Panasonic®

PROGRAMMABLE CONTROLLERS

FP Modem-56k

Technical Manual

BEFORE BEGINNING

Liability and Copyright for the Hardware

This manual and everything described in it are copyrighted. You may not copy this manual, in whole or part, without written consent of Panasonic Electric Works Europe AG (PEWEU).

PEWEU pursues a policy of continuous improvement of the design and performance of its products. Therefore we reserve the right to change the manual/product without notice. In no event will PEWEU be liable for direct, special, incidental, or consequential damage resulting from any defect in the product or its documentation, even if advised of the possibility of such damages.

We invite your comments on this manual. Please e-mail us at:

tech-doc@eu.pewg.panasonic.com.

Please direct support matters and technical questions to your local Panasonic representative.

LIMITED WARRANTY

If physical defects caused by distribution are found, PEWEU will replace/repair the product free of charge. Exceptions include:

- When physical defects are due to different usage/treatment of the product other than described in the manual.
- When physical defects are due to defective equipment other than the distributed product.
- When physical defects are due to modifications/repairs by someone other than PEWEU.
- When physical defects are due to natural disasters.

Important Symbols

One or more of the following symbols may be used in this documentation:

DANGER!

The warning triangle indicates especially important safety instructions. If they are not adhered to, the results could be fatal or critical injury.

◆CAUTION

Indicates that you should proceed with caution. Failure to do so may result in injury or significant damage to instruments or their contents, e.g. data.

◆NOTE

Contains important additional information.

◆EXAMPLE

Contains an illustrative example of the previous text section.

◆Procedure

Indicates that a step-by-step procedure follows.

◆REFERENCE

Indicates where you can find additional information on the subject at hand.

◆KEY POINTS

Summarizes key points in a concise manner.

◆SHORTCUTS

Provides helpful keyboard shortcuts.

◆EXPLANATION

Provides a brief explanation of a function, e.g. why or when you should use it.

☛ next page

Indicates that the text will be continued on the next page.

Table of Contents

Chapter 1

Overview

1.1 Advantages of the FP Modem-56k

The FP Modem-56k is designed for data exchange between programmable logic controllers (PLCs), as well as between PLCs and PCs, via analog telephone network connections in an industrial environment.

The following features distinguish the FP Modem-56k from other standard PC modems:

- Extremely compact size
- Operating voltage 24V DC (extended operating voltage range: 10.8–26.6V DC)
- Attachable to a 35-mm DIN rail
- Additional RS485 interface (see page 29)
- Maximum line speed 56kbps
- Leased line mode (see page 66) (point-to-point) up to 20km at 33.6kbps
- Multidrop leased line mode as specified by V.23 with 1200bps
- DCD output (see page 25) for connection to the digital input of a PLC
- Password protection and callback function (see page 43)
- Enhanced CLIP (see page 47) function (FSK and DTMF)
- CLIP (see page 47) with callback
- PSTN text messaging (see page 59) (if supported by the PSTN)

1.2 Important Functions of the FP Modem-56k

- Dialing method: pulse and tone dialing
- Transmission standards: V.21, V.22bis, V.22, V.23, V.32, V.32bis, V.34, V.90, V.92
- Error correction: V.42, LAPM, MNP
- Data compression: V.42bis and V.44
- RS232C and RS485 baud rate 300 to 115200bps, automatic baud rate detection and storable communications parameters
- Automatic baud rate detection can be disabled for PLC connections (via TOOL port) by predefining communications parameters with AT*W
- Hayes-compatible, extended AT command set (V.250)
- **PLC ↔ PC** communications: Enables remote programming (see page 56) and monitoring (via dial-up and leased line mode) with PLCs of the Panasonic FP series.
- **PLC ↔ PLC** communications: Enables communication via COM port using the Modem Library for FPWIN Pro (see page 57). This library contains function blocks and examples serving various purposes.

◆NOTE

- **The FP Modem-56k has been tested in accordance with ETSI ES 203021 V2.1.1, Parts 1,2,3, ETSI ES 201787 V1.1.1 (Loop Disconnect (LD) dialling specific requirements), ETSI ES 201729 V1.1.1 (Timed break recall (register recall)), and TBR15:1997. It can be used in the following countries: Austria, Belgium, Denmark, Germany, Finland, France, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland, Spain, UK, and USA (US Conformity: C04MM05B077FP).**
- **The framing ground (FG with green cable) must be connected. Defects resulting from failure to comply with these instructions are not covered by our warranty.**
- **Our warranty does not cover damage caused by lightning, or any indirect consequences thereof. We strongly recommend appropriate surge protection.**
- **An RJ12-RJ12 cable is included in the FP Modem-56k unit package. Connections to country-specific telephone jacks require national adapters, which are commercially available from telephone retailers.**

1.3 Compatibility with the FP Modem-EU

The FP Modem-56k was designed for maximum compatibility with the previous model, the FP Modem-EU. Nevertheless, certain features have been modified, including the command set and the design.

In addition, several commands have been replaced in order to more closely reflect the Hayes standard. This will not affect modem operation with Panasonic PLCs and their associated user and technology libraries.

What has changed?		Description
Design	**RS485 port**	New hardware interface with 4-pin spring force plug component
	DIP switches	There are now eight DIP switches instead of four, for activating the terminating resistors in multipoint mode and for the RS485 network. Changes to the DIP settings take effect after the next power-up. (With the FP Modem-EU, DIP changes took effect immediately.)
	Operating voltage	The operating voltage range has been extended.
	Buffer size	In multipoint PLC and transparent modes, the RS232C/RS485 buffer size has changed to 6kB.
Functions	**PSTN text messaging**	New feature
	Password protection and callback function	Compatible with the FP Modem-EU on the caller's, but not the call recipient's side. Before the callback is started, the 56k model outputs "CONNECT XXXX" (unlike the EU model, which outputs "NO CARRIER"). As soon as the callback is in progress, the 56k model outputs "CALLBACK IN PROGRESS..." and then "NO CARRIER" until the connection has been established.
	Fax function	Supports class 2 faxes only.
	ASCII-fax function	This FP Modem-EU feature is no longer available.
	DTMF Alarm and Telecontrol	This FP Modem-EU feature is no longer available.
Commands	**ATFn**	ATFn commands are no longer used; they are bypassed internally with the command **AT+MS=xx**. The ATF2 command is not supported at all.
	ATIn	Additional options (see page 100).
	ATK	This ASCII-fax function is no longer supported.
	ATOn	Additional options (see page 100).
	ATXn	Extended messages can no longer be controlled with ATXn, but only with AT\Vn (see page 100).
	ATYn	The command for delayed termination of the connection is no longer supported.
	AT\An	MNP block size control is no longer supported.
	AT&N0	Activating the terminating resistors by software is no longer supported. Please use the DIP switches instead.
	AT&N1	Activating the terminating resistors by software is no longer supported. Please use the DIP switches instead.
	AT&N2	Activating the terminating resistors by software is no longer supported. Please use the DIP switches instead.
	AT&Sn	The value **&S0** is set as the default.
	AT*L	This command for "Display password" is no longer supported. Please use

What has changed?		Description
		AT*P? instead.
	AT\K	AT\K0, AT\K2 and AT\K4 set the unit to command mode and do not transmit a break signal, regardless of the originator of the command. AT\K6 has been removed because the FP Modem-56k now recognizes break signals with no difficulty.
	AT\P	The command "Password input or display" is no longer supported. Please use **AT*P?** instead.
	AT\Vn	This command controls extended messages.
	AT+...	The entire set of AT+ commands (see page 100) has been added.
	AT-Kn	This command controls V.42 to MNP10 conversion.
	AT%Bn	This command to control blacklisting is no longer required. The FP Modem-56k waits for 5s, and redials automatically after a dialing attempt has failed.
	AT%Cn	The command for enabling/disabling compression has additional options.
	AT&K5	Activates XON/XOFF flow control in transparent mode. (FP Modem-EU: unidirectional XON/XOFF flow control.)
	AT%Sn	The command for selecting the callback function was not listed in the FP Modem-EU manual.
	S registers	Several S registers have been added or their function changed. See S register settings (see page 109).

1.4 Product Names and Numbers

Product name	Product number
FP Modem-56k Unit	FP-MODEM-56k
Modem Library for FPWIN Pro	NCL-CMEU-LIB
FP Modem-56k RS232C Cable for FP Series PLC COM Port with screw terminal, 0.5m	CABMODPLC111
FP Modem-56k RS232C Cable for FP Series PLC COM Port with 9-pin Sub-D connector, 0.5m	CABMODPLC211
RS232 cable between FP Modem-56k and Tool port, 2m	CABMODPLC311
FP Modem-56k Technical Manual	ACGM0144V10EN

Chapter 2

Hardware Installation

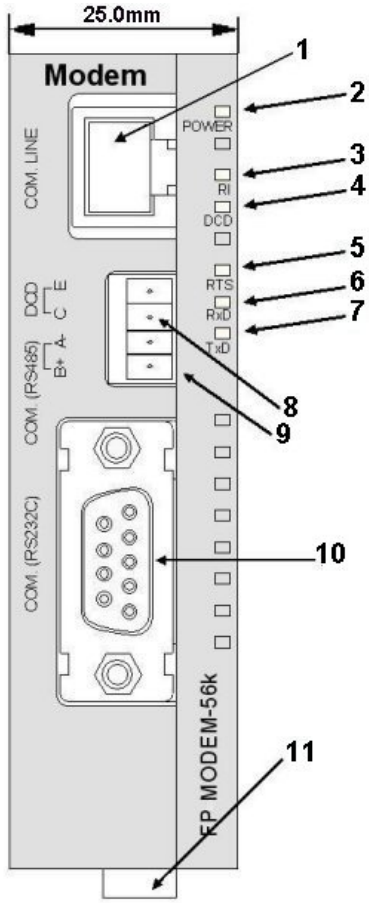
2.1 FP Modem-56k Unit Package

The FP Modem-56k unit package contains:

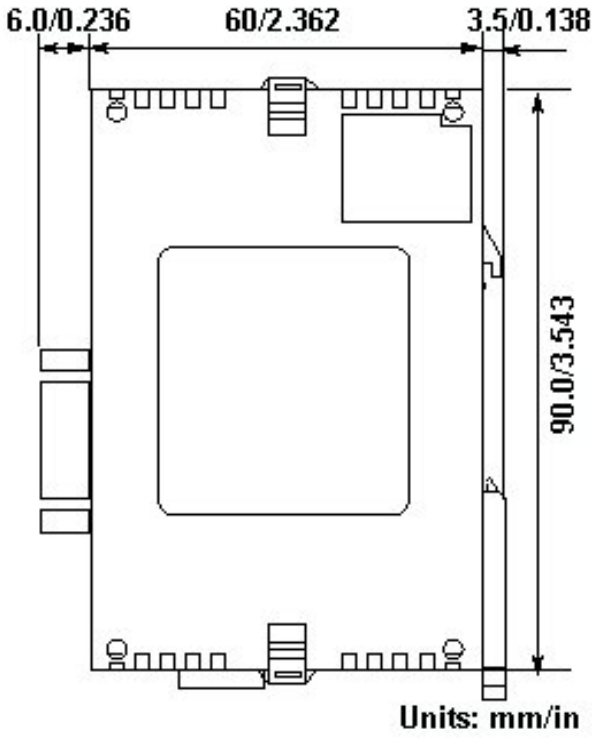
- FP Modem-56k unit
- 24V DC power cable
- Leaflet with installation instructions and important notes
- 4-pin spring force plug
- RJ12-RJ12 telephone cable

2.2 Parts, Functions, and Dimensions

The parts and dimensions of the FP Modem-56k are illustrated below:



FP Modem-56k: Parts



FP Modem-56k: Dimensions

1. **Telephone connector jack** (RJ12) for dial-up, leased, or multipoint lines (middle two wires). An RJ12-RJ12 cable is supplied with the unit.
2. **Power.** LED lights up at power ON, when the unit is ready for operation.
3. **RI.** Ring Indicator. If S=0, LED lights up at incoming ring. If S>0, LED is lit and turns off with each incoming ring.
4. **DCD.** Data Carrier Detect. LED lights up when data connection is established (in dial-up mode). After a successful self-test at power ON, LED turns off.
5. **RTS.** Request To Send. LED lights up when handshake signal has been set.
6. **RxD.** Receive Data. LED flashes during data reception.
7. **TxD.** Transmit Data. LED flashes during data transmission.
8. **DCD output** monitors connections to the digital 24V PLC inputs. Spring force plug (see "DCD Output" on page 25).

9. **RS485** interface. Spring force plug. See wiring scheme for PLC cable (see page 29).
10. **RS232C** (9-pin Sub-D female) interface. See wiring scheme for PLC cable (see page 26). Use standard 1:1 serial cables to connect to an IBM PC serial port or FP Web Server.
11. **24V DC.** An AFP0581 power supply cable is supplied with the unit.

Cable parts

The unit's cable parts are color-coded as follows:

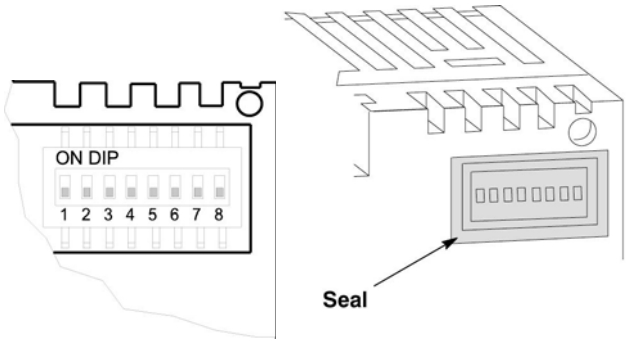
Brown	+24V DC
Blue	GND
Green	Framing ground (FG)

◆NOTE

- **The green wire MUST be connected to the FG.**
- **The RS485 and RS232C interfaces cannot be used at the same time.**

2.3 DIP Switches

Peel the seal off the side of the unit to expose the DIP switches.



DIP switches at side of unit

DIP Switch	Function	
DIP1	ON = Leased line mode (LL)	
DIP2	ON = Multipoint mode (MP)	
DIP3	Leased line (LL): ON = Originate mode (master) OFF = Answer mode (slave)	Multipoint (MP): ON = PLC mode ON+DIP1=ON = Transparent mode (S95 = 3) OFF = PC/RTS mode
DIP4	ON = Default setting (AT&F) at power ON (see below)	
DIP5	ON = RS485 / OFF = RS232C	
DIP6	ON = MP terminating resistor	
DIP7	ON = RS485 terminating resistor for B+ line	
DIP8	ON = RS485 terminating resistor for A- line	

Default setting: All DIPs = OFF

◆NOTE

- **Changes made to DIP switch settings do not take effect until the next power-up.**
- **Because of their small size, DIP switches can be tricky to handle. When changing settings, be sure to use enough force so that they are ON or OFF; otherwise, an undefined position in between settings may result.**

When DIP4 is set to ON

At power ON (i.e., when you switch the modem on), the profile stored on EEPROM (NVRAM) is not read; instead, the default setting is activated, as if you had used the **AT&F** command. With this DIP switch setting, you are not overwriting the stored profiles; you are only overwriting the active profile.

If you do not store the active profile, i.e. DIP4 is switched back, the FP Modem-56k reverts to the previous profile after the next power ON. This DIP setting will not delete the telephone numbers stored in &Zn. To delete these numbers, please use **AT*F** (see page 100).

The following table lists important default settings according to the mode and the corresponding configuration without AT commands:

Mode	Settings for DIP switches 1-3 (in all modes, DIP4 = ON)	Default settings
Dial-up	DIP1-3 = OFF	19200 8o1 S0=1 (like **AT&F**)
Leased line	DIP1 = ON DIP2 = OFF DIP3 = ON/OFF, i.e., ON = Master / OFF = Slave	19200 8o1
Multipoint/PC	DIP1 = OFF DIP2 = ON DIP3 = OFF	1200 8o1
Multipoint/PLC	DIP1 = OFF DIP2 = ON DIP3 = ON	19200 8o1
Multipoint/transparent	DIP1 = ON DIP2 = ON DIP3 = ON	19200 8o1 S95=3

◆**NOTE**

To define a fixed baud rate, we recommend the AT*W command, which you can use to control all available serial interface communications settings. In this context, DIP4 should not be set to ON.

2.4 Technical Data

General	
Dimensions	Height 90mm; width 25mm; depth 64mm
Telephone network connection	RJ12 jack and RJ12-RJ12 cable (cable supplied with unit)
Carrier detect connection	4-pin spring force plug
RS232C port	9-pin Sub-D female plug at front of unit
RS485 port	4-pin spring force plug
Power supply	24V DC Molex35 plug at bottom of unit
LEDs	Power, RI (ring), DCD (Data Carrier Detect), RTS (Request To Send), RxD and TxD (data traffic) at front of unit

Environmental requirements	
Ambient temperature	0 to 55°C
Humidity	5 to 95% noncondensing
Storage temperature	-20 to +70°C
Vibration resistance	10 to 55Hz, 1 cycle/min; 0.75mm double amplitude; 10min on 3 axes
Shock resistance	At least 10g; 4 times every x-, y-, and z-axis

Electrical specifications	
Operating voltage	24V DC (10.8 to 26.6V DC)
Current consumption	Approx. 50mA
Telephone jack	RJ12 jack 4-pin
Signal level of the telephone connection	-13dBm (leased line and multipoint mode) / -12dBm (dial-up mode)
Surge protection	Varistor for long-distance lines, deflection via Molex plug (FG)

Modem specifications		
Equalization		Transmit fixed compromise, receive automatic adaptive
Interface		ZR
Error correction		V.42, LAPM, MNP
Data compression		V.42bis and V.44
Dialing method		Pulse dialing, tone dialing (DTMF)
Call control		Extended AT command set
Mode selection		Automatic configuration of V.21, V.22, V.23, V.22bis, V.32, V.32bis, V.34, V.90, V92
RS232C/RS485 baud rate		300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200 bps
Test mode		Memory test function
Line transmission speed		Up to 56kbps with V.90 and V.92, V.32bis, V.42bis data compression (depending on data type)
Operation modes		Automatic selection
	V.92	Up to 56kbps downstream, up to 48kbps upstream (for ISDN modem only)
	V.90	Up to 56kbps downstream, up to 48kbps upstream (for ISDN modem only)

Modem specifications		
	V.34	Up to 33600bps
	V.32bis	4800bps, 7200bps, 9600bps, 14400bps full duplex
	V.32	4800bps, 7200bps, 9600bps full duplex
	V.22bis	2400bps full duplex
	V.22	1200bps full duplex
	V.23	1200/75bps full duplex, 75/1200bps full duplex, 1200/1200bps half duplex
	V.21	300bps full duplex

Standards and regulations	
Telephone system	ETSI ES 203021 V2.1.1 Parts 1,2,3, ETSI ES 201787 V1.1.1 (Loop Disconnect (LD) dialling specific requirements), ETSI ES 201729 V1.1.1 (Timed break recall (register recall)) and TBR15:1997. The modem can be used in the following countries: Austria, Belgium, Denmark, Germany, Finland, France, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland, Spain, UK, USA.
Electric safety	EN60950
Electromagnetic immunity	EN61000-6-2 (industrial)
Electromagnetic emission	EN50081-1 (domestic)
Conformity	CE Declaration; US Conformity: C04MM05B077FP

2.5 Important Notes

Please read the following warnings carefully before installing your FP Modem-56k.

Preparing to Install

Be sure to install the FP Modem-56k unit only in locations designed for electrical equipment, e.g. in a closed metal cabinet such as a switch cabinet.

Before you touch the FP Modem-56k or one of the data terminal equipment (DTE) units to which you intend to connect it, make sure you are not electrostatically charged. Electrostatic discharge can damage parts and equipment!

To install the FP Modem-56k, please proceed as follows:

◆Procedure

1. **Mount the modem on the DIN rail where the PLC – for example, an FP0R (see "Mounting the Unit" on page 18) _ is normally installed**
2. **Before connecting to the power supply, please read the section on wiring (see "Wiring" on page 24).**
3. **Connect the PLC via RS232C or RS485. For wiring instructions, see the sections on RS232C cables (see page 26) and RS485 cables (see page 29), or refer to the "FP Modem-56k Leaflet."**
4. **Connect the telephone cable (see "Connecting to the Telephone Line" on page 30)**

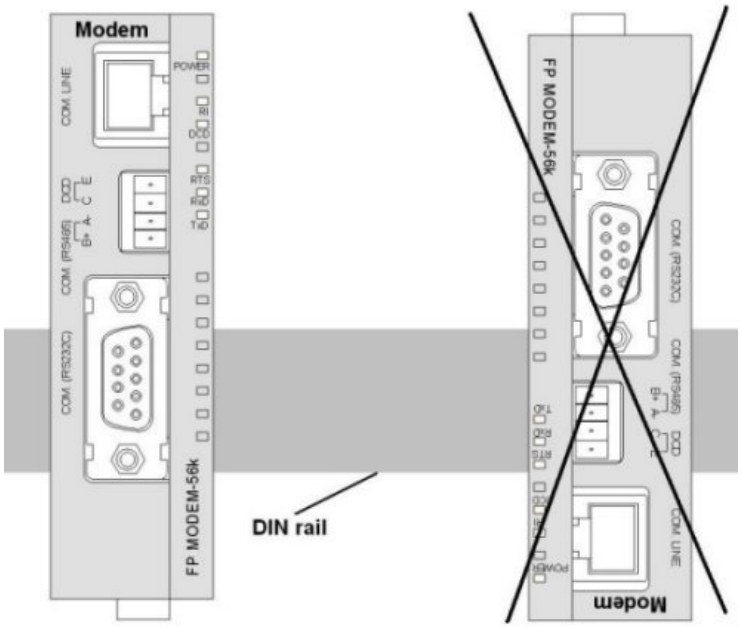
Surge Protection

Discharges and surges from the telephone line side or the operating voltage can cause modem failure. Take appropriate protective measures!

- **In particular, electromagnetic fields and mains-borne surges caused by lightning can damage electronic installations up to a distance of 1.5km from the location of the strike.**
- **In leased line mode and in areas with a high thunderstorm probability, we strongly recommend installing both coarse and fine protection (for the dial line, starting at 185V; for the leased line, starting at 5V).**

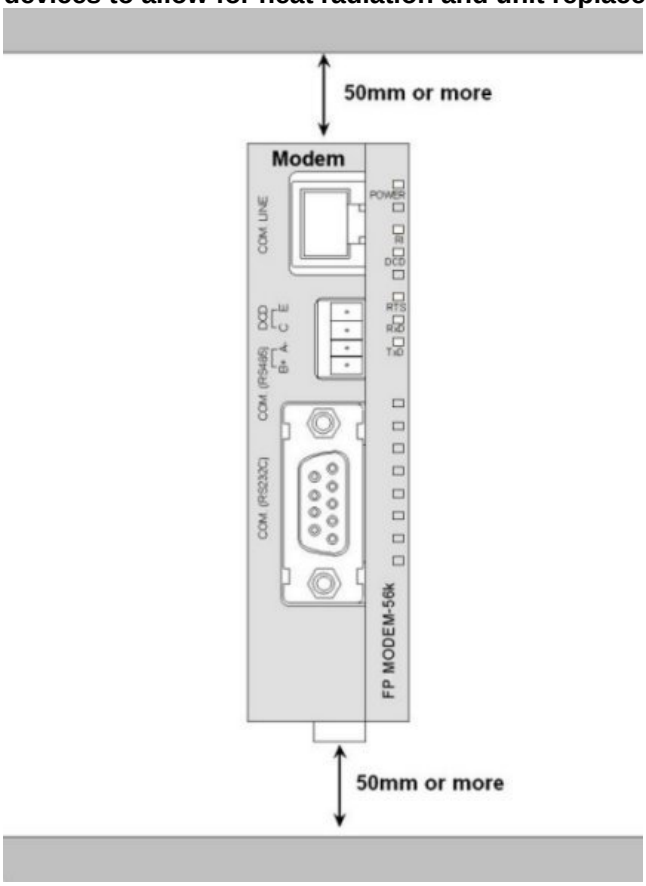
◆NOTE

- **Avoid installing the unit in locations where it could be exposed to:**
  - **Ambient temperatures outside the range of 0°C to 55°C / 32°F to 131°F**
  - **Ambient humidity outside the range of 30% to 85% RH**
  - **Sudden temperature changes causing condensation**
  - **Inflammable or corrosive gases**
  - **Excessive airborne dust or metal particles**
  - **Benzine, paint thinner, alcohol, or other organic solvents or strong alkaline solutions such as ammonia or caustic soda**
  - **Excessive vibrations or shock**
  - **Direct sunlight**
  - **Water in any form including spray or mist**
- **Avoid noise interference from the following sources:**
  - **Power transmission lines, high-voltage equipment, power cables, motors, radio transmitters, or any other power equipment can generate high switching surges**
  - **If noise occurs in the power supply line even after protective countermeasures have been taken, we recommend using an insulated transformer, noise filter, or the like.**
- **Protection against heat discharge:**
  - **Always install the unit with the RS232C port facing outward at the bottom in order to prevent heat generation:**

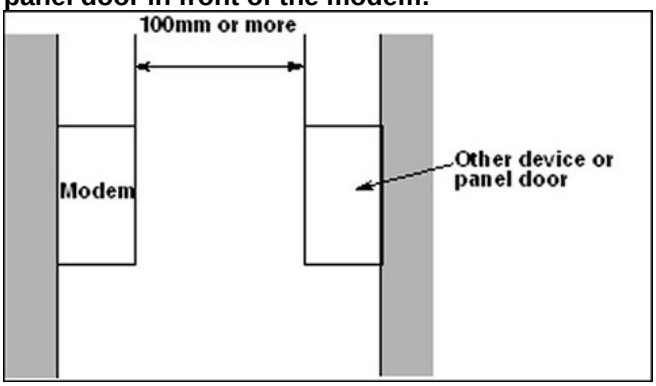


  - **Do not install the unit above devices that generate heat, such as heaters, transformers, or large-scale resistors.**

- **Installation space**
  - **Leave at least 50mm of space between the unit's wiring ducts and other devices to allow for heat radiation and unit replacement:**



  - **Leave at least 100mm of space between the unit and other devices, to avoid adverse affects from noise and heat when installing a device or panel door in front of the modem:**



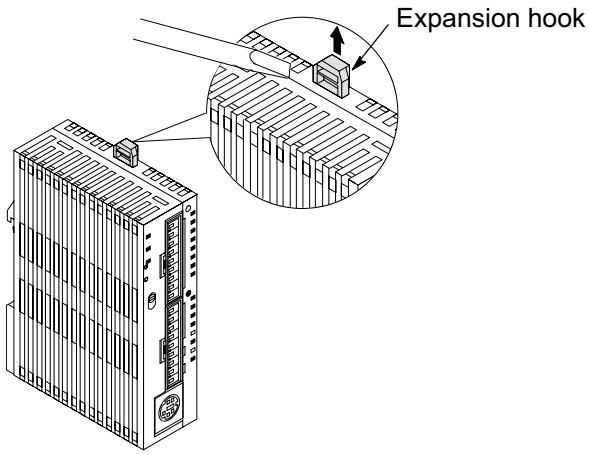
  - **Keep the first 100mm in front of the FP Modem-56k unit open, to provide space for programming tool connections and wiring.**

2.6 Mounting the Unit

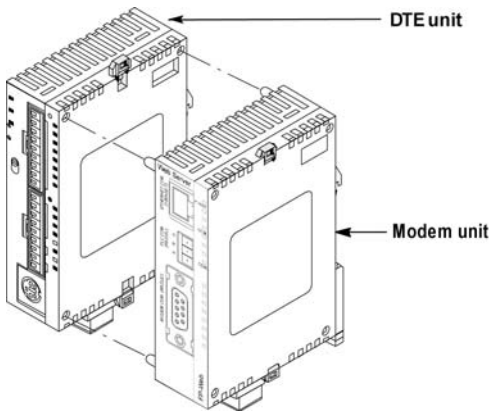
Attaching the FP Modem-56k to the FP0R or to FP Sigma

◆Procedure

1. **Raise the expansion hooks at the top and bottom of the FP0R unit with a screwdriver:**



2. **For a connection setup with no gaps between units, align the pins and holes in the four corners of the control unit and expansion unit, and insert the pins into the holes:**

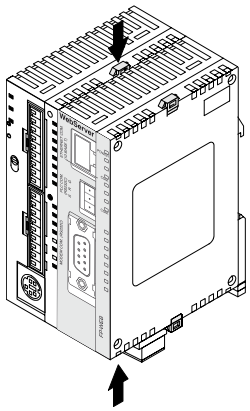


For additional installation options (attaching the unit to DIN rails, or installation using an FP0 slim type or flat type mounting plate), please refer to the alternate procedures described below.

