
| &K5 | Enable transparent XON/XOFF flow control. |
| &K6 | Enable both RTS/CTS and XON/XOFF flow control. |

&R0    CTS tracks RTS.

&R1    CTS is always active.

&V     Display current configurations.

&W0    Store the active profile in NVRAM profile 0.

&W1    Store the active profile in NVRAM profile 1.

&X0    Select internal timing for the transmit clock.

&X1    Select external timing for the transmit clock.

&X2    Select slave receive timing for the transmit clock.

&Y0    Recall stored profile 0 upon power up.

&Y1    Recall stored profile 1 upon power up.

&Zn=x  Store dial string x (to 35) to location n (0 to 3 depending upon modem model).

%C0    Disable data compression.

%C1    Enable MNP 5 data compression.

%C2    Enable V.42 bis data compression.

%C3    Enable both V.42 bis and MNP 5 compression.

%F1     V.23 operation mode 75tx/1200rx.

%F2     V.23 operation mode1200tx/75rx.

%F3     V.23 operation mode 1200/1200 hdx.

\N0    Select normal speed buffered mode.

\N1    Select direct mode.

\N2    Select reliable link mode.

\N3    Select auto reliable mode.

\N4    Force LAPM mode.

\N5    Force MNP mode.

\S     Display Current Configuration

# 5.0 Service

During normal operation within the limits stated under technical specifications the 1MRS119000 modem board is maintenance-free.

# 6.0 Trouble-Shooting

The LED indicators on the modem can be used to find errors in the modem.
The LED indicators are:

| | | |
|---|---|---|
| LIN | Modem connected to line (off hook), connected to the line relay control signals. | Green |
| RNG | Indicates a true incoming ringing signal. | Green |
| TXD | Transmitted data. Connected to the modem TxD signal. | Green |
| RXD | Received data. Connected to the modem RxD signal. | Green |
| CD | Carrier detect. | Green |
| RTS | Request to send. | Green |
| IRF | Internal Fault detected by the watchdog. Normally this LED is off. | Red |

LEDs under normal operation, not connected to another modem:
All LED:s OFF, except for the RTS LED which follows the status of the unit, connected to the RS-232 port.

LEDs under normal operation, connected to another modem:
LIN and CD LEDs are ON, the RTS LED follows the status of the unit that is connected to the RS-232 port. TXD and RXD indicates data transmitted to and from the modem on the RS-232 interface.

If the LED status differs from this please check the connections.

| Disturbance | Possible reason | Corrective action |
| --- | --- | --- |
| IRF LED lit | Internal fault | Switch OFF and ON the auxiliary supply. Check if the fault disappears. If not, contact the local ABB service for repair. |
| The RXD LED not lit even if the remote station asks for contact. | Connection between modem and network. | Check connection wires. If radio unit is present, check connection of antenna and the radio device. |
| | Modem setup. | Check modem software setup with current type of connection. |
| RXD is flashing but not TXD. | Modem setup. | Check modem software setup with current type of connection. |
| | Connection not compatible. | Check data transfer rate and format for all units involved in the communication. |
| | Wrong address | Check the unit address |
| RXD and TXD is flashing but the master station does not receive the message. | Connection between modem and network. | Check connection wires. If radio unit is present, check connection of antenna and the radio device. |
| | Delay time from transmitter ON to data too short. | Increase delay in modem. |

Testing the modem with a terminal or a PC with a terminal program.:
Connect the terminal to the 9-pole RS-232 connection. Use normal Hayes commands to test the modem.

Example:
- Make a normal connection to another modem.
- Make a manual setup of the modem.
- Read the status of the modem with Hayes command AT\S. Compare the result with the expected configuration.
- Set the modem back to factory configuration