◆NOTE

Make sure that the FP Modem-56k is the last unit attached – that is, do NOT install it between the CPU and an expansion unit. Otherwise the CPU cannot communicate with the expansion units.

3. Press down the expansion hooks raised in step 1 to secure the unit



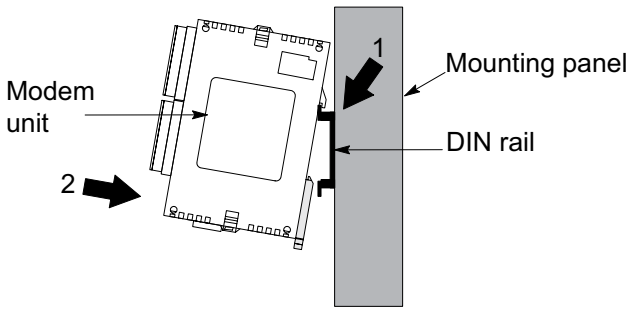
Attaching the FP Modem-56k to DIN rails

The FP Modem-56k unit enables one-touch attachment to DIN rails.

◆Procedure

1. Fit the upper hook of the FP Modem-56k onto the DIN rail

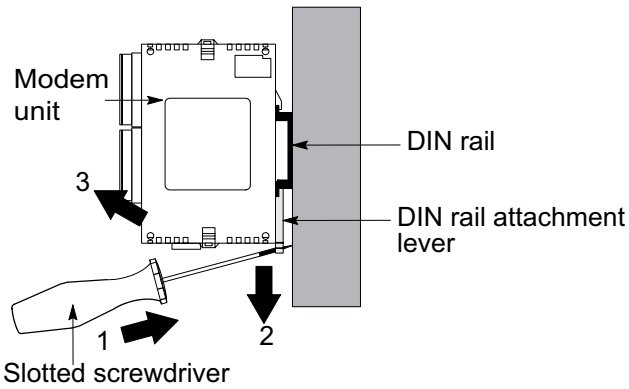
2. Without moving the upper hook, press the lower hook to fit the FP Modem-56k into position



Removing the FP Modem-56k from DIN rails

◆Procedure

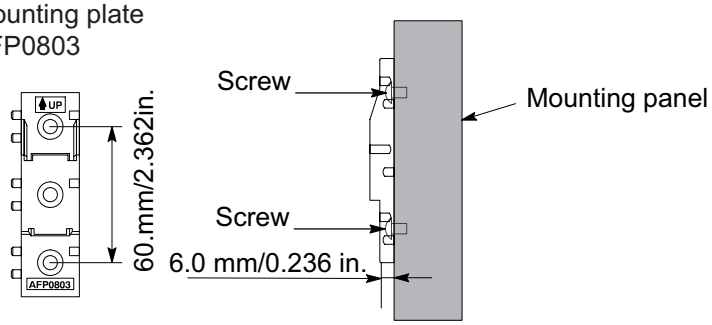
1. **Insert a slotted screwdriver into the DIN rail attachment lever**
2. **Pull the attachment lever downwards**
3. **Lift the FP Modem-56k unit and remove it from the rail**



Installing the FP Modem-56k using an FP0 slim type mounting plate

Use M4 size pan-head screws to attach the FP0 slim type mounting plate (AFP0803) to the mounting panel.

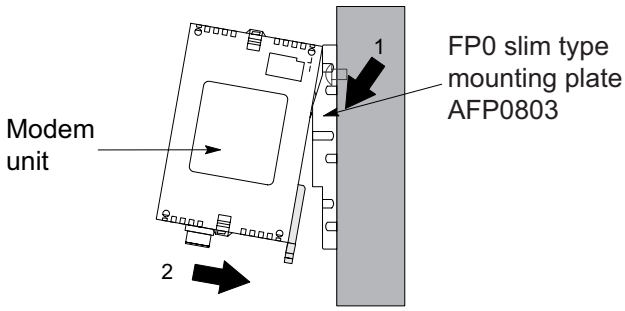
FP0 slim type mounting plate AFP0803



◆Procedure

1. **Fit the upper hook of the FP Modem-56k onto the FP0 slim type mounting plate**

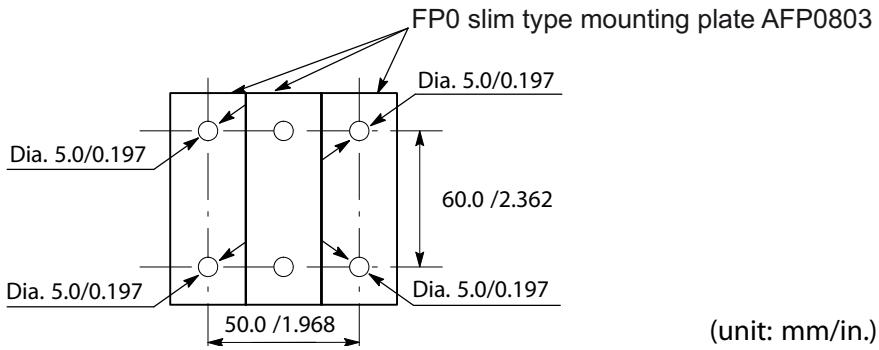
2. Without moving the upper hook, press the lower hook to fit the FP Modem-56k into position



When using an expansion unit, tighten the screws after having joined all of the FP0 slim type mounting plates to be connected. Tighten the screws at each of the four corners.

◆**EXAMPLE**

Example: Two expansion units

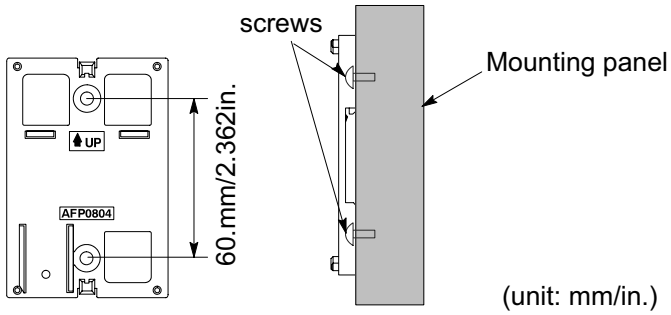


(unit: mm/in.)

Installing the FP Modem-56k using an FP0 flat type mounting plate

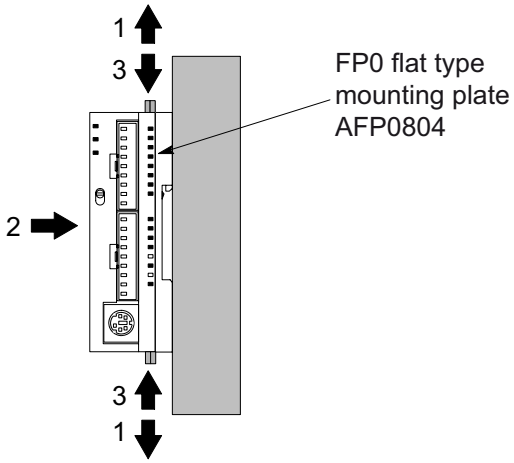
Use M4 size pan-head screws to attach the FP0 flat type mounting plate (AFP0804) and install according to the dimensions shown below.

FP0 flat type
mounting plate
AFP0804



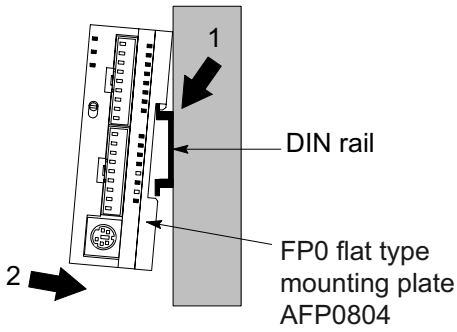
◆Procedure

1. **Raise the expansion hooks at the top and bottom of the unit**
2. **Install the FP Modem-56k on the FP0 flat type mounting plate**
3. **Align the expansion hooks with the plate and press the hooks back down**



◆**NOTE**

An FP Modem-56k with an attached FP0 flat type mounting plate can also be installed sideways on a DIN rail.



2.7 Wiring

This section provides information on the power supply and the operating voltage, as well as the DCD output and the RS232C/RS485 cables. The connection to the telephone line will also be explained.

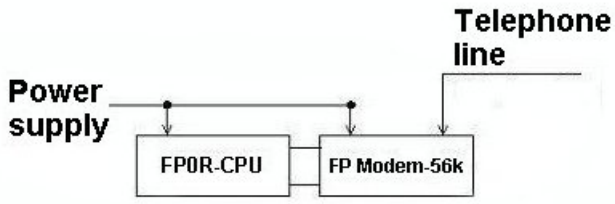
2.7.1 Power Supply and Operating Voltage

Connecting the power supply

The FP Modem-56k turns on as soon as the power supply has been connected.

◆NOTE

- **When connecting the power supply, make sure the polarity (+/–) is correct.**
- **As a rule, the FP Modem-56k and the PLC must be connected to the same power supply unit:**



(Exception: The FP2 can also be used with a 230V power supply unit.)

- **As soon as power is supplied, the green POWER LED will be ON. The framing ground (FG) must be connected.**
- **Please read the Important Notes (see page 15).**
- **Please also read the "FP Modem-56k Leaflet" sheet supplied with the FP Modem-56k.**

Disturbances to the operating voltage

The operating voltage range in which the modem functions safely is 10.8 to 26.6V DC. If the operating voltage falls below this limit, a RESET is triggered and maintained until the operating voltage is restored. This ensures that malfunctions due to insufficient operating voltages are excluded. In this case, and if the operating voltage breaks down entirely, the modem hangs up. After normal operation resumes in dial-up mode, the data connection is not restored automatically.

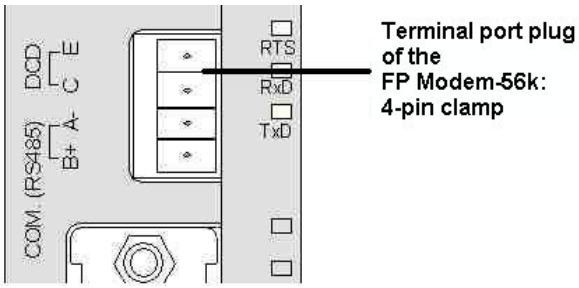
Overvoltage can irreversibly damage the product!
Be sure to adhere to the specified operating voltage range at all times!

2.7.2 DCD Output

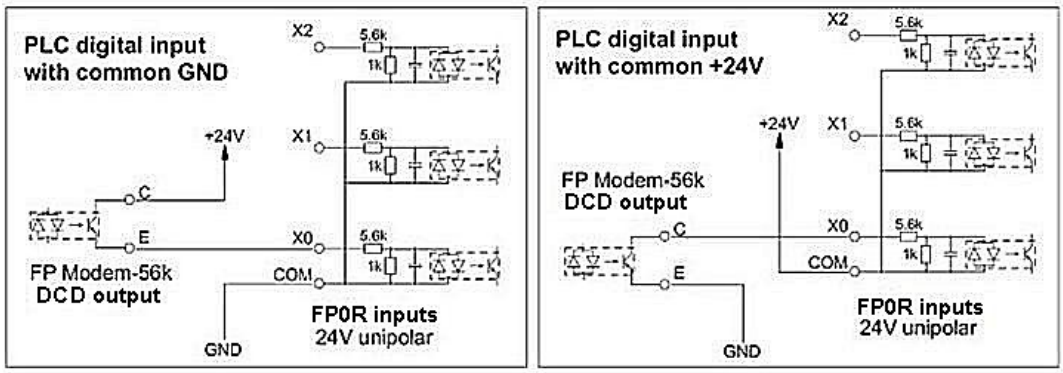
The Data Carrier Detect (DCD) output is an ideal method for monitoring line connection status. The attached DTE (i.e., PC or PLC) can detect the DCD state via this 24V-compatible output connected to a digital input. The DCD output enables the DTE to determine if an active data transfer connection was terminated by the remote modem. To save programming time, you can use the pertinent function blocks from the Modem Library for FPWIN Pro.

The DCD signal, which is sent as soon as a connection is established, is output via optocoupler to the 4-pin clamp in the middle of the housing (front side).

100mA is the maximum power allowed, i.e. maximum power loss is limited to 100mW! When you connect a relay circuit, make sure to include a surge protector.



DCD signal is output to 4-pin clamp



Wiring example for FP0R

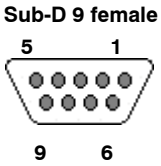
◆NOTE

The 24V digital signal is required because the RS232C interface of Panasonic PLCs does not support handshake or modem control lines. The connect status

message "NO CARRIER" (via RS232C) cannot be detected reliably during a data transfer connection.

2.7.3 RS232C Cables

RS232C interface

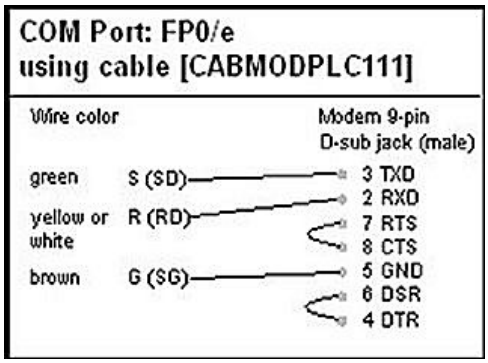


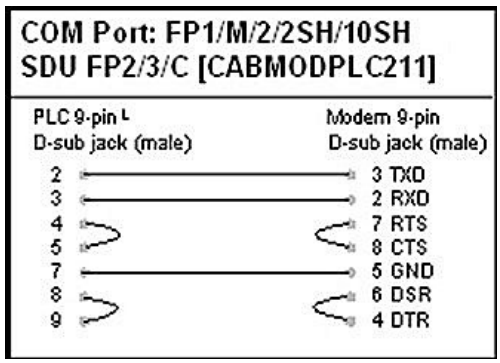
Pin	Name	Direction	Description
1	DCD	→	Carrier Detect
2	RXD	→	Receive Data
3	TXD	←	Transmit Data
4	DTR	←	Data Terminal Ready
5	GND	→	System Ground
6	DSR	→	Data Set Ready
7	RTS	←	Request To Send
8	CTS	→	Clear To Send
9	RI	→	Ring Indicator

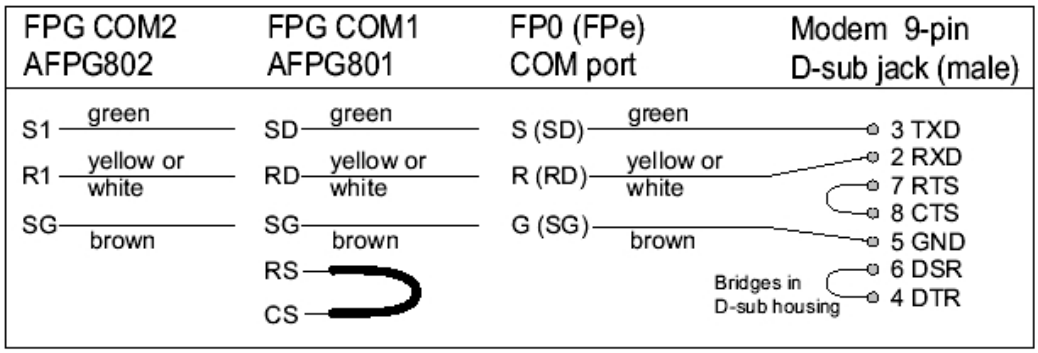
RS232C interface: pin assignment

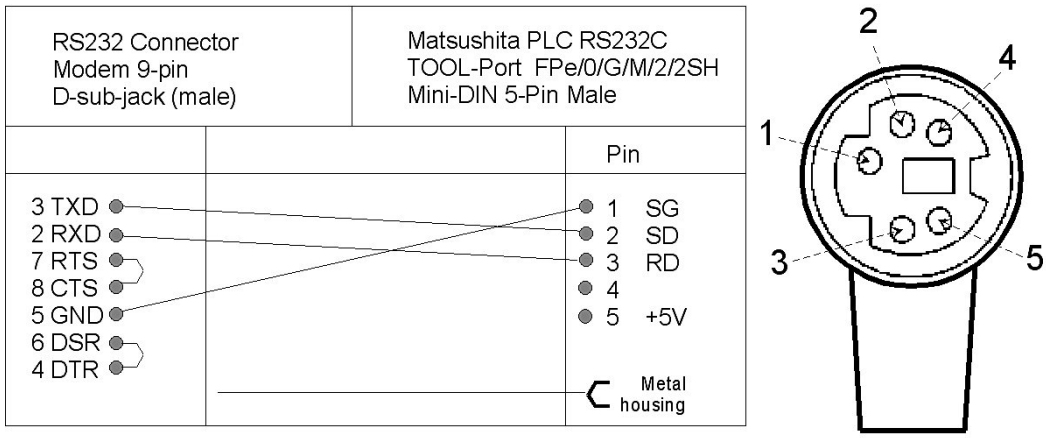
Connecting the FP Modem-56k to a PLC

When connecting to a PLC (especially the TOOL port), you should use the **AT*W** command to disable automatic baud rate detection.



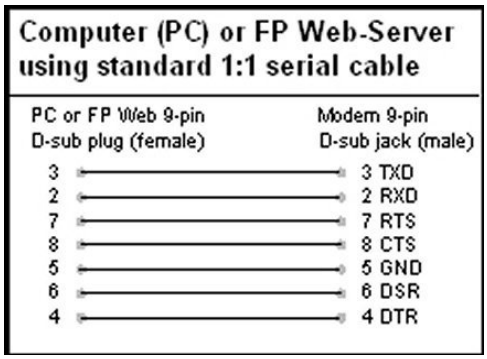






Wiring examples for RS232 interfaces

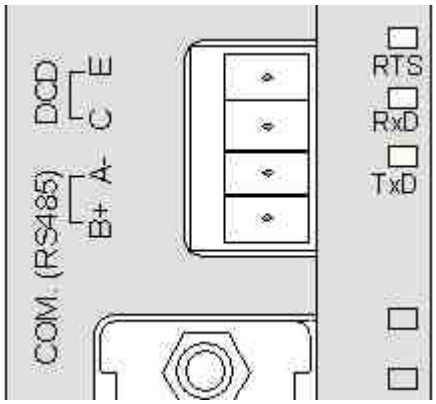
Connecting the FP Modem-56k to a PC or FP Web Server



Wiring example for RS232 interfaces

2.7.4 RS485 Interface

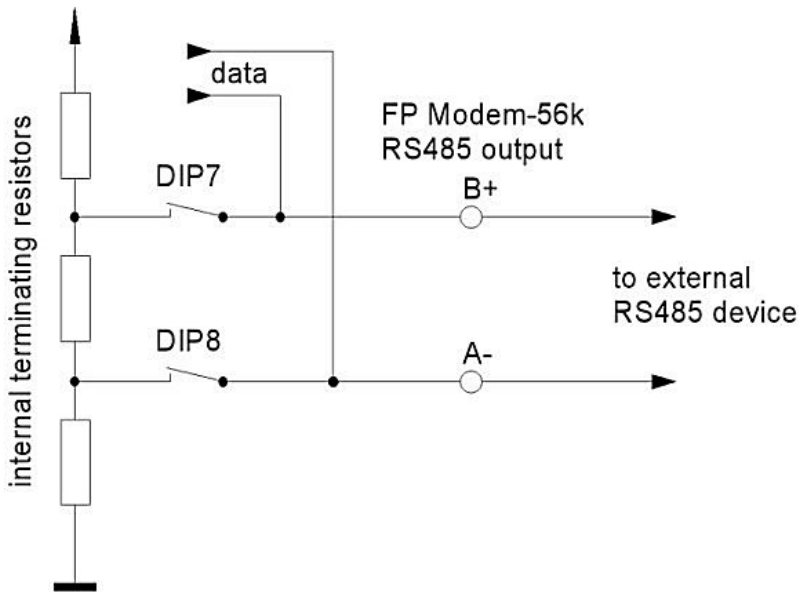
RS485 interface



Pin	Name	Description
A-	TxD-/RxD-	inverting pin
B+	TxD+/RxD+	non-inverting pin

RS485 interface: pin assignment

The internal terminating resistors for the RS485 interface can be switched ON with DIP7 and DIP8:



RS485 interface: internal terminating resistors

◆NOTE

Do not confuse these resistors with the terminating resistor for multipoint mode (DIP6). See also DIP switches (see page 11).

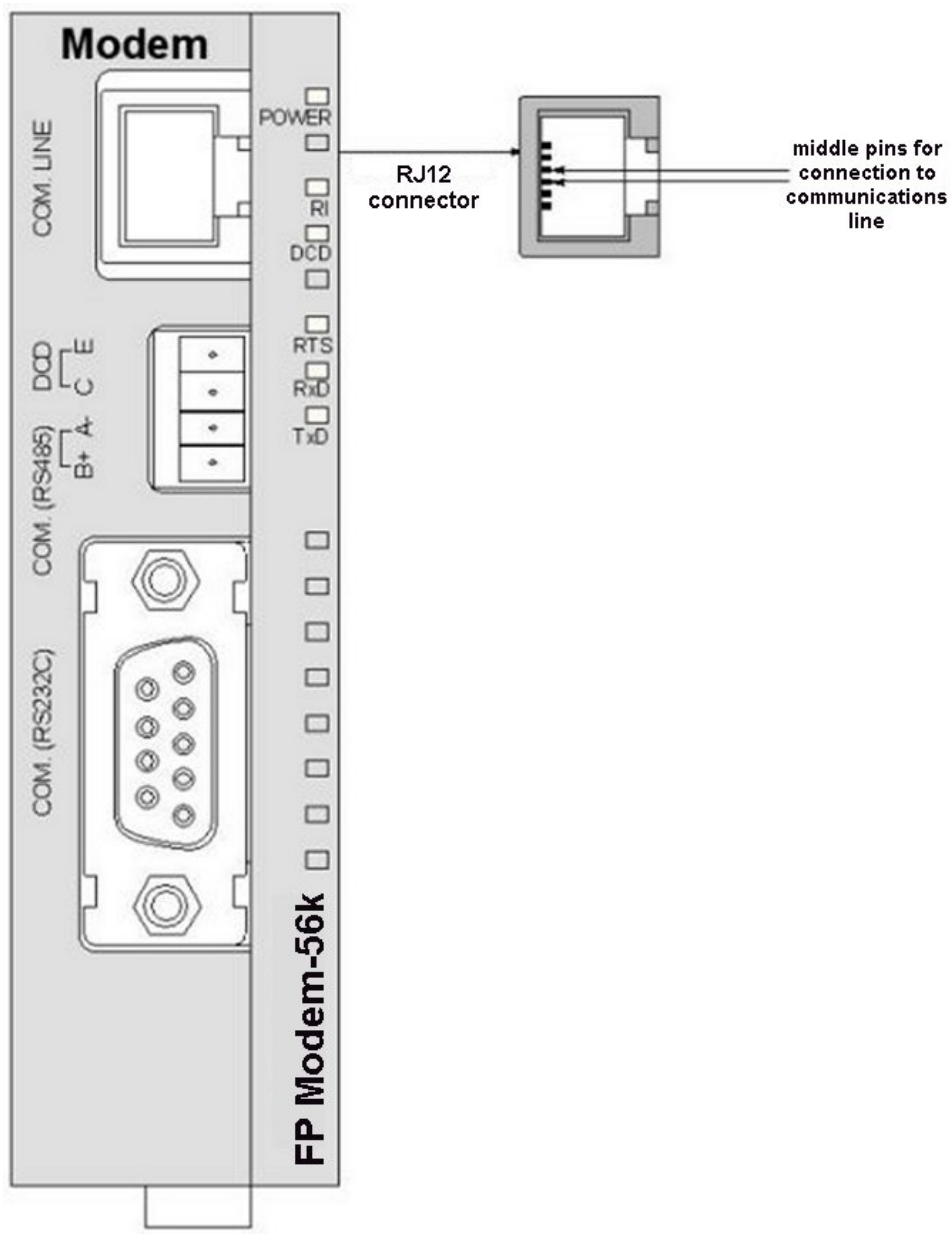
Network cable

The maximum length of the RS485 network cable is determined by the cable properties (e.g. diameter and impedance) and the number of stations connected to the network. The minimum length is 500m.

2.7.5 Connecting to the Telephone Line

A cable with an RJ12 jack at both ends is supplied with the FP Modem-56k. One end connects to the FP Modem-56k, and the other end to the dial-up, leased line, or multipoint network.

Connections to country-specific European public dial-up networks require national RJ12 adapters, which are commercially available from telephone retailers.



You connect the FP Modem-56k to the communications line at the RJ12 female labeled "COM.LINE". Use an RJ12 telephone connector to connect the FP Modem-56k to a:

- Dial-up telephone system (PSTN or PBX),
- 2-wire leased line, or
- Private multipoint cable network

Only the middle two pins of the RJ12 connector are used for the communications line connection. The polarity of the middle two pins does not matter.

2.7.6 Cable Length and Installation: Leased Line or Multipoint

◆**CAUTION**

If you are connecting the FP Modem-56k to private cable installations (leased line or multipoint mode), be sure to take the following precautions:

- The wiring, installation of cables, and cable network setup require a technical expert. Cable communications quality must be tested beforehand.
- Assume that neither cable quality nor cable noise has been defined.
- Perform trial transmissions in order to test the stability of the connection.
- Use overvoltage protection if the communications cable extends outside the room or cabinet.

◆**NOTE**

The reliability of your data connection will depend on cable quality and the installation context. Consider the following extremes:

- **If a data cable is not shielded and is located near and parallel to a noisy power cable, you will already encounter problems at 10m.**
- **If you lease a line with a specified quality from a public provider, the modems are able to communicate over a distance of several hundred kilometers, if there are built-in repeaters.**

To obtain an approved data communications cable, and for recommendations on the individual requirements for your installation locations (such as underground, over poles, etc.), you should contact a local telephone line installation company. Such companies are also experienced in testing modem connections for reliability.

Chapter 3

Modem Operation and Dial-Up Connections

3.1 Operating Modes: Command and Data

Data transmission between data terminal equipment (DTE) and modems takes place via a single communications channel that serves a dual purpose; one and the same channel is used for:

- Commands from the DTE (i.e., a PC or PLC) to the modem
- Information sent modem-to-modem, i.e., from a source station to a remote destination station, via telephone line

As a result, modems have two operation modes:

- Command mode
- Data mode

These modes are defined by the Hayes command set (see page 100), which is the leading international standard for modems.

3.2 Entering AT Commands

You operate the modem from the DTE (i.e., the PC or PLC) by using AT commands in accordance with the Hayes standard. The modem must be in **command mode**.

In dial-up operation (DIP1 = OFF, DIP2 = OFF) the modem is in command mode under the following conditions:

- after the modem has been switched on
- after a connection has been terminated (DIP1 = OFF, DIP2 = OFF).

As soon as a connection has been established, the modem automatically switches to **data mode**.

To switch from data mode to command mode, you enter the **Escape sequence** (**+++**). To switch from command mode back to data mode, enter **ATO**.

The commands are sent in ASCII code. For a complete list of AT commands, please refer to the command tables (see page 100).

◆**NOTE**

If any changes made via AT commands are impairing modem performance, you can restore the default settings with the AT&F command. AT&F will not delete the telephone numbers stored in &Zn. To delete these numbers, please use AT*F (see page 100).

3.3 Hayes Command Syntax

Commands begin with AT

All Hayes commands (see page 100) begin with the ASCII character string **AT** (abbreviation for "Attention").

Entering commands

You can enter the "AT" command in either upper- or lowercase, but NOT in combination (aT, At). The modem interprets all subsequent character input, both lower- and uppercase, as commands.

Deleting input

To delete erroneous input, use the backspace key. AT characters at the beginning of a line cannot be deleted.

Autobaud function

In automatic baud rate detection (Autobaud) mode, the modem analyzes all ASCII characters by detected decoding bit rate, word length, and parity of the command string.

The Autobaud function (**AT*W0**) does not detect Mark and Space. It can only detect the parity checks EVEN, ODD, and NONE. When using Mark and Space, you must therefore set the baud rate manually with **AT*W=b,d,p,s**.

Command sequences

After an "AT" you can group a series of consecutive commands into a command sequence without having to enter "AT" again. Depending on the commands you are using, a command sequence can consist of a total of 50 characters or more. To terminate your input, press Return/Enter. The command sequence is then sent to the modem. The modem confirms with "OK" or, in the case of queries, with the respective value.

Erroneous instructions

If instructions cannot be executed, the modem outputs "ERROR."

3.4 Modem Operation with RS232C or RS485

For command and dial-up mode, be sure that DIP switches (see page 11) 1 and 2 are both OFF.

Interfacing with PCs or PLCs, which are often referred to as data terminal equipment (DTE), is performed via a serial asynchronous RS232C or RS485 interface.

In command mode, the modem automatically adjusts the interface parameters, such as baud rate, number of data bits, and number of control bits. If you enter **AT** or **at**, these settings are recognized automatically.

As a general rule, the modem will not use a line transmission speed exceeding the RS232C/RS485 baud rate. (NOTE: This rule applies to dial-up and point-to-point leased line, but not to multipoint/PLC mode.)

◆NOTE

If no characters are transmitted by the DTE after the FP Modem-56k is switched ON (as is the case with the PLC's TOOL port), the port's baud rate settings cannot be recognized. In this case, you must use the AT*W= (see page 100)... command to set a fixed baud rate.

The AT-Hayes command set (see page 100) (V.250) is used to operate the modem. The command data is transmitted in ASCII format from the PC or PLC to the modem. Commands can either be transmitted by a control program or entered manually via a terminal program.

Several predefined configurations, called profiles, are stored in the modem, (see "User Profiles and Default Settings" on page 41) enabling immediate use without configuration.

When you select V.23hdx in dial-up mode, the Request to Send (RTS) lines must be supported by the DTE (i.e., HyperTerminal is unsuitable). During data transmission, only the source modem will have RTS activated; at the receiving end, RTS must be deactivated. (If both modems had their RTS lines activated, they would both attempt to send, making data reception impossible.)

3.5 Preparing, Establishing, and Terminating Connections

Preparing to connect

If the modem is in data mode, you can return to command mode with the Escape sequence **+++** (which is not preceded by "AT"!). (To switch back to data mode, use the **ATO** command.)

When you prepare to establish a data connection, make sure that:

- The DTE (i.e, PC or PLC) and modem are ready for operation (power LED is ON)
- The external telephone cable has been connected to the telephone jack (e.g., in Germany, the TAE socket)

The following procedure explains how to establish a telephone connection at a subscriber's station with tone dialing.

3.5.1 Establishing a Connection

◆EXAMPLE

The DTE (i.e., PC or PLC) sends **ATDT099912345<CR>** to the modem. The end code carriage return is **hexadecimal 0D**.

Signal	Meaning
AT	Initiate command
DT	Dial via tone dialing
099912345	Telephone number being called

◆Procedure

1. **Dialing and handshake**

   The modem starts dialing. After the subscriber's station has responded, the handshake protocol between the two modems is executed. This protocol specifies the modulation type, line transmission speed, and transmission protocols used.

   When a modem is being called, it sends the ASCII string "RING" to the DTE at every ring.

   If a number greater than zero has been set in the S0 register, the modem responds automatically after expiration of the preset number of rings. Now the handshake protocol starts, as described above.

   With S0=0, the modem remains inactive. As soon as RING has been recognized, you can use the **ATA** command to establish the connection.

2. **Report to DTE (optional)**

   As soon as the data connection has been established, the modem optionally reports the line speed, type of error handling protocol used, and RS232C/RS485 baud rate to the DTE.

3. **Switch to data mode**

   Next, the modem switches to data mode. The DCD LED lights up, and the DCD output switches to the active state. In data mode, the modem transmits information directly from the DTE to the remote modem or vice versa.

Failure to establish a connection

If two modems cannot detect a transmission protocol that can be used by both, or in the case of severe interference, the data connection cannot be established. In this case, the modem responds with NO CARRIER; if the remote modem is busy, the modem responds with BUSY.

3.5.2 Terminating a Connection

The data connection is maintained until the modem:

- Has received the command to hang up (**+++ ATH<CR>**) from the DTE (i.e., PC or PLC), or
- Can no longer detect the carrier (reason: severe interference, carrier is no longer active), or
- Has received a termination sequence from the remote modem.

In all of these cases, the modem responds with "NO CARRIER."

◆**NOTE**

- **If the connection has not been terminated properly after data transmission, the telephone meter may keep on running!**
- **As soon as the data connection is terminated, the DCD LED is switched off, and the DCD output switches back to the inactive state.**

3.5.3 Terminating the Handshake Phase

At the start of each connection procedure, a handshake protocol is executed automatically in order to determine the optimum transmission speed. The handshake phase can take a few seconds.

By default, the keybreak function is inactive – i.e., the handshake cannot be interrupted by a character at the RS232C interface. This phase can only be terminated by the Data Terminal Ready (DTR) signal, unless this signal has been deactivated with **&D0**.

To reactivate the keybreak function, enter the **AT%K0** command.

If the line quality is poor, the default mode (V.34) may reveal that the two stations are verifying different line speeds during the handshake phase. In this case you must use Request To Send / Clear To Send (RTS/CTS) handshaking.

To avoid different line speeds, you can disable V.34 with an AT command, or set the serial interface baud rate to speeds lower than 33600bps.

3.5.4 Using the Break Signal to Terminate Connections

With the **\B** command, you send a break signal – i.e., a signal that terminates the connection – to the remote modem. If you are using a NORMAL (i.e. non-MNP) connection (see page 52), you define the duration of this signal by entering a number after this command. This number is multiplied by 100ms.

With a RELIABLE connection (MNP) (see page 52) you do not need to enter a number after this command. In this case, the break signal always lasts 300ms (default = 3).

Defining the break signal

The **\K** command offers the following options for the break signal:

Setting	Result
Immediate abortion of the connection with data loss	• Buffer memory is deleted • Break signal is transferred immediately
Immediate abortion of the connection	Break signal is transferred immediately
Attached abortion of the connection	Break signal is attached to data block (in buffer memory)
No abortion of the connection	• Command mode is activated • No break signal is transferred

For a list of available settings for the **\K** command, please refer to the AT command table (see page 100).

The FP Modem-56k uses the default command **AT\K5**. This setting attaches break signals to the data in the buffer memory.

3.6 User Profiles and Default Settings

The following commands restore and/or store user profiles and default settings:

Command	Function
AT&V	The modem outputs the following configuration profiles: • Currently active profile ("ACTIVE PROFILE") • Stored profile 0 ("STORED PROFILE 0") • Stored profile 1 ("STORED PROFILE 1") These profiles contain the most important settings.
AT&W **AT&W0**	Saves the current settings in profile 0, such that they are restored at next power-up or ATZ. **AT&W** is identical to **AT&W0**.
AT&W1	Saves a second configuration. Stores the current settings in the second stored profile 1.
ATZ **ATZ0**	Restores profile 0. Same as on power-up (DIP4 = OFF). After you have entered **ATZ**, no further commands can follow. You must enter a new AT command.
ATZ1	Restores profile 1.
AT&F	Restores default settings. You can also use the DIP4 switch (see page 11).
AT&Y0	Restores profile 0 at power-up (default).
AT&Y1	Restores profile 1 at power-up.

The command AT&F does not delete the telephone numbers stored in &Zn. To delete these numbers, please use **AT*F** (see page 100).

The default settings have been defined as follows:

- Dial-up line; asynchronous; AT commands
- Automatic detection of error correction or data compression
- Transmitting and receiving buffers: active
- Modulation type V.34 (2400 to 33600bps)
- Command echo active; report codes indicate modulation speed
- Automatic call acceptance = ON
- No flow control (RTS/CTS handshake switched off)

AT&V will cause the FP Modem-56k to output the following lines:

```
ACTIVE PROFILE:
+IPR: 0
+ICF: 0
B0 E1 L2 M1 Q0 T V1 W2 X3 Y0 -K0 %C0 %E0 %F0 %G0 %K1 %S0 \K5 \S0 \T0 \V0
&C1 &D0 &G0 &K0 &N0 &P0 &Q5 &R0 &S0 &X0 &Y0
S00:001 S01:000 S02:043 S03:013 S04:010 S05:008 S06:003 S07:045 S08:002
S09:006
S10:014 S11:085 S12:050 S25:005 S26:001 S30:000 S36:007 S38:020 S46:136
S48:007
S88:012 S89:012 S91:000 S92:013 S93:025 S94:013 S95:000 S96:000 S104:000

STORED PROFILE 0:
+IPR: 0
+ICF: 0
B0 E1 L2 M1 Q0 T V1 W2 X3 Y0 -K0 %C0 %E0 %F0 %G0 %K1 %S0 \K5 \S0 \T0 \V0
&C1 &D0 &G0 &K0 &P0 &Q5 &R0 &S0 &X0
S00:001 S02:043 S06:003 S07:045 S08:002 S09:006 S10:014 S11:085 S12:050
S30:000
S36:007 S46:136 S48:007 S96:000

STORED PROFILE 1:
+IPR: 0
+ICF: 0
B0 E1 L2 M1 Q0 T V1 W0 X4 Y0 -K0 %C3 %E0 %F0 %G0 %K0 %S0 \K5 \S0 \T0 \V0
&C1 &D2 &G0 &K3 &P0 &Q5 &R1 &S0 &X0
S00:000 S02:043 S06:003 S07:050 S08:002 S09:006 S10:014 S11:085 S12:050
S30:000
S36:007 S46:138 S48:007 S96:000
```

3.7 Password Protection and Callback Function

To block malicious or unintended incoming calls, we strongly recommend that you activate password protection for technical facilities (e.g., devices that are connected to the public telephone network for telemaintenance).

Two security levels are available:

Security Level 1	Password protection
Security Level 2	Password protection and callback of the number that was stored with **&Z0**. If %G3 has been set, the callback is started to the calling number if it matches &Z1 to &Z5.

Command	Function
AT*P=xxxx	Enters the password. You can enter up to 7 characters containing letters, numbers, and/or the following symbols: _-$*+#:;&/\(). Lowercase is changed to uppercase upon entry.
AT*P?	Displays the password
AT*P=	Deletes the password
AT%S2	Activates password protection
AT%S0	Deactivates password protection (default)
AT%S1	Activates password protection with Security Level 2. To activate this function, you must first store a callback number **x** of up to 32 digits with **AT&Z0=x** in the speed dial memory.
AT&Zn=x	Stores a callback number **x** in the speed dial memory with register number **n**.

For password-protected modems, you should set register S0 to at least 1 to enable the modem to answer incoming calls automatically.

With this setting, a normal connection is established, but the caller (i.e., the calling DTE) must enter a password with the prompt: "ENTER PASSWORD:"

Every input character is confirmed by an ∗. If the password is correct, the modem switches to data mode. If it is incorrect, the prompt is repeated twice. After a final incorrect entry attempt, or if nothing has been input, the connection is aborted.

On entry of the correct password, the connection is established. If the callback function is enabled (AT%S1), the connection is aborted after the number of RINGs specified by register S0. The remote modem (AT&Z0 register for the remote telephone number) is then called in order to establish the connection.

If %G3 has been set, the calling modem is called back, if its number is valid. Valid callback numbers (or fragments) are stored in &Z1 to &Z5. If S0 has been set to 0, the callback will be started approximately 23s after the last RING.

After a successful comparison of the modulation procedure (i.e., handshake), the modem immediately switches to data mode, thereby enabling communication.

To display the contents of the stored telephone numbers in the registers &Zn, enter the command **AT\F**. The **AT&F** command will not delete these numbers. To delete the stored dial strings, use **AT*F** (see page 100).

3.7.1 Example: Password Protection and Callback

Activating password protection

Modem A FP Modem-56k		**Modem B FP Modem-56k or FP Modem-EU**	
Terminal 57600/8/o/1		Terminal 57600/8/o/1	
Main station line	DTMF dialing	PBX	DTMF dialing
Phone no.	080244774660	Phone no.	08024648170
AT&F&W	Factory Init	**AT&F&W**	Factory Init
AT&K3&W	Activates RTS/CTS	**AT&K3&W**	Activates RTS/CTS
DIP1-8: OFF		DIP1-8: OFF	
AT*P=qwer	Activates password		
AT&Z0=08024648170	Stores callback number		
AT%S1&W	Activates password protection and callback		
		atd0,080244774660	Input with echo
RING	+ Blank line		
CONNECT 33600	+ Blank line	CONNECT 33600	+ Blank line
		ENTER PASSWORD: ****	Input qwer<CR>
CALLBACK IN PROGRESS...	+ Blank line		
NO CARRIER	+ Blank line	NO CARRIER	+ Blank line
		RING	+ Blank line
CONNECT 33600		CONNECT 33600	
Data transmission		Data transmission	

◆**NOTE**

If you are upgrading to FP Modem-56k, please note the following changes affecting PLC programs; your PLC programs will have to be modified accordingly:

- **On the caller's side, password protection with callback function is compatible with FP Modem-EU; at the receiving end, it is not!**
- **FP Modem-EU outputs "NO CARRIER" before starting the callback, whereas FP Modem-56k outputs "CONNECT XXXX".**
- **FP Modem-56k outputs "CALLBACK IN PROGRESS..." when the callback has been started, and then outputs "NO CARRIER" until the connection has been established.**

Using the callback function

FP Modem-56k → Calls FP Modem-EU	FP Modem-EU **(with callback activated) → Is being called by FP Modem-56k**
	AT&Z0=0,080244774660 OK AT%S1 OK AT*P=secret OK AT&W OK
AT%S0 OK atd08024648170	
	RING
CONNECT 14400 ENTER PASSWORD: ******	
NO CARRIER	NO CARRIER CALLBACK IN PROGRESS... PRESS "A" TO ABORT 0,080244774660
RING	
CONNECT 14400	CONNECT 14400
Data transmission	Data transmission

FP Modem-EU → Calls FP Modem-56k	**FP Modem-56k (with callback activated) → Is being called by FP Modem-EU**
	AT&Z0=08024648170 OK AT%S1 OK AT*P=secret OK AT&W OK
AT%S0 OK atd0,080244774660	
	RING
CONNECT 14400 ENTER PASSWORD: ******	CONNECT 14400
	CALLBACK IN PROGRESS...
NO CARRIER	NO CARRIER
RING	

FP Modem-EU → Calls FP Modem-56k	**FP Modem-56k (with callback activated) → Is being called by FP Modem-EU**
CONNECT 14400	CONNECT 14400
Data transmission	Data transmission

Accepting calls after password check

Modem A FP Modem-56k		**Modem B FP Modem-56k or FP Modem-EU**	
Terminal 57600/8/o/1		Terminal 57600/8/o/1	
Main station line	DTMF dialing	PBX	DTMF dialing
Phone no.	080244774660	Phone no.	08024648170
AT&F&W	Factory Init	**AT&F&W**	Factory Init
AT&K3&W	Activates RTS/CTS	**AT&K3&W**	Activates RTS/CTS
DIP1-8: OFF		DIP1-8: OFF	
AT*P=qwer	Activates password		
AT&Z0=08024648170	Stores callback number		
AT%S2&W	Activates password protection		
		atd0,080244774660	Input with echo
RING	+ Blank line		
CONNECT 33600	+ Blank line	CONNECT 33600	+ Blank line
		ENTER PASSWORD:****	Input qwer<CR>
Data transmission		Data transmission	

3.8 CLIP Function

A Calling Line Identification Presentation (CLIP) decoder is integrated into the FP Modem-56k.

This CLIP function enables modems receiving an incoming call to decode the caller's telephone number. CLIP signaling is activated at the first ring of the incoming call, provided the CLIP function for BOTH sender and call recipient has been enabled by the national PSTN provider.

Whether it be for international, interregional, or domestic telephone connections, devices featuring a caller ID function are not necessarily compatible, even if they are using the same PSTN. Some providers use the frequency-shift keying (FSK) protocol; others use dual-tone multifrequency (DTMF). The following table lists CLIP codes by country:

Country	Code	Caller ID Mode
Australia	09	FSK
Austria	0A	FSK
Belgium	0F	-
Brazil	16	-
Canada	20	FSK
China	26	FSK
Denmark	31	DTMF
Finland	3C	DTMF
France	3D	FSK
Germany	42	FSK
Hong Kong	50	FSK
Ireland	57	FSK
Israel	58	-
Italy	59	FSK
Japan	00	FSK
Korea (Republic of)	61	FSK
Malaysia	6C	-
Mexico	73	-
Netherlands	7B	DTMF
Norway	82	FSK
Poland	8A	-
Portugal	8B	-
South Africa	9F	-
Spain	A0	FSK
Sweden	A5	DTMF
Switzerland	A6	-

Country	Code	Caller ID Mode
Taiwan	FE	FSK
United Kingdom	B4	FSK
United States (USA)	B5	FSK
TBR21*	FD	-

*The international telecommunications standard required for all connections to Europe's PSTN.

3.8.1 CLIP Settings

Main settings

CLIP mode	AT%Gn	CLIP function
Disable CLIP decoder	AT%G0	Restore default setting
General CLIP decoder	AT%G1	Display calling numbers only
Unformatted CLIP decoder	AT%G2	Display CLIP data in unformatted hexadecimal format
Selective call mode	AT%G3	Define accepted calling numbers (**AT&Z1** to **AT&Z5**)

Disable CLIP decoder

To disable the CLIP decoder, enter the **AT%G0** command. Alternatively, you can use **AT&F** to reset the modem to the factory (i.e., default) setting.

General CLIP decoder

The CLIP decoder can be enabled in General Purpose mode with **AT%G1**. At the next RING, the modem reports the following strings (each string is preceded and followed by a <cr> <lf> new line sequence):

- RING (first ring signal string as usual)
- **CLIP:** 01705717123 (if available: new string with caller's telephone number)
- RING (second ring signal string as usual)

The modem then continues functioning "normally," i.e., it accepts the incoming call. This enables the PLC to analyze the caller's number and react accordingly, e.g. to display the number, accept or reject the call, switch outputs or relays, etc.

Unformatted CLIP decoder

To switch the CLIP decoder to unformatted mode, enter the **AT%G2** command. With the next RING, the modem reports the following strings (each string is preceded and followed by a <cr> <lf> new line sequence):

- RING (first ring signal string as usual)
- **CLIP:** 01705717123 (if available: new string with caller's telephone number in hexadecimal format)
- RING (second ring signal string as usual)

Selective call mode

Selective call acceptance can be enabled with **AT%G3**. However, you must define the accepted numbers with **AT&Z1=** to **AT&Z5=**. At the next RING, the modem validates the caller's number, and the call is only accepted if the last digits match the &Z1, &Z2, &Z3, &Z4 or &Z5 settings.

◆**EXAMPLE**

Settings: AT&Z1=**123** AT&Z2=**4567**

Accepted callers: 0808877**123** and 0808877**4567** and 07788**123** and 007788**4567**

The contents of the &Zn registers can be displayed with **AT\F**. The **AT&F** command will not delete these numbers. To delete the stored dial strings, please use **AT*F** (see page 100).

◆**NOTE**

The RING counter S0 is adjusted as follows after the CLIP decoder has been activated with AT%G1, AT%G2, or AT%G3:

S0=0	Incoming call can be accepted with an **ATA** command
S0=1	**Incoming call is automatically accepted at 2nd RING**
S0=2	Incoming call is automatically accepted at 2nd RING
S0=3	Incoming call is automatically accepted at 3rd RING
etc.	etc.

3.8.2 Example: CLIP Function

Monitoring telephone numbers of incoming calls

◆**Procedure**

1. **Modem settings: AT&F** ATS0=0 AT%G1 **AT&W**
2. **Connect modem to PLC's COM port: Select "Program controlled [General Purpose]" mode**

   The PLC can analyze the caller's telephone number from the **CLIP:xxxx** string, and can then

- Display the caller's number,
- Compare the telephone number, and switch a relay, for example, or
- Compare the telephone number, and either reject the call or accept it with **ATA**

Activating CLIP check and automatic acceptance of validated calls

Procedure

1. **Modem settings: AT&F** AT%G3 AT&Z1=**54321** AT&Z2=**789** **AT&W**
2. **Connect modem to PLC's TOOL or COM port**

   Automatic acceptance of incoming calls from any of the following predefined telephone numbers:

- 6**54321**
- 080246**54321**
- 00498024**654321**
- +49 8024 6**54321**
- 8**789**
- 080328**789**
- 004480328**789**
- +44 8032 8**789**

The contents of the &Zn registers can be displayed with **AT\F**. The **AT&F** command will not delete these numbers. To delete the stored dial strings, please use **AT*F** (see page 100).

Modem A FP Modem-56k		**Modem B FP Modem-56k or FP Modem-EU**	
Terminal 57600/8/o/1		Terminal 57600/8/o/1	
Main station line	DTMF dialing	PBX	DTMF dialing
Phone no.	080244774660	Phone no.	08024648170
AT&F&W	Factory Init	**AT&F&W**	Factory Init
AT&K3&W	Activates RTS/CTS	**AT&K3&W**	Activates RTS/CTS
DIP1-8: OFF		DIP1-8: OFF	
AT%G3&W	Activates CLIP check with &Z1…&Z5		
AT&Z4=170	Stores end digits of valid calling number		
		atd0,080244774660	Input with echo
RING	+ Blank line		
CLIP:08024648170	+ Blank line		
RING	+ Blank line		
CONNECT 33600	+ Blank line	CONNECT 33600	
Data transmission		Data transmission	
+++		+++	Input with echo
		ATH	Input with echo

Modem A **FP Modem-56k**	**Modem B** **FP Modem-56k or FP Modem-EU**
NO CARRIER	OK

Activating callback after CLIP check

Modem A **FP Modem-56k**		**Modem B** **FP Modem-56k or FP Modem-EU**	
Terminal 57600/8/o/1		Terminal 57600/8/o/1	
Main station line	DTMF dialing	PBX	DTMF dialing
Phone no.	080244774660	Phone no.	08024648170
AT&F&W	Factory Init	**AT&F&W**	Factory Init
AT&K3&W	Activates RTS/CTS	**AT&K3&W**	Activates RTS/CTS
DIP1-8: OFF		DIP1-8: OFF	
AT&Z4=170	Stores end digits of valid calling number		
AT%G3%S1S0=0	Activates callback after CLIP check with &Z1…&Z5		
		atd0,080244774660	Input with echo
RING	+ Blank line		
CLIP:08024648170	+ Blank line	Break of approx. 15s	
<1 to 11 times> RING	+ Blank line		
		NO ANSWER	+ Blank line
Break of approx. 0.5min		Break of approx 1min	
CALLBACK IN PROGRESS...			
		RING	+ Blank line
CONNECT 33600		CONNECT 33600	
Data transmission		Data transmission	

3.9 Transmission Modes

You can select the following modes for data transmission via telephone line:

Mode	Function
NORMAL	• Line transmission speed adjusted automatically • No error correction • No data compression
DIRECT	• Command sets modem to direct data connection • RS232C/RS485 baud rate = transmission speed • Error correction switched off
RELIABLE	• Line transmission speed adjusted automatically • Functions only with error correction, as specified by LAPM or MNP • If remote modem does not allow error correction, the modem hangs up • Data compression as specified by V.42bis or V.44
AUTO-RELIABLE	• Line transmission speed adjusted automatically • Automatic selection of the error correction method as specified by V.42: LAPM or MNP • If remote modem does not allow error correction, the modem falls back to NORMAL mode • Data compression as specified by V.42bis or V.44

◆NOTE

- **Avoid DIRECT mode unless you have considerable experience with modems. Under certain circumstances, DIRECT mode can make it impossible for you to contact the modem!**
- **In case of a noisy telephone line, please lower the maximum transmission rate by reducing the RS232C/RS485 baud rate – i.e., leave the line transmission speed setting at automatic with ATF0, and set the RS232C/RS485 baud rate with the AT*W command.**

3.10 Communication Methods and Protocols

The communications data processed by modems consists of two data types:

- **Digital** data for data exchange with DTE (i.e., PCs or PLCs), consisting either of modem operation commands or of other information
- **Analog** data for transmission to the telecommunications network. A high throughput must be achieved, and errors must be corrected. Various methods and protocols are applied to this end.

The transmission rate depends on the modulation method used for packing data on the carrier. Methods such as quadrature amplitude modulation (QAM) can accommodate several bits in a single carrier change of state.

The following transmission standards are supported by the FP Modem-56k:

V.21	Full duplex	300bps
V.22	Full duplex	1200bps
V22bis	Full duplex	2400bps
V.23	Asymmetrical full duplex	1200bps or 75bps
V.32	Full duplex	9600bps with fallback to 4800bps
V.32bis	Full duplex	14400bps with fallback
V.34	Full duplex	Up to 33600bps
V.90	Full duplex	Upstream: up to 33.6kbps; downstream: up to 56kbps
V.92	Full duplex	Upstream: up to 48kbps; downstream: up to 56kbps

3.11 Error Correction and Data Compression

In dial-up mode without error correction (**AT\N0** or **AT\N1**), garbage characters may be generated if one party immediately terminates the connection, or if the line is cut. To prevent this problem, error correction protocols must be enabled.

Transmission errors may also be caused by noise interference in telephone lines, or by signal distortion.

To ensure comprehensive data security, the data is incorporated into an error handling protocol; the metadata enables the receiver modem to detect errors and correct them, if necessary.

In accordance with the V.42 standard, the correction methods Link Access Procedure for Modems (LAPM) and Microcom Networking Protocol (MNP) are applied. If V.42 mode has been enabled, the modem transmits a character string to determine which correction method is enabled by the remote station; it then selects LAPM or MNP, as appropriate.

You can also use the FP Modem-56k to enforce a connection under MNP or LAPM, on the condition that one of the two correction methods is supported.

To achieve faster data throughput, you can increase data compression as specified by V.42bis and V.44. Depending on the data type to be transmitted, the transmission rate can be increased by a factor of more than six.

The FP Modem-56k configures itself while the connection is being established, depending on the preset transmission mode. It then adjusts the methods available for the remote station.

3.12 Modem Self-Diagnosis

For modem self-diagnosis, you can use the **ATI2** command to execute the Memory Test. Other functions cannot be tested; however, with the **ATIn** command, you can obtain additional system information.

◆**NOTE**

The AT\M **command used for the FP Modem-EU is no longer supported.**

3.13 PLC Remote Programming with FPWIN Pro

The FP Modem-56k can be used for remote programming, monitoring, etc. with FPWIN Pro. If you are not using "NCL-CMEU-LIB," the modems should be set up as follows:

◆Procedure

FP Modem-56k on the PC:

1. **Use a standard PC/modem 1:1 cable**
2. **All DIP switches should be in OFF position (as delivered)**
3. **If the modem is not new, return to the default settings by entering the** AT&F&W **command**
4. **FPWIN Pro should use the** AT&FV1E0%K0 **command for initialization**

FP Modem-56k at the PLC's TOOL port:

1. **Use a suitable cable (see page 26)**
2. **Set DIP4 switch to ON, or use the** AT*W=19200,8,O,1 **command**
3. **Set the PLC's TOOL port to 19200bps (8 data bits, odd parity, one stop bit)**
   For FP0R, FP-Sigma, FP-X, if available: MEWTOCOL-COM-Master/Slave, in [Computer Link] mode
4. **Modem support of the TOOL port should** NOT **be enabled**

FP Modem-56k at the PLC's COM port:

1. **Use a suitable RS232 (see page 26) or RS485 (see page 29) cable**
2. **Set DIP4 switch to ON, or use the** AT*W=19200,8,O,1 **command**
3. **Set the PLC's COM port to 19200bps (8 data bits, odd parity)**
   For FP0R, FP-Sigma, FP-X, if available: MEWTOCOL-COM-Master/Slave, in [Computer Link] mode
4. **Modem support of the COM port should** NOT **be enabled**

◆NOTE

- **Changes made to DIP switch settings do not take effect until the next power-up.**
- **At first MEWTOCOL request, some PLCs may respond with an error if the "CONNECT" message preceded the first MEWTOCOL command. Repeating the MEWTOCOL command once should solve this problem.**

3.14 Modem Library for FPWIN Pro

The modem library developed for FPWIN Pro provides convenient function blocks (FBs) that save programming time. For example, the library enables a PLC connected to the FP Modem-56k to:

- Dial up a remote station in order to send an alarm or exchange data
- Receive incoming calls for data exchange
- Handle password-protected calls
- Handle callback connections
- Activate remote control

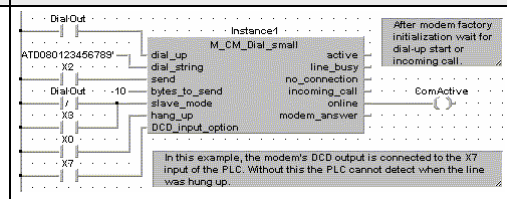
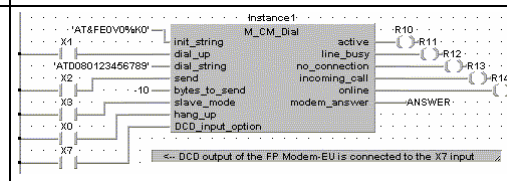
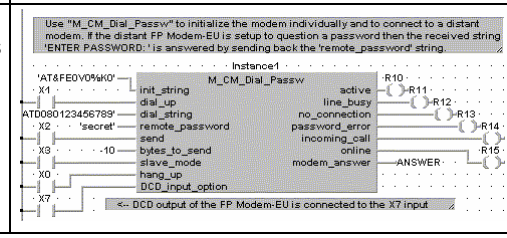
Moreover, sample programs enable you to start using your FP Modem-56k immediately.

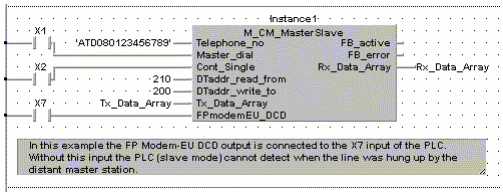
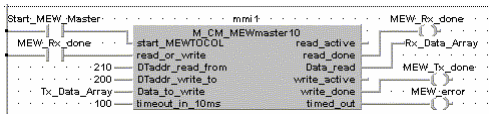
◆NOTE

While originally designed for the FP Modem-EU, this library is compatible with the FP Modem-56k, except for the FP Modem-EU Library function blocks for the DTMF Remote, ASCII-fax, and callback functions. A supplementary library designed specifically for the FP Modem-56k will soon be released; this new library will also support PSTN text messaging and the callback function.

Product number: NCL-CMEU-LIB

Overview

FB name	Description	Details
M_CM_Dial_small	Dial up / Receive Incoming Calls	
M_CM_Dial	Initialization / Dial up / Receive Calls	
M_CM_Dial_Passw	Initialization / Dial up and Password / Receive Calls	

FB name	Description	Details
M_CM_MasterSlave	Dial out as Master / Receive Calls as Slave	
M_CM_MEWmaster10	MEWTOCOL Master Communication	

Chapter 4

PSTN Text Messaging

4.1 PSTN Short Message Service

The Short Message Service (SMS) enables text messaging.

In accordance with ETSI-ES 201 912, there are two protocols (protocol 1 and protocol 2) providing a reliable service that ensures proper delivery and enables message senders to verify that a text message has been correctly received by the message recipient.

The FP Modem-56k only supports protocol 1, which has the advantage of being fully compliant with the GSM SMS service.

4.2 Sending and Receiving PSTN Text Messages

PSTN text messages are always sent via Short Message Service (SMS) Service Center 1.

To enable text messaging, the SMS Service Center telephone numbers must be stored in the &Zn registers as follows:

- &Z9: Short Message Service Center 1
- &Z8: Short Message Service Center 2, if available

The contents of the &Zn registers can be displayed with **AT\F**. The command **AT&F** will not delete these numbers. To delete the stored dial strings, please use **AT*F** (see page 100).

For text message reception, CLIP function (see "CLIP Settings" on page 48) (**%G1**) and automatic reception of PSTN text messages (see page 100) (**\S**) must be enabled.

To send a PSTN text message, please follow these steps:

Procedure

1. **Save Service Center numbers**

   Service Center 1 (example): **AT&Z9=0193010** (in this example, 0193010 is the number for Deutsche Telekom)

   Service Center 2: **AT&Z8=xxxx** (xxxx is the provider's number, used only to check message reception)

   NOTE: To be able to switch back and forth between voice messaging and PSTN text messages, you may have to register with your provider.

2. **Activate CLIP and enable automatic reception of PSTN text messages**

   Activate the General CLIP Decoder with the **AT%G1** command

   Enable automatic reception of PSTN text messages with the **AT\S** command

3. **Send text message**

   Enter **AT+CMGS=da<CR>** ("da" ="destination address, i.e. phone number"). The modem switches to text mode.

   Enter text message. Finish text message input with **CTRL-Z**

   If sending was successful, the FP Modem-56k returns "+CMGS:<mr>" and "OK". This can take some time. If sending has failed, it returns "ERROR" or "NO CARRIER"**.**

4. **FP Modem-56k reports text message reception with the following output:**

   RING

   CLIP:01930100 (in this example, the country code suffix "0" follows the Service Center number)

   If reception was successful, the FP Modem-56k returns "+CMTI: 1". Otherwise, it returns "NO CARRIER".

The FP Modem-56k uses "+CMTI" to notify the PC or PLC that a new text message has been received; it also specifies the memory location.

5. **Read received text message**

   Use the **AT+CMGR=1** command to read the received text message**.** The number specifies the memory buffer destination: 1=receive buffer; 2=send buffer.

   FP Modem-56k returns the following output:

+CMGR: "REC UNREAD","01712345678",,"09/06/02, 11:25:16+04"

TEXT (text sent from source station 01712345678, with time stamp "09/06/02, 11:25:16+04")

NOTE: If no memory buffer destination has been specified with **AT+CMGR=**, the FP Modem-56k returns "ERROR".

4.2.1 Example: PSTN Text Messaging

Sending text messages

<table>
<tr><th colspan="2">FP Modem-56k (sender)</th><th colspan="2">Cell phone (recipient)</th></tr>
<tr><td>Terminal</td><td>57600/8/o/1</td><td rowspan="10">Phone no.</td><td rowspan="10">01705717543</td></tr>
<tr><td>Main station line</td><td>DTMF dialing</td></tr>
<tr><td>Phone no.</td><td>080244774660</td></tr>
<tr><td colspan="2">Registration with provider (Deutsche Telekom) already completed (send ANMELD to 8888)</td></tr>
<tr><td>AT&F&W</td><td>Factory Init</td></tr>
<tr><td colspan="2">DIP1-8: OFF</td></tr>
<tr><td>AT&Z8=0193010</td><td>Phone no. of Service Center 2</td></tr>
<tr><td>AT&Z9=0193010</td><td>Phone no. of Service Center 1</td></tr>
<tr><td>AT%G1\S1&W</td><td>SMS reception enabled</td></tr>
<tr><td>AT+CMGS=01705717543<CR></td><td>Input with echo</td><td colspan="2" rowspan="12">Cell phone has received text message that reads "Message to cell phone"</td></tr>
<tr><td>Message to cell phone<Ctrl-Z></td><td>(Sample) text input with echo</td></tr>
<tr><td colspan="2">It takes ca. 1min for SMS to be sent</td></tr>
<tr><td>+CMGS: 1</td><td>Finished</td></tr>
<tr><td colspan="2">OK</td></tr>
<tr><td colspan="2">OPTIONAL: Check reception</td></tr>
<tr><td>AT+CMGR=2</td><td>Input with echo</td></tr>
<tr><td>+CMGR: "STO SENT","01705717543"</td><td>Output</td></tr>
<tr><td>Message to cell phone</td><td>Output</td></tr>
</table>

Receiving text messages

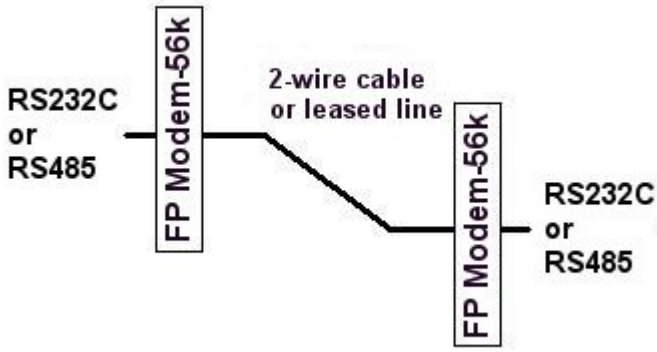
<table>
<tr><th colspan="2">FP Modem-56k (recipient)</th><th colspan="2">Cell phone (sender)</th></tr>
<tr><td>Terminal</td><td>57600/8/o/1</td><td rowspan="10">Phone no.</td><td rowspan="10">01705717543</td></tr>
<tr><td>Main station line</td><td>DTMF dialing</td></tr>
<tr><td>Phone no.</td><td>080244774660</td></tr>
<tr><td colspan="2">Registration with provider (Deutsche Telekom) already completed (send ANMELD to 8888)</td></tr>
<tr><td>AT&F&W</td><td>Factory Init</td></tr>
<tr><td colspan="2">DIP1-8: OFF</td></tr>
<tr><td>AT&Z8=0193010</td><td>Phone no. of Service Center 2</td></tr>
<tr><td>AT&Z9=0193010</td><td>Phone no. of Service Center 1</td></tr>
<tr><td>AT%G1\S1&W</td><td>SMS reception enabled</td></tr>
<tr><td>RING</td><td>+ Blank line</td><td colspan="2" rowspan="11">Cell phone sends text message that reads "Message to PLC"</td></tr>
<tr><td>CLIP:01930100</td><td>+ Blank line</td></tr>
<tr><td colspan="2">It takes ca. 1min for SMS to be received</td></tr>
<tr><td>+CMTI: 1</td><td>Finished (NO CARRIER in case of error)</td></tr>
<tr><td colspan="2">Read message content</td></tr>
<tr><td>AT+CMGR=1</td><td>Input with echo</td></tr>
<tr><td>+CMGR: "REC UNREAD","01705717543",</td><td>Output</td></tr>
<tr><td>,"09/03/11,15:16:56+04"</td><td>Output</td></tr>
<tr><td>Message to PLC</td><td>Output</td></tr>
</table>

Chapter 5

Cable Networks / Permanent Connections

5.1 Leased Line Mode

The FP Modem-56k can be operated with two-wire private cables or leased lines.



FP Modem-56k with 2-wire cable or leased line

- DIP switch activation and master/slave selection
- Up to 57600bps (bidirectional, full duplex)
- Automatic connection / continuous check
- Data error correction and compression available
- Transparent RS232C or RS485, also for MEWTOCOL
- TBR15-approved (public provider)
- Up to 20km range with private telephone cable (2-wire)

5.1.1 Use with PSTN or Private Cable

The FP Modem-56k is approved for use with lines leased from a public telephone system provider in accordance with EU standard ETSI ES 203021. This means that if you rent a line from a provider, e.g. from Deutsche Telekom, the modem is approved for connection to the provider's public telephone system.

Moreover, the modem also works with any private telephone line in leased line mode. Even outside Europe, the modem can be used for point-to-point connections via private telephone cable.

5.1.2 Enabling Leased Line with DIP Switches

In leased line mode, the modem goes online automatically after power-up. After performing a self-diagnosis, the source modem attempts to establish a connection with the remote modem. The source modem remains active even if the remote modem is temporarily unprepared to receive data.

To activate the automatic leased line mode, set up the FP Modem-56k DIP switches (see page 11) as follows:

Modem	DIP1	DIP3
Modem 1 (Master)	ON	ON
Modem 2 (Slave)	ON	OFF

Use the DIP4 switch to define the baud rate for the RS232C and RS485 interfaces:

Master or Slave	DIP4	Remark
Fixed baud rate	ON	19200bps 8o1 (8 data, odd parity, 1 stop bit)
Selectable baud rate	OFF	Baud rate last used in command mode

◆**NOTE**

When you power up the FP Modem-56k, the RS232 interface sometimes outputs garbage characters.

Defining a baud rate other than 19200bps 8o1

◆**Procedure**

1. **To enter the dial-up command mode, set all DIP switches to OFF**
2. **In the DTE program, define the desired RS232C baud rate and data format**
3. **Power up the modem and enter AT (or AT&F to restore the default settings)**

   The modem should respond with "OK."

   Optional: To disable automatic baud rate detection (command mode), use the command **AT*W=baud,data,parity,stop** (*W0).
4. **To save your settings, enter AT&W**
5. **Activate the leased line mode with DIP switches 1 and 3 as described above, but leave DIP4 OFF**

5.1.3 Recommendations for Leased Line

If you set the serial line baud rate to at least 33.6kbps (see "Enabling Leased Line with DIP Switches" on page 66), the modems always use the maximum line transmission speed. This speed is reached during the handshake procedure after power-up and before the connection has been established.

The modem never selects a line speed exceeding the RS232C/RS485 baud rate. Thus, the modem with the lowest RS232C/RS485 baud rate limits the maximum serial line speed.

If line quality is poor, the default mode (V.34) may reveal that the two stations are verifying different line speeds during the handshake phase. In this case you must use Request To Send / Clear To Send (RTS/CTS) handshaking.

To avoid differing line transmission speeds, you can disable V.34 with an AT command, or set the serial interface baud rate to speeds lower than 33600bps.

If a lower baud rate is required to resolve transmission line discontinuities, reduce the RS232C/RS485 baud rate of both modems (see "Enabling Leased Line with DIP Switches" on page 66).

Alternatively, you can use the ATFx command (see page 100) to adjust the modem's modulation type. However, we do not recommend switching off automatic data error correction (**AT\Nx** command).

5.1.4 Maximum Line Length: Leased Line

For leased line mode, the maximum line length tested by Panasonic was 22km, under the following conditions:

- Leased line mode (default settings)
- Telephone cable (diameter: 0.6mm), tested with a simulator
- Automatic line transmission speed adjustment (max. speed 33.6kbps)
- No noise, no adverse effects, no disturbances

To achieve maximum transmission distances, the serial interface must be set to low baud rates (19200 or 9600bps) enabling only low line speeds. Otherwise, the unit must fall back to lower baud rates in order to extend its reach.

◆NOTE

Please read the instructions on cable installation (see "Cable Length and Installation: Leased Line or Multipoint" on page 32) carefully!

5.1.5 Example: Leased Line Setups

Leased Line: FP Modem-56k (Originate) + FP Modem-EU (Answer)

Modem A **FP Modem-56k: Originate mode**		**Modem B** **FP Modem-EU: Answer mode**	
Terminal 57600/8/o/1		Terminal 57600/8/o/1	
1:1 connection via RJ12-RJ12 cable		1:1 connection via RJ12-RJ12 cable	
All DIPs set to OFF		All DIPs set to OFF	
AT&F&W	Factory Init with 57600bps	**AT&F&W**	Factory Init with 57600bps
AT&K3&W	Activates RTS/CTS	**AT&K3&W**	Activates RTS/CTS

Modem A **FP Modem-56k: Originate mode**		**Modem B** **FP Modem-EU: Answer mode**	
DIP1 and 3: ON; all others OFF	Originate mode	DIP1: ON; all others OFF	Answer mode
Garbage output possible		Output	
Blank line		Blank line	
CONNECT 14400		CONNECT 14400	
Data transmission		Data transmission	

Leased Line: FP Modem-56k (Answer) + FP Modem-EU (Originate)

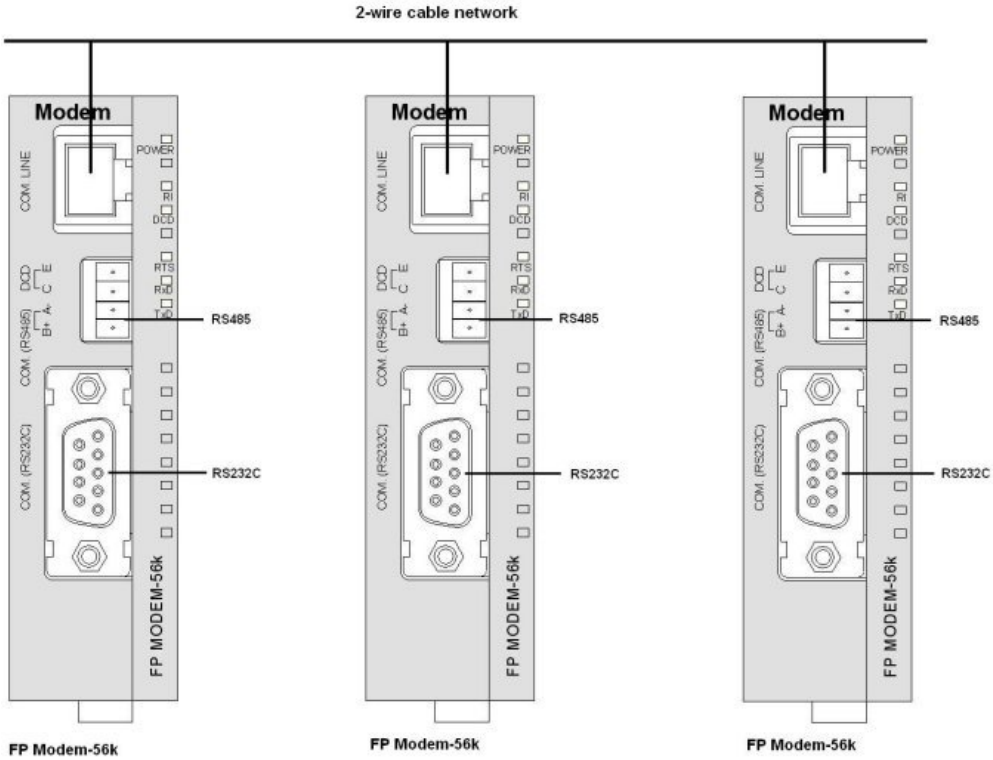
Modem A **FP Modem-56k: Answer mode**		**Modem B** **FP Modem-EU: Originate mode**	
Terminal 57600/8/o/1		Terminal 57600/8/o/1	
1:1 connection via RJ12-RJ12 cable		1:1 connection via RJ12-RJ12 cable	
All DIPs set to OFF		All DIPs set to OFF	
AT&F&W	Factory Init with 57600bps	**AT&F&W**	Factory Init with 57600bps
AT&K3&W	Activates RTS/CTS	**AT&K3&W**	Activates RTS/CTS
DIP1: ON; all others OFF	Answer mode	DIP1 and 3: ON; all others OFF	Originate mode
Garbage output possible		Output	
Blank line		Blank line	
CONNECT 14400		CONNECT 14400	
Data transmission		Data transmission	

Leased Line: FP Modem-56k (Originate) + FP Modem-56k (Answer)

Modem A **FP Modem-56k: Originate mode**		**Modem B** **FP Modem-56k: Answer mode**	
Terminal 57600/8/o/1		Terminal 57600/8/o/1	
1:1 connection via RJ12-RJ12 cable		1:1 connection via RJ12-RJ12 cable	
All DIPs set to OFF		All DIPs set to OFF	
AT&F&W	Factory Init with 57600bps	**AT&F&W**	Factory Init with 57600bps
AT&K3&W	Activates RTS/CTS	**AT&K3&W**	Activates RTS/CTS
DIP1 and 3: ON; all others OFF	Originate mode	DIP1: ON; all others OFF	Answer mode
Garbage output possible		Garbage output possible	
Blank line		Blank line	
CONNECT 14400		CONNECT 14400	
Data transmission		Data transmission	

5.2 Multipoint Mode

The FP Modem-56k can be operated on a two-wire private cable network.



Multipoint operation on a 2-wire cable network

Multipoint (MP) mode: features

- DIP switch (see page 11) activation (DIP switch changes take effect after the next power-up) and multipoint mode options:
  - PC/RTS mode
  - PLC mode
  - Transparent mode
- Line speed: 1200bps fixed (bidirectional, V.23 half-duplex)
- Sender control with:
  - RTS handshake line
  - Special characters
  - Idle time
- No automatic error handling
- Flexible setup of the terminating resistor for multipoint mode using DIP6 switch

- DCD shows network status
- Up to 20km range with 2-wire cable

5.2.1 Multipoint Options: PC/RTS, PLC, Transparent

After power-up with DIP2 switched ON, the message "CONNECT" is output via RS232C/RS485, and the modem is in multipoint (MP) online receive mode (high impedance).

In receive mode, all modems are listening and all data received via the communications line is transmitted to the RS232C/RS485 interface without being checked for errors.

The following three multipoint options are available for sending data:

- **PC/RTS mode**
  The receive/send changeover is controlled by the connected DTE (i.e., PC or PLC) via an RTS handshake signal. First the RTS signal is activated; then data is sent to the modem. When all data has been sent, the RTS should be deactivated.
- **PLC mode**
  All data received via RS232C/RS485 is buffered by the modem until the end character (see register S94) has been received. Then the modem switches to send mode and transfers all characters it has buffered. Next, the modem returns to receive mode.
- **Transparent mode**
  As with PLC mode, the modem buffers all data received via RS232C/RS485. If the modem receives no data for the idle time specified (see register S95), the modem switches to send mode and transfers all characters it has buffered. Next, the modem returns to receive mode. For transparent mode an S95 value of 1...255 is needed (increments of 3.3ms). The S95 register can be set by the DTE or with DIP1 (S95=3=10ms). If you use the default setting (S95=0), the unit enters the PLC mode.

In PLC and transparent modes, the RS232C/RS485 buffer size is 6KB.

In receive mode, the modem's DCD output reports that data is being sent on the cable network; therefore, any PLC that is connected will wait to receive data and not send simultaneously.

A changeover into command mode using the Escape sequence **+++** is not possible.

As the new FP Modem-56k sends replies at a faster rate than the FP Modem-EU, a combination of both types in a multipoint network may cause problems.

The FP Modem-56k multipoint frequency modulation is fully compatible with the industrial standard V.23 Mode 2 (half-duplex with 1200bps via two-wire cable). This is particularly useful for IEC60870-5-101 communication with the IEC60870 Communicator Unit.

5.2.2 Enabling Multipoint with DIP Switches

In multipoint mode you can operate multiple modems on a two-wire cable network.

To activate multipoint mode, set up the FP Modem-56k DIP switches (see page 11) as follows:

	DIP1	DIP2	DIP3
PC/RTS	OFF	ON	OFF
PLC	OFF	ON	ON
Transparent (S95=3 set by DIP1)	ON	ON	ON
Transparent (only if S95 not zero)	OFF	ON	ON

Use the DIP4 switch to define the baud rate for the RS232C and RS485 interfaces:

	DIP4 = ON Fixed baud rate	DIP4 = OFF Selectable baud rate
PC/RTS	1200bps 8o1*	1200bps with format last used in command mode
PLC	19200bps 8o1	Baud rate and format last used in command mode
Transparent	19200bps 8o1	Baud rate and format last used in command mode

*8o1 stands for: 8 data bits, odd parity, 1 stop bit

Defining a baud rate without using DIP4=ON

◆ **Procedure**

1. **To enter the dial-up command mode, set all DIP switches to OFF**
2. **In the DTE program, define the desired RS232C baud rate and data format**
3. **Power up the modem and enter AT (or AT&F to restore the default settings)**

   The modem should respond with OK.

   Optional: To disable automatic baud rate detection (command mode), use the command **AT*W=baud,data,parity,stop** (*W0).
4. **To save your settings, enter AT&W**
5. **Activate the multipoint mode with DIP switches 1, 2, and 3 as described above, but leave DIP4 OFF**

◆NOTE

- **If you are using FP0R, FP-Sigma, or FP-X series PLCs in multipoint mode, be sure adjust the baud rate accordingly with the SYS1 command. In the COM port / TOOL port dialog, these PLCs do not support a baud rate of 1200bps.**
- **Changes to DIP switch settings take effect only after the next power-up.**

5.2.3 Terminating Resistors

To optimize the electrical characteristics of a multipoint cable network, you can activate a terminating resistor within the FP Modem-56k. To switch on the built-in terminating resistor, use DIP switch (see page 11) 6.

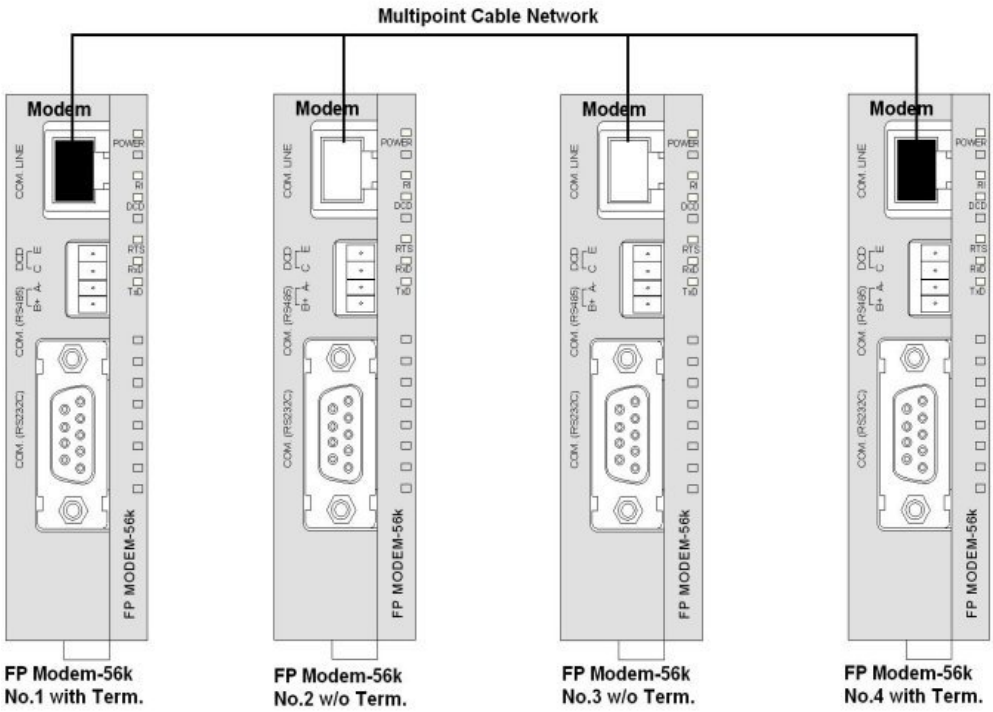
DIP6	Function
OFF	Terminating resistor activated only during transmission
ON	Terminating resistor always on

The command **AT&Nn** (used for the FP Modem-EU) is no longer supported with the FP Modem-56k.

We recommend that you mark the modems in which the terminating resistor has been activated in order to identify those that must subsequently be placed at the end of the straight cable.

Straight network

A straight two-wire cable requires a terminating resistor at either end in order to avoid floating voltages, line disturbance, noise, induction, high voltages, and other adverse effects. If a wire is not terminated by a resistor, you may have problems with data communications.



Star network

If you are working with a star network topology, you cannot activate all terminating resistors at each end of the star, because no more than 3 or 4 active terminating resistors may be connected to a single communications cable. All terminating resistors are connected to the cable in parallel, which means that each additional terminating resistor reduces the data voltage level.

With the FP Modem-56k, you can activate the terminating resistor for data transmission only. In star networks with a master modem in the middle, you can configure the master modem such that the terminating resistor is always activated. All the other modems can be configured such that their terminating resistors are only activated during data transmission. This way, the cable ends that are currently in use are always terminated, and no more than two terminating resistors are required at a time.

5.2.4 Error Correction in Multipoint

Multipoint communication is only possible in V.23 line modulation mode. In multipoint mode (unlike dial-up or leased line mode), automatic error correction is not available.

In multipoint mode, modems do not execute an error handling protocol; rather, the DTE units (i.e., PCs or PLCs) connected to the RS232C or RS485 interface must detect and correct any transmission errors.

In case you are using the MEWTOCOL protocol in a multipoint modem network, be sure to take the following points into account:

◆NOTE

- **If MEWTOCOL data is transferred via modem, the remote station can use a checksum to determine whether the data packet has been transmitted correctly.**
- **If an error is detected, the remote station reports it to the sender by using the pertinent MEWTOCOL command. This command enables the sender to repeat data packet transmission. In this way error correction is performed by MEWTOCOL, one level higher than the modem.**
- **However, if you are using MEWTOCOL multiframe communication (i.e., multiple data packets for PLC program download), single data packets cannot be resent. This means that ONE transmission error is all it takes to terminate an FPWIN Pro program download. To reduce data transmission errors during program download, we recommend that you observe the following guidelines:**
  - **Prevent line disturbances by ensuring that communications lines are not running parallel/adjacent to power lines**
  - **Optimize terminating resistor (see "Terminating Resistors" on page 73) use**
  - **Be sure the reply timeout setting in FPWIN Pro is high enough, e.g. perhaps 25s. You define this setting in the FPWIN Pro "Communication Settings" menu.**
  - **Use the following procedure to configure FPWIN Pro such that short program download packets are enabled:**

◆Procedure

1. **Locate "NAIS_MewPLC.dat" in folder "\\Program Files\NAIS MEWNET\"**
2. **Open file with Notepad for editing**
3. **Locate the section for your PLC (e.g. [FPSIGMA])**
4. **Locate the parameter "EXTCMD=...."**
5. **Set parameter to ZERO: "EXTCMD=0"**
6. **Save "NAIS_MewPLC.dat" and end Notepad**

5.2.5 Maximum Line Length: Multipoint

For multipoint mode, maximum line length was tested under the following conditions:

- Multipoint PLC mode (default transmission level and carrier online time)
- Straight telephone cable (diameter: 0.6mm), tested with a simulator
- Two modems
- Each modem with an active terminating resistor
- 1200bps line transmission speed
- No noise, no adverse effects, no disturbances

Results

Distance in km	Number of errors
20	Negligible
24	One error in 1 out of 10 data blocks (wrong character)
26	One error in every data block (wrong character)

◆**NOTE**

Please read the instructions on cable installation (see "Cable Length and Installation: Leased Line or Multipoint" on page 32) carefully!

5.2.6 Example: Multipoint Setups

Multipoint PC/RTS mode: Two **FP Modem-56k units**

Modem A **FP Modem-56k**		**Modem B** **FP Modem-56k**	
Terminal 1200/8/o/1		Terminal 1200/8/o/1	
1:1 connection via RJ12-RJ12 cable		1:1 connection via RJ12-RJ12 cable	
All DIPs set to OFF		All DIPs set to OFF	
AT&F&W	Factory Init	**AT&F&W**	Factory Init
DIP2: ON; all others OFF		DIP2: ON; all others OFF	
CONNECT V.23 HDX		CONNECT V.23 HDX	
<RTS ON> data block1 <RTS OFF>	Send data	Data block1	Receive data
Data block2	Receive data	<RTS ON> data block2 <RTS OFF>	Send data

Multipoint PLC mode: FP Modem-56k **and FP Modem-**EU

Modem A **FP Modem-56k**		**Modem B** **FP Modem-EU**	
Terminal 57600/8/o/1		Terminal 57600/8/o/1	
1:1 connection via RJ12-RJ12 cable		1:1 connection via RJ12-RJ12 cable	
All DIPs set to OFF		All DIPs set to OFF	
AT&F&W	Factory Init	**AT&F&W**	Factory Init
ATS94=xx&W	Stores end code character in S94; default is S94:013="CR"	**ATS94=xx&W**	Stores end code character in S94; default is S94:013="CR"
DIP2 and 3: ON; all others OFF		DIP2 and 3: ON; all others OFF	
Garbage output possible		CONNECT	
CONNECT V.23 HDX			
Data block1<CR>	Data + end code; see S94	Data block1<CR>	Receive data + end code
Data block2<CR>	Receive data + end code	Data block2<CR>	Data + end code; see S94

Multipoint PLC mode: Two **FP Modem-56k units**

Modem A **FP Modem-56k**		**Modem B** **FP Modem-56k**	
Terminal 57600/8/o/1		Terminal 57600/8/o/1	
1:1 connection via RJ12-RJ12 cable		1:1 connection via RJ12-RJ12 cable	
All DIPs set to OFF		All DIPs set to OFF	
AT&F&W	Factory Init	**AT&F&W**	Factory Init
ATS94=xx&W	Stores end code character in S94; default is	**ATS94=xx&W**	Stores end code character in S94; default is S94:013="CR"

Modem A **FP Modem-56k**		**Modem B** **FP Modem-56k**	
	S94:013="CR"		
DIP2 and 3: ON; all others OFF		DIP2 and 3: ON; all others OFF	
Garbage output possible		Garbage output possible	
CONNECT V.23 HDX		CONNECT V.23 HDX	
Data block1<CR>	Data + end code; see S94	Data block1<CR>	Receive data + end code
Data block2<CR>	Receive data + end code	Data block2<CR>	Data + end code; see S94

◆**NOTE**

In the following example, ensure that the data will be transmitted in a single block:

- **Use a function key to create the data block, or**
- **Increase the value for the S95 register**

Multipoint transparent mode: FP Modem-56k **and FP Modem-**EU

Modem A **FP Modem-56k**		**Modem B** **FP Modem-EU**	
Terminal 57600/8/o/1		Terminal 57600/8/o/1	
1:1 connection via RJ12-RJ12 cable		1:1 connection via RJ12-RJ12 cable	
All DIPs set to OFF		All DIPs set to OFF	
AT&F&W	Factory Init	**AT&F&W**	Factory Init
ATS94=xx&W	Stores end code character in S94; default is S94:013="CR"	**ATS94=xx&W**	Stores end code character in S94; default is S94:013="CR"
DIP1, 2 and 3: ON; all others OFF NOTE: DIP3 sets S95=3, i.e. 10ms delay		**ATS94=xx&W**	Stores end code character in S94; default is S94:013="CR"
Garbage output possible		CONNECT	
CONNECT V.23 HDX			
Data block1<CR>	Send data + at least 10ms break	Data block1	Receive data
Data block2<receive data>	Receive data	Data block2	Send data + at least 10ms break

◆NOTE

In the following example, ensure that the data will be transmitted in a single block:

- **Use a function key to create the data block, or**
- **Increase the value for the S95 register**

Multipoint transparent mode: Two **FP Modem-56k units**

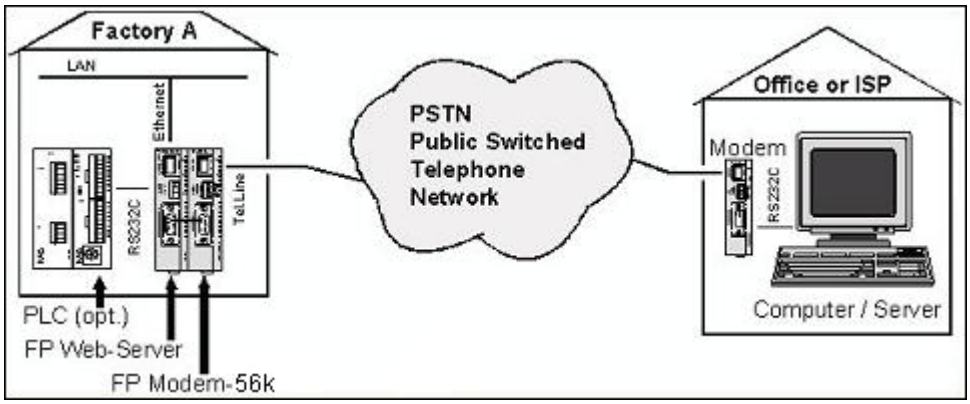
Modem A **FP Modem-56k**		**Modem B** **FP Modem-56k**	
Terminal 57600/8/o/1		Terminal 57600/8/o/1	
1:1 connection via RJ12-RJ12 cable		1:1 connection via RJ12-RJ12 cable	
All DIPs set to OFF		All DIPs set to OFF	
AT&F&W	Factory Init	**AT&F&W**	Factory Init
DIP1, 2 and 3: ON; all others OFF NOTE: DIP3 sets S95=3, i.e. 10ms delay		DIP1, 2 and 3: ON; all others OFF NOTE: DIP3 sets S95=3, i.e. 10ms delay	
Garbage output possible		Garbage output possible	
CONNECT V.23 HDX		CONNECT V.23 HDX	
Data block1<CR>	Send data + min. 10ms break	Data block1	Receive data
Data block2	Receive data	Data block2	Send data + min. 10ms break

Chapter 6

Remote Networking with Windows

6.1 Modem Setup for FP Web Server and Windows

This chapter explains how to set up Windows XP, Windows NT, or Windows 95/98 for communication via FP Modem-56k and dial-up networking with the FP Web Server's Point-to-Point Protocol (PPP) Server.



Modem Setup: System Landscape

PLC/FP Modem-56k setup

- The FP Modem-56k should use the default setting (**AT&F&W**)
- Use a 1:1 cable to connect FP Modem-56k and FP Web Server
- Configure the FP Web Server's PPP Server as in the following examples

Windows PC setup

- TCP/IP network protocol required (Control Panel → Network Connections)
- Modem installation under Windows using the appropriate .INF file
- Dial-up network installation as for ISP access via modem

◆NOTE

The following screenshots were taken from a Windows XP operating system, whose layout may differ slightly from that of other Windows operating systems.

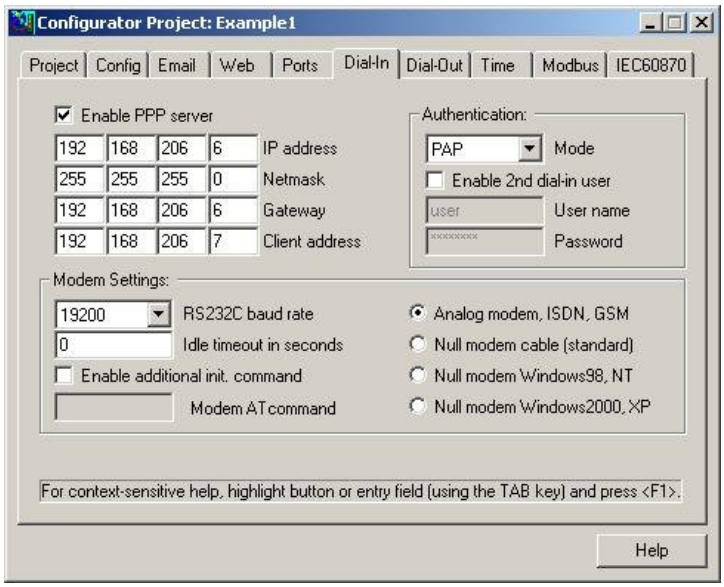
6.2 Server Side: Configuring the FP Web Server / PLC Connection

Configuring the FP Web Server

For more information on the PPP Server setup and an IP configuration example, please refer to the Online Help for the FP WEB Configurator Tool.

Procedure

1. **Open the FP WEB Configurator Tool**
2. **Open the "**Dial-In" **tab:**



3. **Select the "**Enable PPP server" **checkbox**
4. **For the first test, use the following IP settings:**

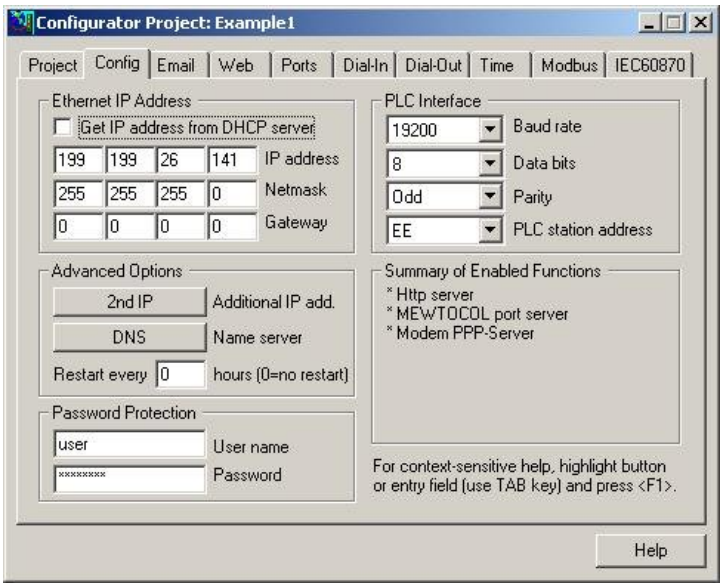
   IP address: 192.168.206.6

   Netmask: 255.255.255.0

   Gateway: 192.168.206.6

   Remote/Client address: 192.168.206.7
5. **Select** PAP **as the** authentication mode
6. **Select the** RS232C (modem) baud rate **(use** 19200bps **for the first test)**
7. **Enter** 0 **for "**Idle timeout in seconds"
8. **Select "**Analog modem, ISDN, GSM"

9. **Enter your user name and password in the "**Config" **tab:**



Connecting your hardware for the FP Modem-56k / FP Web Server setup

◆Procedure

1. **Make sure that all DIP switches belonging to the FP Modem-56k are set to OFF (default setting)**
2. **Use a standard modem cable as described in the Online Help for the FP WEB Configurator Tool**
3. **Connect the 9-pin port of the FP Web Server to the 9-pin port of the FP Modem-56k**
4. **Use the same power supply for the FP Web Server as for the FP Modem-56k**

6.3 Client Side: Configuring a Windows Dial-Up Network

Connecting your hardware: FP Modem-56k to PC

Procedure

1. **Make sure that all DIP switches belonging to the FP Modem-56k are set to OFF (default setting)**
2. **Find an unused COM port on the Windows PC**

   In this example, COM4 is used. Make a note of this COM port for the Windows modem setup.
3. **Connect this COM port to the 9-pin connector belonging to the FP Modem-56k**

   Use a standard PC/modem cable.

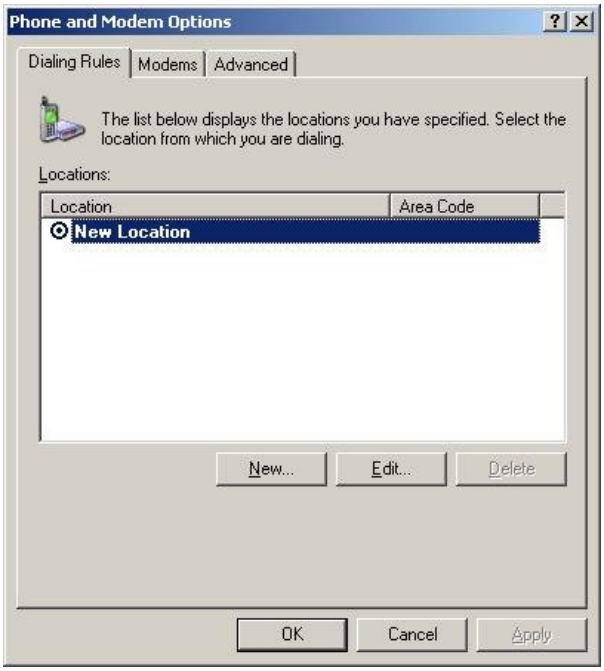
Installing an FP Modem-56k on Windows XP

Procedure

The Windows driver file "PAN_FP56.inf" enables installation of the FP Modem-56k for Windows. You can find this file on the FP WEB Configurator Tool CD, or you can purchase it from your local Panasonic dealer.

1. **Locate the file "PAN_FP56.inf" on the CD**
2. **Copy this file into a temporary folder**
3. **Choose** Start → Settings → Control Panel

4. **Choose the  "Phone and Modem Options" icon to open the dialog:**



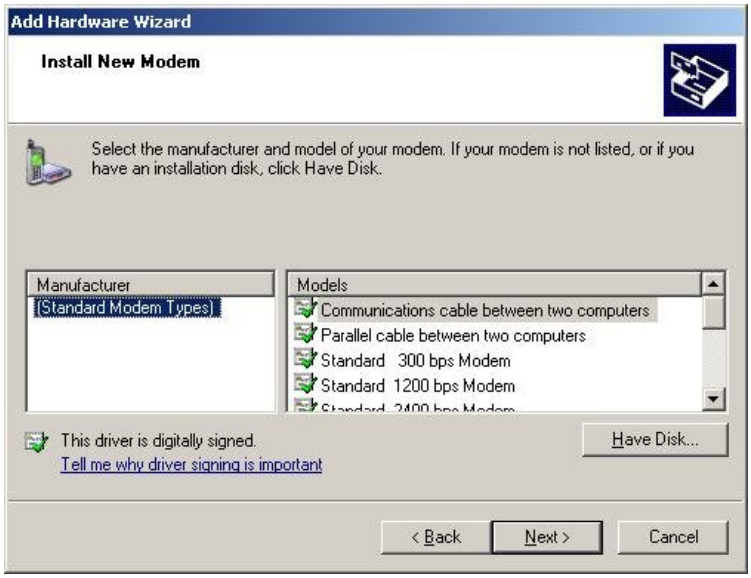
5. **Select the "Modems" tab to display the installed modems**

6. **To add a modem, choose [Add]:**

7. **Check "Don't detect my modem: I will select it from a list":**

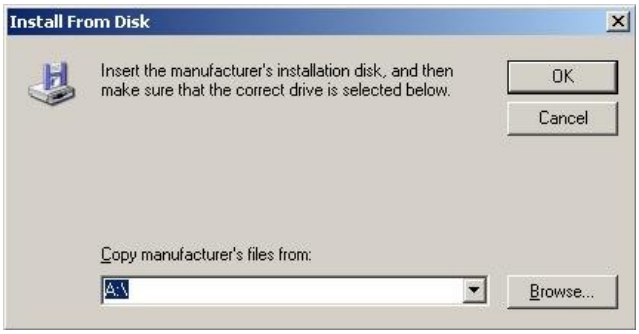
8. **Choose [Next]**

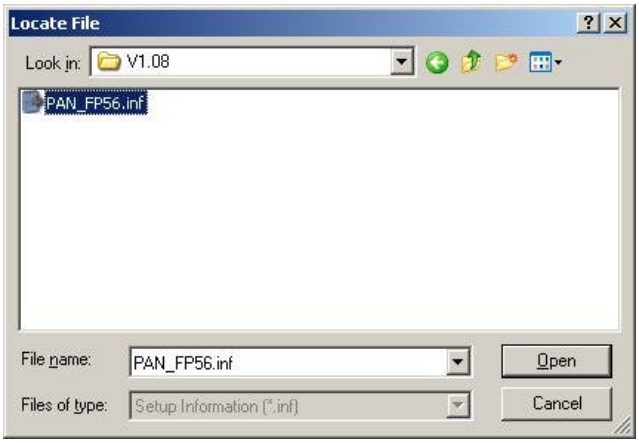
9. **Choose [Have Disk]:**



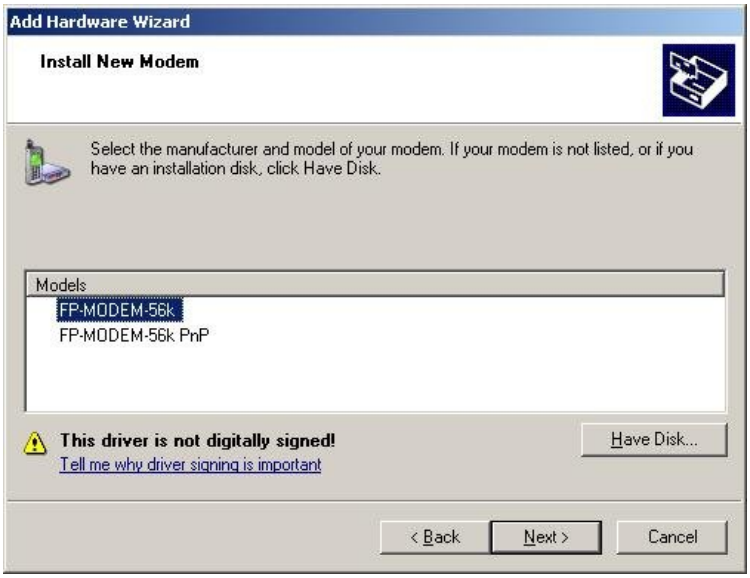
10. **Enter the path for the driver file "PAN_FP56.inf"**

You can use [Browse] to locate the file in your temporary folder:



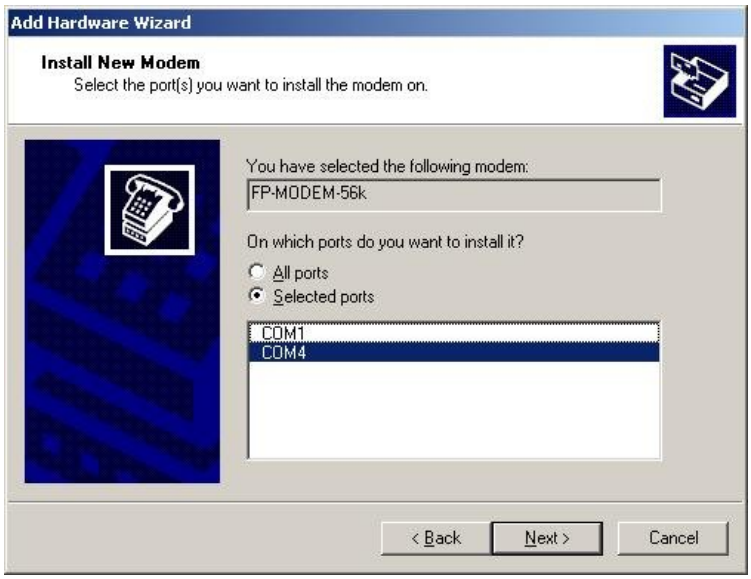


11. Select "FP-MODEM-56k" or "FP-MODEM-56k PnP":



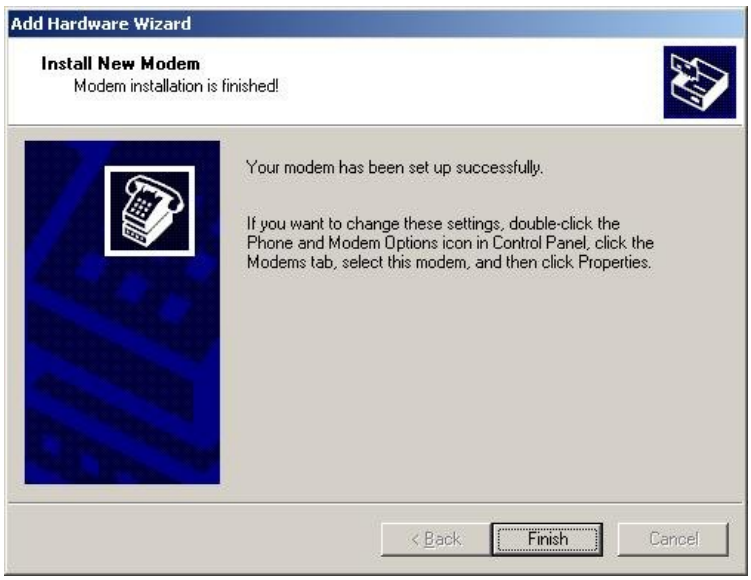
12. Choose [Next] (or [OK])

13. **Select the COM port of the PC to be used (e.g. "COM4")**

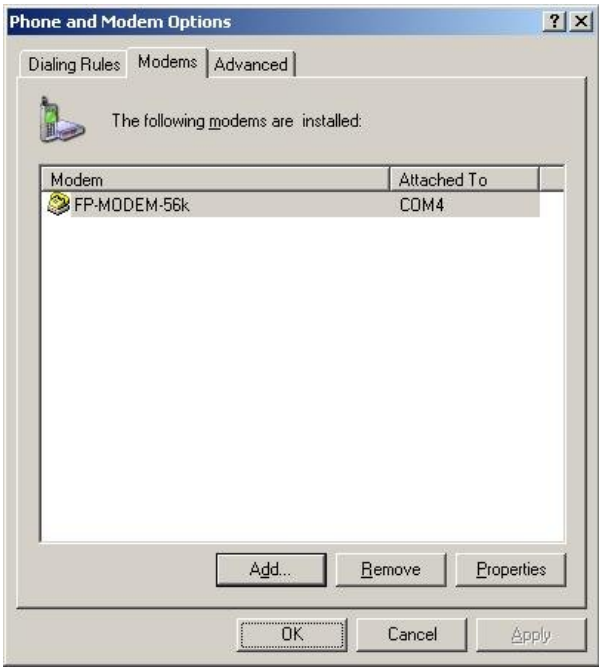


14. **Choose [Next] (or [OK])**

15. **Choose [Finish]:**

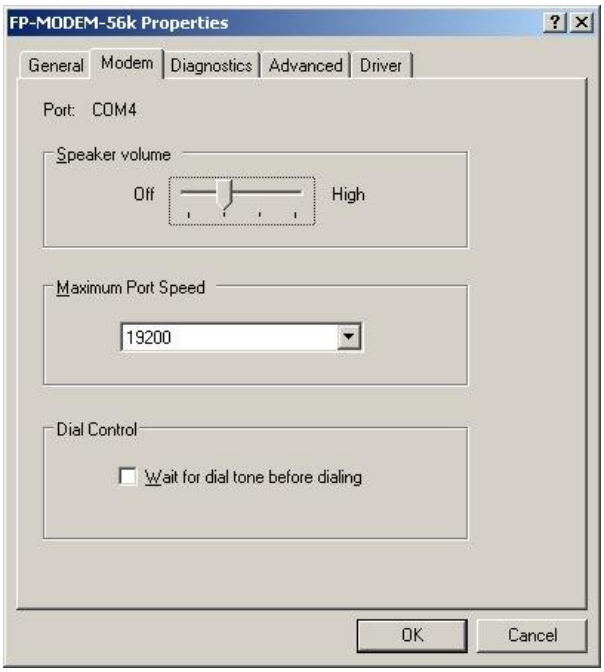


16. **Back on the "Modems" tab, select the new FP Modem-56k:**

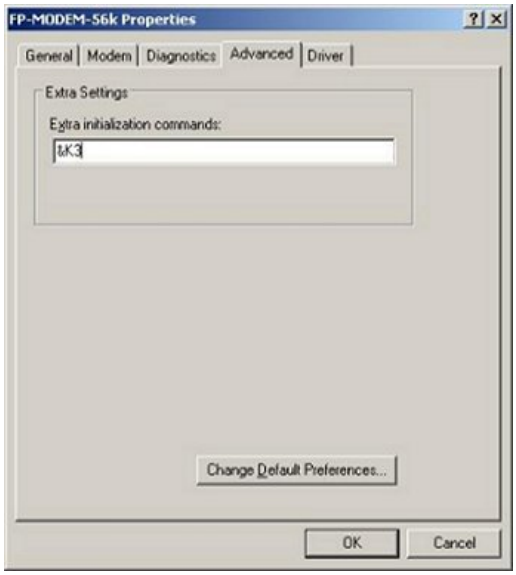


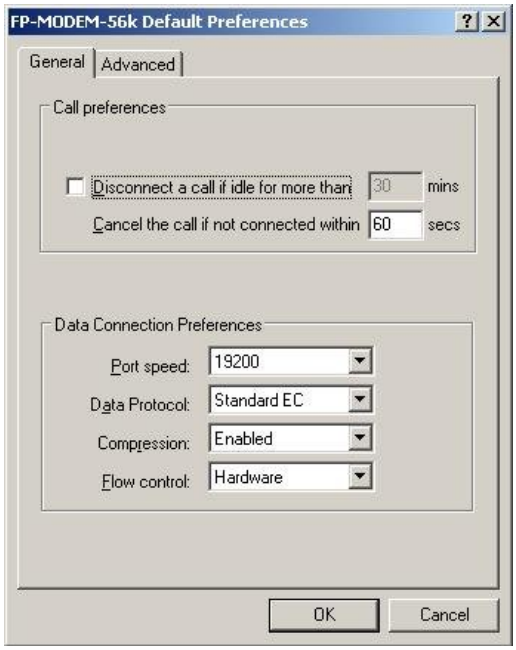
17. **Choose [Properties]**

18. **Select the "Modem" tab, and set the maximum speed to the same value as specified in the FP Web Server configuration (in this example, 19200 bps). Ensure that the "Wait for dial tone before dialing" checkbox is deactivated:**

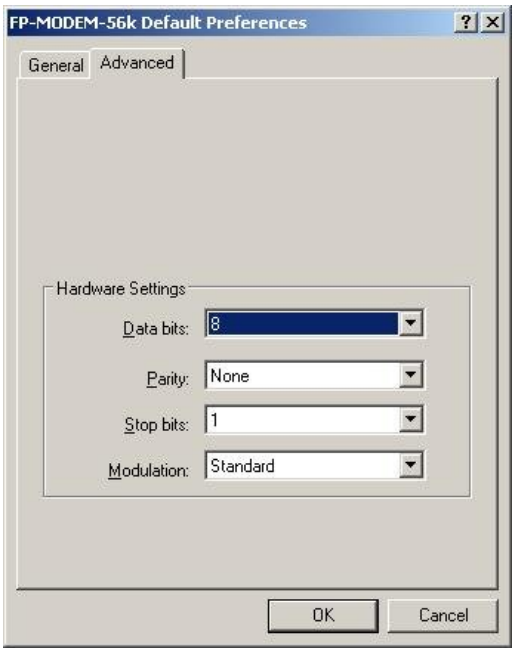


19. Select the "Advanced" tab, and choose [Change Default Preferences] to define the modem communications settings:





The "Advanced" tab displays more detailed communications parameters:



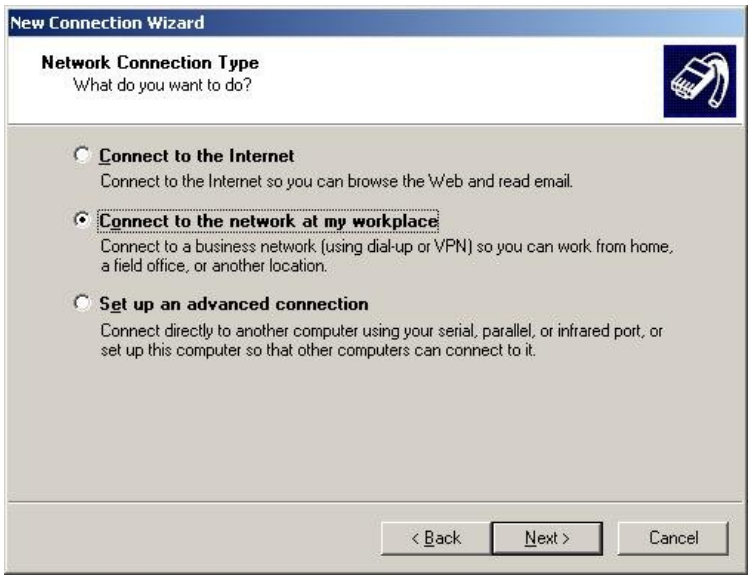
20. Choose [OK] and close the dialog

Configuring your Windows dial-up network

◆Procedure

1. Choose Start → Programs → Accessories → Communications → New Connection Wizard

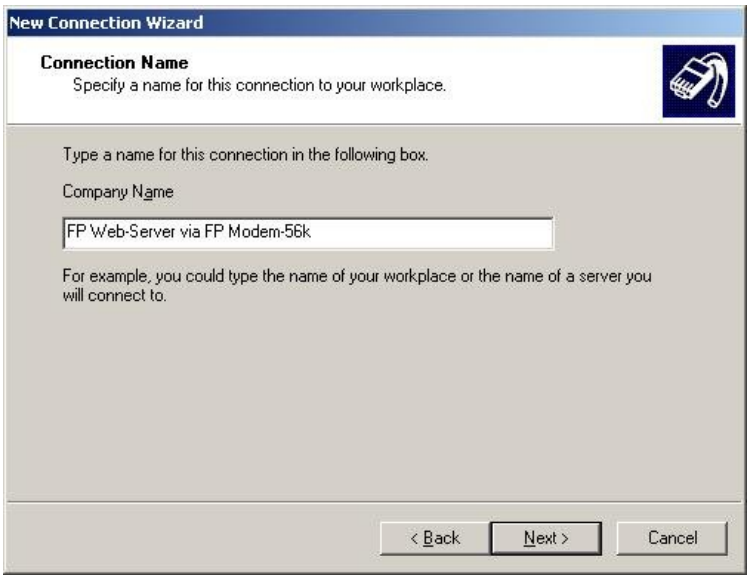
2. **Select "Connect to the network at my workplace" and choose [Next]:**



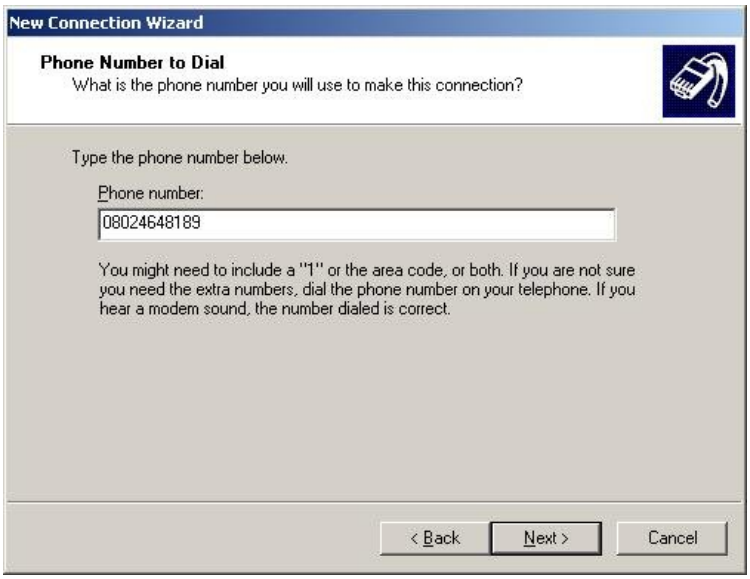
3. **Select "Dial-Up connection" and choose [Next]:**

4. **Enter a name for the new connection and choose [Next]:**

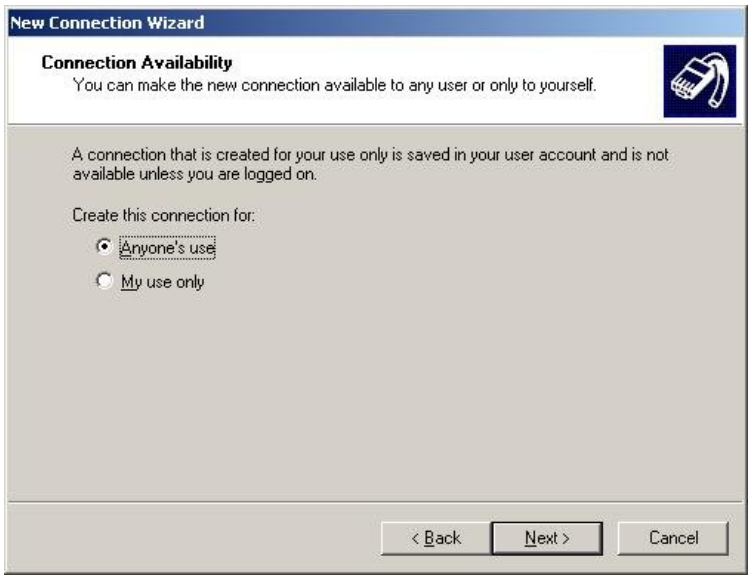
Example: "FP Web-Server via FP Modem-56k"



5. Enter the telephone number of the remote FP Web Server in the "Phone number" field and choose [Next]:



6. Select the desired connection availability and choose [Next]:

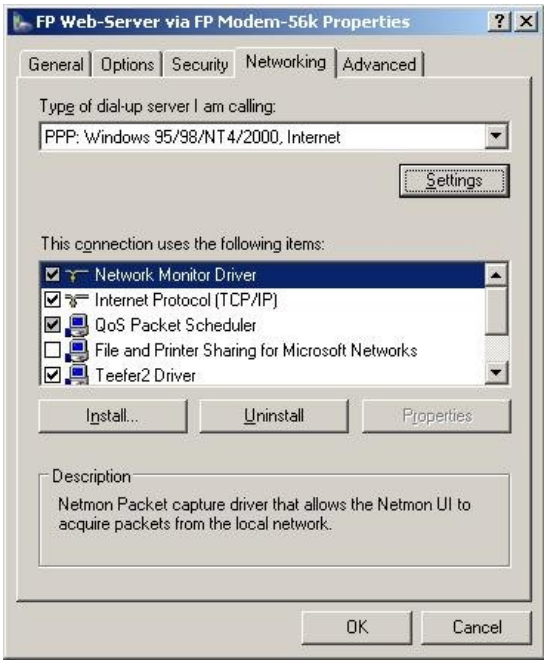


7. Choose [Finish] (or [OK])

You can add a shortcut to this connection to your desktop:

8. Open the new connection and choose [Properties]

9. **Select "PPP: Windows95/98/NT 4/2000, Internet" in the dial-up server field, and choose [Settings]:**



10. **Deactivate the "Enable software compression" checkbox:**

(Windows95: Under "Advanced options," deselect "Enable software compression" and deselect "Require encrypted password")

11. **Under "Network protocols" ensure that "IPX/SPX compatible" and "NetBEUI" are not selected.**

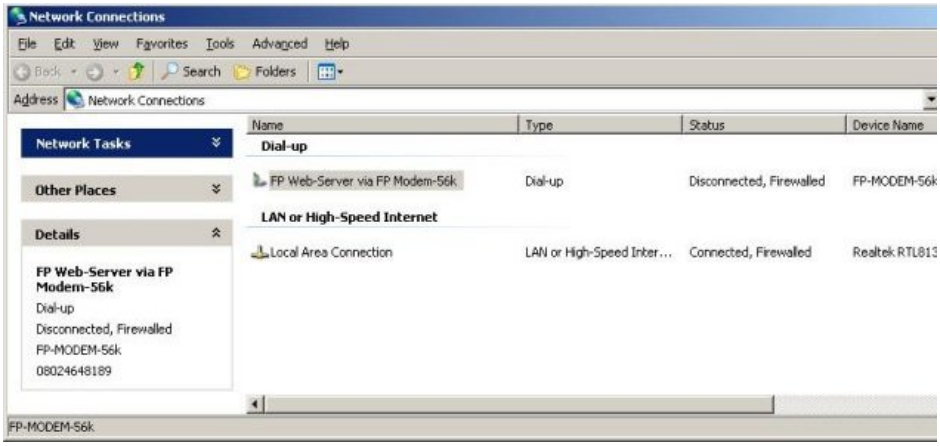
12. **Choose [OK]**

6.4 Client Side: Dialing the FP Web Server

Windows dial-up procedure

Procedure

1. **Locate your newly created dial-up connection (FP Web Server via FP Modem-56k): choose Start → Programs → Accessories → Communications → Network Connections:**



2. **On the "Network Connections" screen, double-click "FP Web Server via FP Modem-56k" to open the connection**

3. **Enter your user name and password as defined in the FP Web Server configuration and choose [Dial]:**

The dial-up process can take a few seconds:

4. **On successful connection, the connection icon appears on the Windows task bar**

   To end this connection, click this icon, and choose [Disconnect]

5. **To test your connection, use a standard Internet browser configured as described in the Online Help for the FP WEB Configurator Tool**

6. **Enter the PPP Server's IP address in the URL field of your Internet browser, e.g. http://192.168.206.6**

7. **The main.htm page, as set up with the Configurator tool, should be displayed**

Chapter 7

AT Commands, Registers, and Modem Messages

7.1 Command Tables

The following table lists all available AT commands and their functions, as well as the S registers (see page 109) belonging to the commands.

◆NOTE

- **All commands start with the characters** AT**, e.g. "**ATA" **for the command "A".**
- **The only exception where "**AT**" does not precede a command is "**A/**" for repetition of a command.**
- **The standard and/or recommended settings, where applicable, are shown in bold under "Description".**

Command		Description
A/		Repeat previous command
A		Answer a call; pick up and attempt to answer a call
B		Bell mode **0=OFF**, 1=ON
Dn		Dial modifier, n-values
	P	Pulse dialing
	T	DTMF dialing
	0-9	Dial string; in addition, for DTMF dialing: *, #, A, D
	A-D*#	Send DTMF tones
	,	Dial pause; delay as defined by S8 register setting
	W	Wait for dial tone; delay as defined by S6 register setting
	@	Wait for silence
	...;	Return to command mode after dialing: "..." stands for the number to dial
	!	Flash
	S=n	Dial number stored in directory; n (0-9) stands for a speed dial string, e.g. ATDS1 dials the number previously stored using AT&Z1
En		n=0 Turn off command echo (returned when connected to a PLC, for example) **n=1 Turn on command echo; all commands are returned to DTE**
Fn		**n=0 Adjust transmission mode automatically (RS232C/RS485 baud rate = maximum line transmission speed)**
		n=1 300bps, as specified by V.21 n=2 not supported n=3 1200bps, as specified by V.23 n=4 1200bps, as specified by V.22 n=5 2400bps, as specified by V.22bis n=6 4800bps, as specified by V.32bis n=7 7200bps, as specified by V.32bis n=8 9600bps, as specified by V.32bis n=9 12000bps, as specified by V.32bis n=10 14400bps, as specified by V.32bis
Hn		Hang up ATH or ATH0 and initiate termination of the connection

Command	Description
	n=1 If connection has been terminated, establish a connection and switch to command mode
In	0 = Product code: Panasonic FP Modem-56k 1 = Precalculated checksum 2 = Memory test; calculates checksum and compares to stored value; output "OK" if checksums are equal; otherwise, "ERROR" **3 = Report firmware version** 4 = Report OEM ID 5 = Report country code 6 = Report data pump type 7 = Report software model 8 = Report serial number 9 = Report Plug-n-Play (PnP) identification
Ln	Set speaker volume n=0,1: Low; **n=2: Medium**; n=3: High
Mn	Speaker ON/OFF n=0: OFF; **n=1: ON until connection is established**; n=2: always ON
On	n=0 Data mode on; no retrain n=1 Data mode on; start retrain sequence n=2 Fast retrain without speed change n=3 Renegotiate rate without speed change n=4 Renegotiate rate, down one speed n=5 Renegotiate rate, up one speed n=2–5 For diagnostic purposes only
Qn	**n=0 Issue modem messages** n=1 Suppress modem messages
Sr? **Sr=n**	Report value set for S register r Set S register r to value n
Vn	n=0 Report numerical answer codes **(normally returned when connected to a PLC)** **n=1 Report modem reply in text form** See modem messages (see page 111).
Wn	n=0 Report DTE (RS232C/RS485) baud rate; output "CONNECT" n=1 Report line transmission speed, protocol, and DTE baud rate **n=2 Report line transmission (DCE) speed; output "CONNECT"**
Xn	n=0 Switch off dial tone and busy signal detection; report only messages 0–4 and 8 (see "Modem Messages" on page 111) n=1 Switch off dial tone and busy signal detection; reporting is same as X0 plus all "CONNECT XXXX" messages n=2 Same as X1; switch on dial tone identification **n=3 Same as X1; switch on busy signal identification; use for PBX** n=4 Switch on dial tone and busy signal detection; all messages are reported. For extended modem messages (see page 111), use AT\Vn.
Zn	n=0 Reset software and restore user profile 0 n=1 Reset software and restore user profile 1 After you have entered the ATZ command, no further command can follow. A new AT command must be entered.

Command	Description
&Cn	n=0 Keep DCD switched on at all times. For test purposes only (LED or DCD output) **n=1 DCD indicates connection state**
&Dn	**n=0 Ignore DTR (Data Terminal Ready) signal** n=1 Return to command mode after DTR change n=2 Terminate connection and return to command mode after DTR change n=3 Reset after DTR change
&Fn	n=0 (or only AT&F): Restore default setting 0 n=1 Restore default setting 1 (reserved) The AT&F command does not delete the telephone numbers stored in &Zn. To delete these numbers, use AT*F.
&Kn	**n=0 Switch off DTE/DCE flow control** n=3 Switch on RTS/CTS DTE/DCE flow control n=4 Switch on XON/XOFF DTE/DCE flow control n=5 Switch on transparent XON/XOFF flow control
&Nn	This command has no function. Terminating resistor for multipoint mode (see page 70) is switched on and off by DIP6 n=0,1,2 Switch terminating resistor via DIP6
&Pn	**n=0 Define 39%-61% make/break ratio at 10Hz** n=1 Define 33%-67% make/break ratio at 10Hz n=2 Define 39%-61% make/break ratio at 20Hz n=2 Define 33%-67% make/break ratio at 20Hz
&Rn	**n=0 CTS follows after RTS (as specified by V.24)** n=1 CTS always active
&Sn	n=0 Handshake signal DSR always active **n=1 Deactivate DSR if flow control is required (as specified by V.24)**
&V, &V0 **&V1**	Display current configuration and stored profiles 0 and 1 Display most recent connection statistics
&Wn	Save current configuration in user profile n (0 to 1)
&Yn	Restore user profile n (**0** or 1) at next power-up
&Zn=x	Store dial string x (up to 32 digits) to location n (0 to 9) Telephone number **0** is decisive for the password and callback function (see also AT\F: report list of stored telephone numbers) Telephone number **1 to 5** is also used by CLIP function
-Kn	**n=0 Disable V.42 to MNP10 conversion** n=1 Enable V.42 to MNP10 conversion n=2 Enable V.42 to MNP10 conversion; inhibit MNP Extended Services initiation
\Bn	Send break signal to calling modem that terminates connection. n* 100ms (default setting n=3; see also: AT\Kn and disconnecting with a break signal (see page 40))
\F	Report list of all stored telephone numbers (stored with AT&Zn=x)
\Kn	Define one of four options for processing a break signal, see AT\Bn (see page 40). n=0, 2, 4: Set to command mode; no break signal is being sent to remote station n=1: Clear buffer and send break signal to remote modem n=3 Send break signal to remote modem immediately **n=5 Send break signal to remote modem; signal is attached to transmitted data**

Command	Description
\Nn	n=0 NORMAL mode: Adjust line transmission speed automatically; no error correction; no data compression (sets &Q6) n=1 DIRECT mode: Change to direct data connection. RS232C/RS485 baud rate = line transmission speed (error correction switched off; sets &Q0) **CAUTION: As soon as connection is established, the RS232C/RS485 baud rate is automatically adjusted to the CONNECT baud rate!** n=2 RELIABLE mode: Hang up if remote modem does not allow error correction. Error correction first after LAPM, then after MNP. Data compression as specified by V.42bis or V.44 (forces &Q5). **n=3 AUTO-RELIABLE mode: Define error correction method automatically. If no remote station allows error correction, set to NORMAL mode, with error correction method as specified by V.42: LAPM or MNP. Data compression as specified by V.42bis or MNP5.** n=4 RELIABLE mode: Error correction only as specified by LAPM; otherwise, abort the connection. Data compression as specified by V.42bis. n=5 RELIABLE mode: Error correction only as specified by MNP; otherwise, abort the connection. Data compression as specified by MNP5.
\Sn	**n=0 Disable PSTN text message reception** n=1 Enable automatic reception of PSTN text messages, if CLIP decoder is active
\Tn	Define inactivity timeout in register S30: n=**0**...90 in 10-s increments Define inactivity timeout – i.e., waiting period while no data is being received or sent before the connection is aborted. In error correction mode, any characters transmitted and received reset the timer. In other modes, transferred data resets the timer. Increments: 10s
\Vn	**Select extended modem messages** **n=0 Connect messages are controlled by the X and W command settings** n=1 Enable extended single-line connect messages
%Cn	**n=0: Deactivate data compression** n=1: Enable MNP5 data compression n=2: Enable V.42bis data compression n=3: Enable V.42bis and MNP5 data compression
%En	n=0: Disable telephone line quality monitoring; disable autoretrain **CAUTION: In the case of line transmission discontinuities or short-term interference, the n=0 setting can cause problems. We recommend setting %E to 1.** **n=1 Enable telephone line quality monitoring; enable autoretrain** n=2 Enable telephone line quality monitoring; enable fallback / fall forward
%Fn	**n=0 Disable half-duplex (V.23)** n=1 Enable half-duplex n=3 Enable half-duplex
%Gn	**n=0 Deactivate CLIP decoder** n=1 Activate CLIP decoder display with RING n=2 Display CLIP data in unformatted hexadecimal format n=3 Activate selective call acceptance of valid telephone numbers stored in &Z1 to &Z5 (see also AT\F: report list of stored telephone numbers) See CLIP function modes (see "CLIP Settings" on page 48).
%Kn	n=0 Enable aborting the handshake phase by a character input at the RS232C/RS485 interface **n=1 Deactivate aborting the handshake phase by a character input at the RS232C/RS485 interface**
***F**	Set all available settings (plus S register) back to default by deleting all memory content.

Command	Description
	After entering AT*F, you must wait 5s before entering next command.
***P=xxx**	Enter the password: AT*P=xxxx<CR> You can enter up to 7 characters. These characters may contain letters, numbers, and/or special characters _-$*+#:;&/\(). Lowercase letters change to uppercase upon entry.
***P?**	Display password: AT*P? or AT*L Delete password: AT*P=
***W0** ***W=b,d,p,s**	**Enable automatic baud rate detection for the RS232C/RS485 interface** Switch off autodetect; adjust RS232C/RS485 format b = baud rate = 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps d = number of data bits (7 or 8) p = parity (N = none, E = even, O = odd, S = Space, M = Mark) s = number of stop bits (1 or 2) Examples: AT*W=2400,7,E,1 – 2400bps, 7 data bits, even parity, 1 stop bit AT*W=57600,8,O,1 – 57600bps, 8 data bits, odd parity, 1 stop bit AT*W=19200,8,M,2 – 19200bps, 8 data bits, none parity, 2 stop bits As a general rule, the modem will not use a line transmission speed exceeding the RS232C/RS485 baud rate. (NOTE: This rule applies to dial-up and point-to-point leased line, but not to multipoint/PLC mode.) See also Modem Operation with RS232C or RS485 (see page 37)
+GMM	Modem identification: Panasonic FP-MODEM-56k
+GMR	Software version number (same as ATI3)
+GCI=n **+GCI?** **+GCI=?**	Select country code n Display current country code Display available country codes
+IPR=n	Select data rate of connected DTE: **0=autobaud**, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
+IPR? **+IPR=?**	Display current data rate Display available data rates
+ICF=	Select data format: [f[,p]] (f=format, p=parity) **f=0: Detect format automatically** f=1: 8 data bits, 2 stop bits f=2: 8 data bits, 1 parity bit, 1 stop bit f=3: 8 data bits, 1 stop bit f=4: 7 data bits, 2 stop bits f=5: 7 data bits, 1 parity bit, 1 stop bit f=6: 7 data bits, 1 stop bit p=0: odd, p=1: even, p=2: Mark, p=3: Space
+ICF? **+ICF=?**	Display current data format Display available settings for data format

Command	Description
+IFC=	Select flow control: [DCE_by_DTE[,DTE_by_DCE]] **DCE_by_DTE:** **0: No flow control** 1: XON/XOFF, do not pass XON/XOFF characters to remote modem 2: RTS control 3: XON/XOFF, pass XON/XOFF characters to the modem **DTE_by_DCE:** **0: No flow control** 1: XON/XOFF 2: CTS control
+IFC? **+IFC=?**	Display current flow control Display available settings for flow control
+MS=	Select modulation type: [carrier[,automode[,min_tx_rate[,max_tx_rate[,min_rx_rate[,max_rx_rate]]]]]] automode= 0 or 1 **Carrier with possible baud rates (bps):** B103: 300 B212: 1200/75, 75/1200 V21: 300 V22: 1200 V22B: 1200, 2400 V23C: 1200 V32: 4800, 9600 V32B: 14400, 12000, 9600, 7200, 4800 **V34:** 33600, 31200, 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, 2400 V90: 56000, 54667, 53333, 52000, 50667, 49333, 48000, 46667, 45333, 44000, 42667, 41333, 40000, 38667, 37333, 36000, 34667, 33333, 32000, 30667, 29333, 28000 V92: V.92 downstream: 56000, 54667, 53333, 52000, 50667, 49333, 48000, 46667, 45333, 44000, 42667, 41333, 40000, 38667, 37333, 36000, 34667, 33333, 32000, 30667, 29333, 28000 V.92 upstream: 48000, 46667, 45333, 44000, 42667, 41333, 40000, 38667, 37333, 36000, 34667, 33333, 32000, 30667, 29333, 28000, 26667, 25333, 24000
+MS? **+MS=?**	Display current modulation type Display available settings for modulation type

Command	Description
+ES=	Select Error Control and Synchronous mode: [orig_rqst[,orig_fbk[,ans_fbk]]] **orig_rqst:** requested mode 0: Initiate call with DIRECT mode 1: Initiate call with NORMAL mode 2: Initiate V42 without detection phase **3: Initiate V.42 with automatic detection phase** 4: Initiate MNP 6: Initiate V.80 Synchronous Access mode 7: Initiate Frame Tunneling mode **orig_fbk:** Accepted mode in originator mode **0: LAPM, MNP or Normal mode. Error control is optional** 1: LAPM, MNP or DIRECT mode. Error control is optional 2: LAPM or MNP error control required. Disconnect if error control is not established 3: LAPM error control required. Disconnect if error control is not established 4: MNP error control required. Disconnect if error control is not established **ans_fbk:** accepted mode in answer mode 0: DIRECT mode 1: NORMAL mode. Error control is disabled **2: LAPM, MNP or NORMAL mode. Error control is optional** 3: LAPM, MNP or DIRECT mode. Error control is optional 4: LAPM or MNP error control required. Disconnect if error control is not established 5: LAPM error control required. Disconnect if error control is not established 6: MNP error control required. Disconnect if error control is not established 8: Initiate V.80 Synchronous Access mode 9: Initiate Frame Tunneling mode
+ES? **+ES=?**	Display current Error Control and Synchronous mode Display available settings for Error Control and Synchronous mode
+DS=	Select data compression: [direction[, compr_neg[,max_dict[,max_string]]]] **direction:** Specify direction of data compression from DTE point of view **0: Negotiated, no compression.** 3: Both directions, accept any direction. **compr_neg:** Specify continuation of operation if result is not obtained **0: Do not disconnect if compression is not negotiated** **max_dict:** Specify maximum number of dictionary entries to be negotiated **(2048 entries)** **max_string:** Specify maximum string length to be negotiated (**32 bytes**)
+DS? **+DS=?**	Display current data compression settings Display available data compression settings

Command	Description
+DS44=	Select V.44 data compression: [direction[,compress_negotiation[,capability[,max_codewords_tx [,max_codewords_rx[, max_string_tx[, max_string_rx[,max_history_tx[,max_history_rx]]]]]]]] **direction:** Specify direction of data compression from DTE point of view 0: Negotiated, no compression. 1: Transmit only. 2: Receive only. **3: Both directions, accept any direction.** **compress_negotiation:** Specify continuation of operation if result is not obtained **0: Do not disconnect if V.44 compression is not negotiated** 1: Disconnect if V.44 compression is not negotiated **capability:** Data compression method **0: Data stream** 1: Packet 2: Multi-packet **max_codewords_tx:** Maximum number of codewords in transmit direction: 256 to **2048** **max_codewords_rx:** Maximum number of codewords in receive direction: 256 to **2048** **max_string_tx:** Maximum string length in transmit direction: **32** to 255 **max_string_rx:** Maximum string length in receive direction: **32** to 255 **max_history_tx:** Maximum size of history buffer in transmit direction: 2048 to **4096** **max_history_rx:** Maximum size of history buffer in receive direction: 2048 to **4096**
+DS44? **+DS44=?**	Display current V.44 data compression settings Display available V.44 data compression settings
+CMGS=da	Send message in text mode: **da:** destination address If sending is successful, this command returns **+CMGS:mr** and **OK** If sending has failed, this command returns **ERROR** or **NO CARRIER** **mr:** message reference number
+CMGS=?	Returns **OK**, i.e. command is available.

Command	Description
+CMGR=i	Read message in number i of text message buffer in text mode. i=1: send buffer, i=2: receive buffer If message has been received, generate the following output: **+CMGR: <stat>,<oa>,,<scts><CR><LF><data>** When message has been sent, generate the following output: **+CMGR: <stat>,<da><CR><LF><data>** where **<stat>:** message status "REC UNREAD": new received, unread message "REC READ": received, read message "STO UNSENT": unsent message "STO SENT": sent message **<da>:** destination address **<oa>:** originator address **<scts>:** Service Center time stamp
+CMGR=?	Returns **OK**, i.e. command is available
+CMGD=i	Delete message in number i of text message buffer i=1: send buffer, i=2: receive buffer
+CMGD=?	Query existing messages Report buffers containing messages
+CSCS?	Request character set for coding/decoding messages Answer with "8859-1", i.e. all messages will be coded/decoded using the **ISO 8859-1 Latin 1** character set
+CSCS=?	Display available character sets

7.2 S Register Settings

The FP Modem-56k has a number of internal registers – termed "S registers" – that can be used to control modem operation. There are two register types:

- **Normal**, with values representing a time or a character
- **Bitmapped**, where a function is allocated to each bit

Register content is expressed in decimal numbers.

The modem command set contains two commands for viewing or editing register content:

Command	Function	Register content
ATSr?	Display register content with the number r	Returned to the DTE as a three-digit decimal number
ATSr=n	Edit register content	r=register number; n=edited value
AT&V	View all current settings	---

◆NOTE

We advise against changing the contents of bitmapped registers directly; please use the AT commands (see page 100) instead.

The following table lists the available S registers. Registers labeled **"*"** or **"$"** can be stored with **AT&W** or reset to the default with **AT&F**. After a software reset or a power ON reset, all other registers revert to the default. Registers labeled **"R"** are read-only. Registers labeled **"$"** are stored only in the active profile.

S0 *	Number of rings required before modem automatically answers a call. If this register is set to 0, the automatic reply mode is disabled.	0–8	1
S1 R	Ring counter: Every incoming ring signal increases the register value by 1. If this register equals S0, the modem automatically answers a call. The register is set to 0 if an interval of 8s is detected after a ring signal. If the time between two calls is less than 8s, the S1 register value is also increased without being reset.	0–255	0
S2 *	ASCII character for ESCAPE sequence used to switch from data mode to command mode	0–127	43="+"
S3	ASCII character for carriage return	0–127	13="CR"
S4	ASCII character for line feed	0–127	10="LF"
S5	ASCII character for backspace (backspace, delete to the left of the cursor, ←)	0–255	8="BS"
S6 *	Interval (in seconds) between entering ATD and dialing if dial tone detection is switched off	3–8	3
S7 *	Interval (in seconds) between end of dialing to receipt of answer tone from remote station. If no answer tone is received during this interval, the modem terminates the connection. The timer is started when the modem has finished dialing (originate), or 2s after answering.	1–255	45
S8 *	Waiting period in seconds for a dial pause (,) within the command **ATD...W...**	1–255	2

S9 *	Waiting period (in 1/10s) that a carrier must be present before the modem establishes the DCD signal	1–255	6
S10 *	Waiting period (in 1/10s) between recognition of a lost carrier and termination of the connection	1–254	14
S11 *	Tone Dial Timing (fixed setting): Duration of a DTMF tone in milliseconds	50–255	85
S12 *	Escape Prompt Delay (EPD): Interval (in 1/50s) during which no character may be entered before and after the Escape sequence	0–255	50
S25	Delay for DTR off (in 10-ms increments)	0–255	5
S26	RTS after CTS delay (in 10-ms increments)	0–255	1
S30 *	Inactivity timeout (see command **\Tn**) Inactivity interval (i.e., idle time) during which no data is being received or sent before the connection is automatically terminated. In the error correction mode, any characters transmitted and received reset the timer. In other modes, transferred data resets the timer. Increments: 10s. Zero (0) disables the timeout function.	0–255	0
S36 *	LAPM control (bitmapped)		7
S38	Disconnect delay (in seconds)		20
S46 *	Data compression control (bitmapped)		136
S48 *	V42 negotiation control (bitmapped)		7
S88 $	Transmission level in data mode (in -dBm)	10–15	12
S89 $	Transmission level in fax mode (in -dBm)	10–15	12
S91 R	Terminating resistor status See DIP6 (see page 11) or multipoint mode (see page 70)		0: DIP6=OFF 2: DIP6=ON
S92 $	Transmission level in leased line and multipoint modes Sets analog transmission level (in -dBm). Do not change!	6–15	13
S93 $	Carrier online time (in ms) for V23 half-duplex	18–255	25
S94 $	End code character for multipoint PLC mode: Terminates data buffering and starts data transmission	0–255	13="CR"
S95 $	Multipoint transparent mode is selected if S95>0. In this mode, data received via RS232C/RS485 is continually buffered in the modem for the idle time specified in S95. If no data is received by the time this interval expires, all buffered data is sent. Increments: 3.3ms. DIP1 sets S95=3 (10ms)	0–255	0 3 with DIP1
S96 *	Extended answer codes (bitmapped)		0
S104 *	Timeout (maximum sending time in MP mode): Waiting period (i.e., idle time) during which modem remains online before the connection is automatically terminated. Increments: 1min. Zero (0) disables the timeout function.	0–255	0

7.3 Modem Messages

The modem generates messages in response to commands and in case of errors. This enables the DTE (i.e., PC or PLC unit) to monitor the modem's operation mode as well as execution of the commands. Modem messages are sent in ASCII code, in (long) text or (short) numerical format. The text format is set with **ATV1** and the numerical format with **ATV0**.

Message ranges and types can be adjusted with the **ATVn** and **ATXn** commands. The following messages are output if **ATX** is set to the **ATX4** setting:

Message		Meaning
Long (text)	**Numerical**	
OK	**0**	Most recent command was executed error-free.
CONNECT	**1**	Handshaking successful; data connection established.
RING	**2**	Incoming call detected; each ring is reported with "RING" until connection has been established or terminated.
NO CARRIER	**3**	No carrier frequency recognized; therefore, no connection could be established. This message also appears when an existing connection has been terminated.
ERROR	**4**	**Two possible causes:** 1. Most recent command could not be executed error-free. 2. Command line contains too many characters.
NO DIALTONE	**6**	No dial tone on telephone line detected. If **ATX0,1** is set, "NO CARRIER" or "3" is displayed.
BUSY	**7**	Busy signal detected; the dialed connection is busy. If **ATX0...2** is set, "NO CARRIER" or "3" is displayed. In Germany, "BUSY" is reported, even though "NO DIAL TONE" would be the correct message. This definition has been standardized according to CTR21.
NO ANSWER	**8**	No connection established until expiration of timeout as defined in S register 7.
DELAYED	**24**	Delayed dialing active. Wait 30s before trying to redial a connection that has just been busy.
FAX	**33**	FAX modem connection established.
DATA	**35**	Data modem connection established in facsimile mode.
CONNECT XXX		Connection successfully established. If **ATW0** is set, the RS232C baud rate is displayed in bps. If **ATW2** is set, the line speed is displayed in bps.
+FCERROR	+F4	Facsimile transmission at 2400bps or more is not possible.

If **ATW1** is set, the following messages are displayed:

Message		Meaning
Long (text)	**Numerical**	
+DR: ALT	66	Data compression as specified by MNP5 protocol
+DR: V42B	67	Data compression as specified by V.42bis protocol
+DR: NONE	69	No data compression
+ER: NONE	70	No error correction
+ER: LAPM	77	Error correction as specified by V.42 LAPM
+ER: ALT	80	Error correction as specified by MNP
+ER: ALT-CELLULAT	81	Error correction as specified by MNP10 with cellular power level adjustment

Modem messages controlled by the ATXn command

◆**NOTE**

Modem messages are only output if the modem has been set up with the appropriate ATXn command. In the following table, an "X" in the right-hand columns indicates the "n" value for the ATXn command that is used to enable message output. A number instead of an "X" indicates the message number (see left-hand column) that is output if the message was not enabled with ATXn.

Numerical (message number)	Long (text)	n =				
		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 DIAL TONE	3	3	X	X	X
7	BUSY	3	3	3	X	X
8	NO ANSWER	X	X	X	X	X
9	CONNECT 600	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

Numerical (message number)	Long (text)	n =				
		0	1	2	3	4
19	CONNECT 115200	1	X	X	X	X
22	CONNECT 75TX/1200RX	1	X	X	X	X
23	CONNECT 1200 TX/75RX	1	X	X	X	X
24	DELAYED	4	4	4	4	X
32	BLACKLISTED	4	4	4	4	X
33	FAX	X	X	X	X	X
35	DATA	X	X	X	X	X
39	+MRR: 75	X	X	X	X	X
40	+MRR: 300	X	X	X	X	X
42	+MRR: 600	X	X	X	X	X
44	+MRR: 1200/75	X	X	X	X	X
45	+MRR: 75/1200	X	X	X	X	X
46	+MRR: 1200	X	X	X	X	X
47	+MRR: 2400	X	X	X	X	X
48	+MRR: 4800	X	X	X	X	X
49	+MRR: 7200	X	X	X	X	X
50	+MRR: 9600	X	X	X	X	X
51	+MRR: 12000	X	X	X	X	X
52	+MRR: 14400	X	X	X	X	X
66	+DR: ALT	X	X	X	X	X
67	+DR: V42B	X	X	X	X	X
70	+ER: NONE	X	X	X	X	X
77	+ER: LAPM	X	X	X	X	X
+F4	+FCERROR	X	X	X	X	X

Abbreviations: +MRR = carrier; +DR = data compression; +ER = error correction protocol

Chapter 8

Glossary

8.1 Technical Terms

AM
Amplitude modulation. Technique used to transmit information via a radio carrier wave. AM works by varying the strength of the transmitted signal in relation to the information being sent. See also "FM."

Answer mode
Modem setting (S0 register=1) that triggers an automatic reply after a ring (RING). The modem receiving the call enters the answer mode. The calling modem enters the originate mode.

ARQ
Message stating that a connection with error correction has been established. Attached to the CONNECT message.

ASCII
American Standard Code for Information Interchange. During data transmission via modem, a predefined combination of 8 bits is used to represent individual characters. This standard is called ASCII. The ASCII table contains only 128 characters (letters, digits, special characters) and can also be represented by groups of 7 bits instead of 8 bits; the most significant bit is always 0. In the ASCII representation, this eighth bit is superfluous; however, it is generally transmitted, since the computer is processing the data internally on an 8-bit basis (i.e., using bytes). When your modem is in certain transmission modes, you can sometimes choose between 7-bit or 8-bit ASCII.

Asymmetrical
Modem with differing bandwidths for uploading and downloading. 56k modems are asymmetrical: their maximum download speed is 56k, compared to 28.8k or 33.6k for uploading. See also "Downstream" and "Upstream."

Asynchronous
Connection without transmission of a synchronizing frequency. The beginning and end of a word must be indicated by a start bit and a stop bit. Synonym: anisochronous. Antonym: synchronous.

AT commands
Standard for modem commands, enabling PCs or PLCs to operate a modem. All Hayes commands begin with the ASCII character AT (Abbreviation for: "Attention"). See also "Hayes."

Autobaud
Process by which a modem determines the speed, code level, and stop bits of incoming data by examining the first character. Synonym: automatic baud rate (ABR) detection.

Autoretrain
If two modems attempting a first connection are having trouble negotiating to find a common protocol, the transmission parameters are “retrained,” i.e. adjusted during the connection. See also "Retrain."

Baud rate
Transmission speed, defined as the number of symbol changes (i.e., signaling events) made to a transmission medium per second using a digitally modulated signal. The symbol rate is measured in baud (Bd) or symbols per second.

Blacklist
Used to block incoming calls from certain predefined telephone numbers.

Block size
Size of data blocks.

Break signal
Aborts the connection.

Btx
Bildschirmtext. An interactive online service launched in 1983 by the German postal service and maintained through 2001. Data was transmitted through the telephone network and the content displayed on a TV monitor. Btx technology was rendered obsolete by the Internet.

Busy
Busy signal. The remote modem cannot receive an incoming call because it is occupied with a different connection.

Callback function
Authentication procedure used to confirm the validity of incoming calls.

Carrier
Signal sent by modems to identify sender and receiver; the signal frequency is modulated (i.e., altered) to convey information.

CCITT
Comité Consultatif International Téléphonique et Télégraphique. Original name of the ITU-T, a United Nations agency, consisting of a public-private partnership, that issues international telecommunications standards. These standards are referred to as "Recommendations" and become mandatory only when ratified as part of a national law. The agency was renamed "ITU-T" in 1994. See also "ITU-T."

Checksum
After data transmission, checksum results for the transmitted data blocks are compared to determine whether transmission was carried out error-free.

CLIP decoder
Calling Line Identification Presentation decoder. The CLIP function enables modems receiving an incoming call to decode the caller's telephone number.

Coarse protection
Overvoltage protection type. Diverts voltage spikes caused by lightning, and limits residual voltage in electrical circuits.

Command mode
One of two modem operation modes. Commands can only be entered when the modem is in command mode – i.e., when it is turned on or reset, when it loses its connection to a remote modem, or when Escape characters (+++) are typed. [To transmit data, the modem must be in data mode.]

COM port
COM is the name of the serial port interface on IBM PC-compatible computers. It can refer not only to physical but also to virtual ports, such as ports created by Bluetooth or USB-to-serial adapters.

Compression
Compression reduces data volume. With most standards (e.g. V.42bis, MNP5) the most frequently occurring characters and character sequences are coded in short bit sequences, while the less frequent ones are coded in long bit sequences. This applies only to data that contains characters occurring at frequencies that vary at least slightly. Even in this case, however, the data is compressed two- or threefold. If data bytes are distributed almost evenly

(e.g., in the case of data that is already compressed), the compressed data becomes longer than the uncompressed data. This is detected by modern standards such as V.42bis, which then temporarily switch off compression, but not by MNP5. See also "Data compression."

CR
Carriage return. The "Return" character is named CR.

CTS
Clear To Send / Ready To Send. A V.24 interface signal.

Data block
A sequence of bytes or bits having a nominal length (a block size). Blocking facilitates data stream handling by the program receiving the data. See also "Data packet," which is not a synonym.

Data compression
The process of encoding information using fewer bits (or other information-bearing units) than an unencoded representation would use. Compression helps reduce the consumption of resources such as hard disk space or transmission bandwidth. See also "Compression."

Data mode
One of two modem operation modes: mode for sending and receiving data files. The modem is in data mode when a connection has been established with a remote modem, and the remote modem has sent a CONNECT response confirming the connection. User data may then be transmitted or received. Synonym: online mode.

Data packet
A formatted unit of data carried by a packet mode computer network. Computer communications links that do not support packets, such as traditional point-to-point telecommunications links, simply transmit data as a series of bytes, characters, or bits alone. When data is formatted into packets, the bitrate can better be shared among users than if the network were circuit-switched.

Datex-J
Data transmission service offered by the German Postal Service during the 1990s; rendered obsolete by the Internet.

dBm
Power ratio in decibels (dB) of the measured power referenced to 1 milliwatt (mW).

DCD
Data Carrier Detect. Signal for data transmission; a V.24 interface signal used to monitor line connection status. The DCD output (at the RS232C interface and at the 4-pin spring force plug as a 24V signal) is set when the modem has established a connection.

DCE
Data circuit terminating equipment, e.g. modems.

Dial tone
Tone indicating that PSTN or PBX is ready and that dialing can proceed.

Downstream
Direction of data transfer: server to client. See also "Upstream."

DSR
Data Set Ready. V.24 interface signal indicating the modem's power-up state.

DTE
Data terminal equipment, e.g. PCs, PLCs, or "dummy" terminals.

DTMF
Dual-tone multifrequency dialing. Synonym: tone dialing. Telephones using DTMF usually have 12 keys, each corresponding to a different set of standard frequencies. The FP Modem-56k can also send and receive DTMF tones. DTMF tones are also called "touch tones." See also "Pulse dialing."

DTR
Data Terminal Ready. Signal line for serial interfaces (RS232C). The DTE signals to the modem whether it is ready to send or receive data. See also "Handshake."

Dual-tone multifrequency dialing
See "DTMF."

Echo service
Generic IP network service (i.e., Internet protocol) that reads and writes back what is sent to it. Used for debugging TCP- and UDP-based network code such as event loops without disrupting the operation of existing services.

EDI
Electronic Data Interchange. The transfer of structured data, by agreed message standards, from one computer system to another without human intervention. EDI consists of a sequence of messages between two parties, either of whom may serve as originator or recipient. The formatted data representing the documents may be transmitted from originator to recipient via telecommunications, or physically transported on electronic storage media. EDI is currently still the data format used by most E-commerce transactions worldwide. EDI protocols include the Internet protocol suite (SMTP, HTTP, FTP, etc.).

EIA standards
Electronic Industries Alliance. An alliance of trade associations for electronics manufacturers in the U.S., accredited by the American National Standards Institute (ANSI) for the development of standards for electronic components, consumer electronics, telecommunications, and Internet security. These standards were formerly termed "RS-#"; the current designation is "EIA-#". See also "RS232C" and "RS485."

EPD
Escape prompt delay. Duration (in 1/50s) during which characters may not be entered before and after the Escape sequence.

Equalization
The use of passive or active electronic elements or digital algorithms for the purpose of altering the frequency response characteristics of a system. When the term is used with no qualifiers, it usually refers to amplitude equalization; however, any frequency-dependent response characteristic can be equalized. Equalization types include phase- and time-delay as well as spatial directivity equalization.

ETSI
European Telecommunications Standards Institute.

Fallback
Automatic reversion to a slower transmission speed in case of noisy lines.

Fine protection
Overvoltage protection type. Protects plugs and sockets connected to power lines that are not directly affected by lightning-induced voltage spikes; reduces residual voltages to levels that power lines can handle.

FM
Frequency modulation. Conveys information over a carrier wave by varying its frequency. See also "AM."

FSK
Frequency-shift keying. Frequency modulation scheme in which digital information is transmitted through frequency changes of a carrier wave.

Full duplex
Data transmission is executed in both directions simultaneously.

GSM
Global System for Mobile Communications (originally "Groupe Spécial Mobile"). Mobile phone standard used by an estimated 80% of the global market.

Half-duplex
Data transmission is executed in only one direction at a time; the direction is controlled by the modem. Synonym: semiduplex.

Handshake
Synchronization procedure for data sent at irregular intervals. The sender signals when it is ready to send new data, the receiver when it is ready to process incoming data. Handshaking is subdivided into hardware and software handshaking, depending on whether signaling is carried out via lines or characters. The hardware handshake is faster than the software handshake because it does not require a transfer of characters.

Hayes
Command language for modem operation. Originally developed for the Hayes corporation, it is also called the "AT command set," because all commands begin with "AT." This is a quasi-standard, i.e. it is not legally binding, but rather a command set that has been extended in various ways. Since this command set has become the de facto standard, its ITU-T counterpart (V.25) has been unable to achieve a comparable level of acceptance.

HyperTerminal
"Lite" version of HyperACCESS, a computer communications software that was initially designed to enable 8-bit Heath computers to communicate over a modem.

INF (.inf) file
Text file specifying the files required to install a specific piece of software or plug-in.

ITU-T
International Telecommunications Union of the European Telecommunications Administrations. New name since 1994 for CCITT (Comité Consultatif International Téléphonique et Télégraphique). The data transmission standards published by this committee apply to telephones (V standards), data networks (X standards), and ISDN (I standards). See also "CCITT."

K56flex
K56flex was a proprietary modem chipset that supported higher transmission speeds on ordinary phone lines (56kbps vs. the previous maximum of 33.6kbps).

Keybreak function
By pressing any key, the handshake phase can be terminated at the RS232C interface.

LAPM
Link Access Procedure for Modems. Part of the V.42 modem error correction protocol.

Leased line mode
A symmetrical telecommunications line connecting two locations. Unlike PSTN lines, it does not have a telephone number, each side of the line being permanently connected to the other. Leased lines can be used for telephone, data, or Internet services.

Line
Telephone line.

Line transmission speed
Transfer rate between two modems in bps. Also called "line speed."

Mark
A type of parity bit (i.e., error detection code). If the parity bit is present but not used, it may be referred to as mark parity (where the parity bit is always 1), or as space parity (where the bit is always 0).

MNP
Microcom Networking Protocol, a transmission protocol developed by the Microcom corporation. There are nine classes, some of which are partially upward compatible. Classes 1-4 are merely data transfer protocols; these are included in the V.42 standard. From MNP Class 5 on, data compression has been implemented (see "Compression"). The higher classes 6-9 are used relatively seldom.

MNP5
Automatic data compression protocol that includes the automatic error handling protocol MNP4. Adaptive data compression in real time, with an efficiency rate that varies between 75% and 200%. Microcom specifies 160% as a realistic value. Efficiency at 160% compression is at about 200%.

MNP10
Data flow optimization. This new variation on error correction ensures higher data flow rates during data transmission, provided the remote modem has the same protocol and that said protocol has also been enabled.

Modem
Device that transmits digital data via analog telephone lines. "Modem" stands for "MOdulator-DEModulator": Using predefined carrier frequencies, digital data originating from a DTE is modulated to an analog carrier, transmitted via the telecommunications network, and demodulated at the destination station. After reconversion into digital form, the data is made available to a PC or PLC. Modulation maximizes the data transmission volume possible within the frequency range defined by the transmission channel (telephone line). In this way, information can be exchanged without data loss. Remote data transmission between modems via telephone line is carried out according to ITU-T standards. This enables data exchange between units originating from different manufacturers, and ensures compatibility independently of the data source.

Modulation
The process of varying one waveform in relation to another waveform. In telecommunications, modulation is used to convey messages via telephone lines; to this end, data is converted from digital to analog form and then back again. Modulation techniques include amplitude modulation (AM), frequency modulation (FM, FSK), phase modulation (PM, PSK), and quadruple amplitude modulation (QAM).

Multidrop leased line mode
Synonym for: multipoint mode, multipoint dedicated line mode.

Multipoint mode
Abbreviation: MP. Enables operation of multiple modems on a two-wire private cable network.

Negotiate
At first connection, two modems automatically negotiate to find a common protocol (this process may be audible through the modem or PC loudspeakers). Some modem protocols allow the two modems to renegotiate ("retrain") if the initial choice of data rate is too high and yields too many transmission errors.

NVRAM
Nonvolatile random-access memory. Data content is saved when a computer is turned off or loses its external power source. Storage is implemented via backup battery power or by saving and restoring contents from an electrically erasable programmable ROM (EEPROM). Some modems use NVRAM to store preset or user-specified phone numbers and modem profiles.

OFF HOOK
As soon as a modem replies, it is in "Off Hook" state, i.e. the telephone line is occupied by the modem, and a connection to the telephone network has been established.

ON HOOK
As soon as a modem hangs up, the connection to the telephone line is terminated.

Operation mode
Two modem operation modes are available: (1) data mode for sending and receiving data, and (2) command mode for entering AT commands.

Originate mode
During online data transmission, the calling modem enters the originate mode, and the modem receiving the call enters the answer mode. See also "Answer mode."

Parity
Error detection code for asynchronous data transfer, consisting of an extra bit added to a byte or word as part of the transmission format. Sometimes omitted (no parity), or always one (mark), or zero (space). For even parity, the bit is set when the number of data bits is even. The same applies to odd parity with an odd number of bits.

PBX
Private branch exchange. Telephone exchange that serves a particular business or office, as opposed to one that a telephone company operates for many businesses or for the general public. See also "PSTN."

PCM
Pulse code modulation. Digital representation of an analog signal where the magnitude of the signal is sampled regularly at uniform intervals, then quantized to a series of symbols in a numeric (usually binary) code.

PC/RTS mode
Multipoint mode transmission option. In PC/RTS mode, the receive/send changeover is controlled by the connected DTE (i.e., PC or PLC) via an RTS handshake signal. First the RTS signal is activated; then data is sent to the modem.

Peer-to-peer connection
A peer-to-peer distributed network architecture is composed of participants that make a portion of their resources (such as network bandwidth) available directly to their peers without intermediary network hosts or servers. Peers are both suppliers and consumers of resources, in contrast to the traditional client-server model (where only servers supply, and clients consume).

Abbreviation: P2P. Note: Do not confuse with "point-to-point connection," which refers to a permanent link between two network endpoints.

PM
Phase modulation. A modulation type where data is represented as variations in the instantaneous phase of a carrier wave. Unlike frequency modulation (FM), PM has not gained widespread acceptance, because it requires relatively complex receiving hardware.

PnP
Plug-n-Play. An industry standard for add-on hardware specifying that it will configure itself, thus enabling users to connect peripheral devices without having to install drivers or modify user settings.

Point-to-point connection
A permanent link between two network endpoints.

PPP
Point-to-Point Protocol. A data link protocol commonly used to establish a direct connection between two networking nodes. Most Internet service providers (ISPs) use PPP for customer dial-up access to the Internet.

Protocol
Declaration specifying how signals are coded or decoded, or which data saving methods are used. Note that there is a difference between error correction and data saving protocols.

PSK
Phase-shift keying. A digital modulation scheme that transmits data by modulating (i.e., altering) the phase of a reference signal (i.e., the carrier wave) in order to represent the data signal.

PSTN
Public Switched Telephone Network (i.e., public telephone network). This is the worldwide voice telephone network, which uses two-wire cables.

Pulse dialing
In older telephone models, dialing triggered a series of impulses with a predefined pulse repetition rate. With the **ATDP** command, the modem controls this dialing procedure, which is still required by some telephone networks.

QAM
Quadrature-amplitude modulation. Modulation scheme (either digital or analog) that conveys two digital bit streams, or two analog message signals, by modulating the amplitudes of two carrier waves. These two waves are out of phase with each other by 90° (and are thus called quadrature carriers).

Remote data transmission
Data transmission using two data lines between two geographically remote DTE units. A DTE unit sends its data via an interface to a dial-up networking unit (modem). There, the data is processed and sent to the destination modem. The DTE unit adjusts the signals for the receiving station.

Retrain
If line quality deteriorates significantly during transmission, both modems agree to “retrain.” In this case, the line's transmission characteristics are analyzed again, and the parameters adjusted accordingly. See also "Autoretrain."

RI
Ring indicator. V.24 interface signal that indicates incoming calls.

Ring
Ringing that signals an incoming call.

RJ12-RJ12 cable
A registered jack (RJ) is a standardized physical network interface for connecting telecommunications, data equipment (commonly, a telephone jack), or computer networking equipment to a network service provider. Naming convention for RJ cables: "RJ"+<number>

RS232C
American EIA standard for serial interfaces. The V.24 standard defines functional features; the V.28 standard defines electrical features.

RS485
RS485 or EIA-485 enables the configuration of inexpensive local networks and multidrop communications links. It offers high data transmission speeds (35Mbps up to 10m and 100kbps at 1200m).

RS232C/RS485 baud rate
Transfer rate in bps at the serial interface between a DTE and modem. The RS232C/RS485 baud rate may exceed the line transmission speed because of the modem's compression capabilities.

RTS
Request To Send: Switch sender to ON; V.24 interface signal.

RxD
Receive Data.

S register
AT command settings are defined in the S registers.

Serial
Normally, only one data line is available for data transmission. Data is transferred serially, i.e. transmission is carried out bit by bit.

Space
A type of parity bit (i.e., error detection code). If the parity bit is present but not used, it may be referred to as space parity (where the bit is always 0) or mark parity (where the parity bit is always 1).

Star network
Network topology. In a LAN using star topology, each machine is connected point-to-point to a central hub.

Stop bit
Start/stop bits are signaling bits attached to a character before and after the character is transmitted during asynchronous transmission.

Synchronous
With synchronous transmission, the connected units emit signals that control the frequency of data transmission. See also "Asynchronous."

T.4
Compression standard (ITU-T) for fax machines (G3).

T.30
Fax transmission protocol with error correction (ITU-T). Describes initialization of calls, selection of transmission mode, data transmission, confirmation of receipt, and termination of calls.

TAE
Telephone jack. Socket system used by Deutsche Telekom (Germany's PSTN provider) since 1989. In Germany only the 6-pin version, TAE-6, is used. There are two TAE types: (1) TAE-N for devices such as modems, answering machines, or fax machines, and (2) TAE-F for telephones.

TBR15
Timed break recall. ETSI standard. Applies to leased line mode.

TBR21
Timed break recall. ETSI standard. Enables telephone equipment to connect to the European PSTN.

Terminating resistor
A terminator is placed at the end of a cable to prevent a radio frequency signal from being reflected back from the end, causing interference. Passive terminators consist of a simple resistor. Active terminators consist of a voltage regulator that keeps the voltage used for the terminating resistor(s) at a constant level.

Tone dialing
See "DTMF."

Transmission mode
Connection type. Without error correction: DIRECT mode, NORMAL mode. With error correction: RELIABLE mode.

Transparent mode
One of three multipoint mode variants available for sending data. As with multipoint PLC mode, the modem buffers all data received by the RS232C/RS485 interface.

TxD
Transmit Data.

Upstream
Direction of data transfer: client to server. See also "Downstream."

V standards
ITU-T data transmission standards.

V.17
Fax transmission standard (G3) used at 14400bps (2400baud). Half-duplex transmission reduces the transmission rate to 7200bps.

V.21
Modulation standard used at 300bps.

V.22
Modulation standard used at 1200bps.

V.22bis
Modulation standard used at max. 2400bps.

V.23
Modulation standard used at 75/1200bps half-duplex, i.e. with the send channel at 1200bps and the receive channel at only 75bps. Used especially for T-Online (classic) or Datex-J/Btx telephone exchange.

V.24
In combination with V.28, this CCITT standard defines the electrical characteristics of serial

data transmission and the functional characteristics (e.g. pin assignment) of serial interfaces. Corresponds to the U.S.-American RS232C standard for serial interfaces (as specified by ITU-T), and is the equivalent of DIN 66020. In its entirety, this standard is highly complex; it is therefore usually implemented only in part. Typical signals defined by this standard are RTS, CTS, DSR, DTR, RD, TD, DCD, and RI.

V.25bis
Standard for modem commands (CCITT) enabling PCs to define modem operation. Has not gained a level of acceptance comparable to that of the Hayes standard.

V.27ter
Modulation standard for fax operation at 2400bps (1200Bd) and 4800bps (1600Bd).

V.28
Level standardization on V.24 as specified by ITU-T. The level ranges from -12V to -3V and +3V to 12V.

V.29
Fax transmission standard (leased line) used at 7200bps and 9600bps.

V.32
Modulation standard used at max. 9600bps. Half-duplex transmission results in 4800bps.

V.32bis
Modulation standard used at max. 14400bps. Half-duplex transmission results in 4800bps.

V.34
Modulation standard used at 28800bps.

V.34+
Modulation standard used at 33600bps. See also "V.34."

V.42
Error correction protocol according to the ITU-T standard.

V.42bis
Data compression according to ITU-T, also containing the V.42 Link Access Procedure for Modems (LAPM) declaration for error correction. In fallback mode, MNP2-4 is enabled, if necessary.

V.90
Modulation standard used for 56kbps channels for downloading files, i.e. only unidirectional. V.90 combines the x2 and K56flex techniques. A spectral deformation method by Motorola and the coding methods of 3COM U.S. Robotics are used.

V.92
V.92 is an ITU-T recommendation entitled "Enhancements to Recommendation V.90" that establishes a modem standard allowing 48kbps PCM upload, at the expense of download rates. For example a 48kbps upstream rate would reduce the downstream as low as 40kbps, due to echo on the telephone line.

XOFF
Control character (<Ctrl>+<S>) used in software handshaking. Signals that data cannot be received (buffer full).

XON
Control character (<Ctrl>+<Q>) used in software handshaking. Signals that data can be received.

Index

E

F

G

H

I

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Record of Changes

Manual No.	Date	Description of Changes
ACGM0144V10EN	October 2009	First Edition
ACGM0144V2EN	February 2010	Second Edition

North America | **Europe** | **Asia Pacific** | **China** | **Japan**

Panasonic Electric Works Global Sales Companies

Europe

▶ **Headquarters**	**Panasonic Electric Works Europe AG**	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49 (0) 8024 648-0, Fax +49 (0) 8024 648-111, www.panasonic-electric-works.com
▶ **Austria**	**Panasonic Electric Works Austria GmbH**	Rep. of PEWDE, Josef Madersperger Str. 2, 2362 Biedermannsdorf, Tel. +43 (0) 2236-26846, Fax +43 (0) 2236-46133, www.panasonic-electric-works.at
	PEW Electronic Materials Europe GmbH	Ennshafenstraße 30, 4470 Enns, Tel. +43 (0) 7223 883, Fax +43 (0) 7223 88333, www.panasonic-electronic-materials.com
▶ **Benelux**	**Panasonic Electric Works Sales Western Europe B.V.**	De Rijn 4, (Postbus 211), 5684 PJ Best, (5680 AE Best), Netherlands, Tel. +31 (0) 499 372727, Fax +31 (0) 499 372185, www.panasonic-electric-works.nl
▶ **Czech Republic**	**Panasonic Electric Works Czech s.r.o.**	Prumtyslová 1, 34815 Planá, Tel. (+420-)374799990, Fax (+420-)374799999, www.panasonic-electric-works.cz
▶ **France**	**Panasonic Electric Works Sales Western Europe B.V.**	Succursale française, 10, rue des petits ruisseaux, 91371 Verrières le Buisson, Tél. +33 (0) 1 6013 5757, Fax +33 (0) 1 6013 5758, www.panasonic-electric-works.fr
▶ **Germany**	**Panasonic Electric Works Deutschland GmbH**	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. +49 (0) 8024 648-0, Fax +49 (0) 8024 648-555, www.panasonic-electric-works.de
▶ **Hungary**	**Panasonic Electric Works Europe AG**	Magyarországi Közvetlen Kereskedelmi Képviselet, 1117 Budapest, Neumann János u. 1., Tel. +36(0)1482 9258, Fax +36 (0) 1482 9259, www.panasonic-electric-works.hu
▶ **Ireland**	**Panasonic Electric Works UK Ltd.**	Dublin, Tel. +353 (0) 14600969, Fax +353 (0) 14601131, www.panasonic-electric-works.co.uk
▶ **Italy**	**Panasonic Electric Works Italia s.r.l.**	Via del Commercio 3-5 (Z.I. Ferlina), 37012 Bussolengo (VR), Tel. +39 (0) 456752711, Fax +39 (0) 456700444, www.panasonic-electric-works.it
▶ **Nordic Countries**	**Panasonic Electric Works Nordic AB**	Sjöängsvägen 10, 19272 Sollentuna, Sweden, Tel. +46 859476680, Fax +46 859476690, www.panasonic-electric-works.se
	PEW Fire & Security Technology Europe AB	Jungmansgatan 12, 21119 Malmö, Tel. +46 40697-7000, Fax +46 40697-7099, www.panasonic-fire-security.com
▶ **Poland**	**Panasonic Electric Works Polska sp. z o.o.**	Al. Krakowska 4/6, 02-284 Warszawa, Tel. +48 (0) 22 338-11-33, Fax +48 (0) 22 338-12-00, www.panasonic-electric-works.pl
▶ **Portugal**	**Panasonic Electric Works España S.A.**	Portuguese Branch Office, Avda Adelino Amaro da Costa 728 R/C J, 2750-277 Cascais, Tel. +351 214812520, Fax +351 214812529
▶ **Spain**	**Panasonic Electric Works España S.A.**	Barajas Park, San Severo 20, 28042 Madrid, Tel. +34 913293875, Fax +34 913292976, www.panasonic-electric-works.es
▶ **Switzerland**	**Panasonic Electric Works Schweiz AG**	Grundstrasse 8, 6343 Rotkreuz, Tel. +41 (0) 417997050, Fax +41 (0) 417997055, www.panasonic-electric-works.ch
▶ **United Kingdom**	**Panasonic Electric Works UK Ltd.**	Sunrise Parkway, Linford Wood, Milton Keynes, MK14 6LF, Tel. +44(0) 1908 231555, +44(0) 1908 231599, www.panasonic-electric-works.co.uk

North & South America

▶ **USA**	**PEW Corporation of America**	629 Central Avenue, New Providence, N.J. 07974, Tel. +1-908-464-3550, Fax +1-908-464-8513, www.pewa.panasonic.com

Asia Pacific / China / Japan

▶ **China**	**Panasonic Electric Works (China) Co., Ltd.**	Level 2, Tower W3, The Tower Oriental Plaza, No. 2, East Chang An Ave., Dong Cheng District, Beijing 100738, Tel. (010) 5925-5988, Fax (010) 5925-5973, www.pewc.panasonic.cn
▶ **Hong Kong**	**Panasonic Electric Works (Hong Kong) Co., Ltd.**	RM1205-9, 12/F, Tower 2, The Gateway, 25 Canton Road, Tsimshatsui, Kowloon, Hong Kong, Tel. (8520) 2956-3118, Fax (0852) 2956-0398
▶ **Japan**	**Panasonic Electric Works Co., Ltd.**	1048 Kadoma, Kadoma-shi, Osaka 571-8686, Japan, Tel. (06)-6908-1050, Fax (06)-6908-5781 http://panasonic-electric-works.net
▶ **Singapore**	**Panasonic Electric Works Asia Pacific Pte. Ltd.**	101 Thomson Road, #25-03/05, United Square, Singapore 307591, Tel. (06255)-5473, Fax (06253)-5689

ACGM0144V2EN 2/2010