NAiS

FP SERIES Telecontrol Manual GSM

Matsushita Electric Works (Europe) AG

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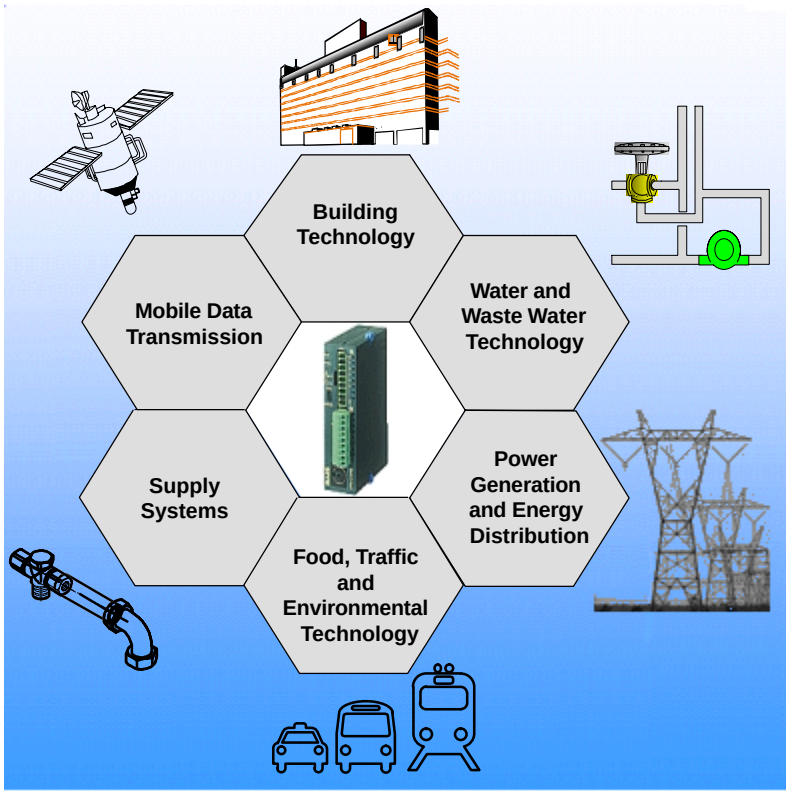
NAiS

FP SERIES Telecontrol Manual

PLC – GSM Communication



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Important Symbols

The following symbols are used in this manual:

Note

Contains important additional information or indicates that you should proceed with caution.

Example:

Contains an illustrative example of the previous text section.

next page

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

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1.1 GSM Data Communication

The **G**lobal **S**ystem for **M**obile Communication is a European mobile telephone network that allows access between national networks. Nevertheless, the system is not yet available everywhere, e.g. in Eastern Europe. Moreover, accessing foreign networks has to be cleared by some network operators.

When establishing a connection via GSM, for example when using the function blocks M_CG_connect and M_CG_slave in Matsushita's GSM library, the following combinations are possible:

- Connection GSM to GSM.
- Connection GSM to ISDN.
- Connection GSM to modem (analog).

In this chapter, the Siemens GSM M20 module will largely be used to explain concepts and examples.

1.1.1 GSM to GSM

Although establishing the connection and communicating with the help of the transceiver module M20 is principally no problem from a technical point of view, some features do need your attention. For example, in the GSM network, the M20 user has to register and be cleared for data communication with the network operator, e.g. the GSM network provider. You then receive a second number for data communication. When the M20 is called by another station, only this number can be reached.

1.1.2 GSM to ISDN

For communication with ISDN terminals, especially FP–ISDN 64K from Matsushita, the setting ATF64 is necessary. Only with this fixed transmission rate of 9600 baud is a data connection possible!

In addition, activating the RLP safeguard is recommended. Ask your GSM service provider for details.

1.1.3 Types of Radio Communication Error Handling Protocol

If your provider differentiates between transparent and non–transparent data communication, choose non–transparent. For more information, ☛ section 1.2.

1.2 Radio Link Protocol

When applying for approval of data transmission, you can choose between connections with or without **R**adio **L**ink **P**rotocol (RLP) fail–safe protocol. Normally, non–transparent data connections are enabled, i.e. with RLP fail–safe protocol. In conjunction with telecontrol and PLC applications, using a 'non–transparent' data connection is recommended. But it must be possible to change the timeout values (maximum time waiting for an answer of the remote station) of the communication software.

The RLP is a fail–safe protocol that protects data transfer in transit, i.e. between the mobile telephone device (M20) and the base station (the network's next radio station).

These base stations are produced by various manufacturers and may have implemented various RLP versions. The M20, however, only works with the most recent RLP version. Thus, it is possible that the M20 will not be able to establish a non–transparent RLP connection to an older base station (error message 'NO CARRIER'). One possibility to deal with such problems is to ask for a second number for transparent data transmission when applying for data transmission approval. Thus the transparent data phone number, which functions without RLP, can be used when there are RLP problems.

However, recognize that when no fail–safe protocol is used, undesired or false data can be received by the computer or PLC, which should be detected by an appropriate error check (CRC, Check sum...).

With some providers it is possible to switch off the RLP fail–safe protocol with the command AT+CBST and thus switch a non–transparent connection to transparent mode without needing a second telephone number. However, with a transparent telephone number, the RLP can never be activated.

An IWF (Inter Working Function or Unit) is integrated into the base station. The IWF regulates the GSM data connection to analog modems and ISDN terminals. If RLP is used in the transmission, then the IWF also has a fail–safe connection in the telephone network (analog or ISDN). If this is not possible, (reliable mode or fail–safe protocol is turned off with the modem or ISDN adapter), then no connection can be established!

With a transparent radio connection, the IWF also forces a normal data connection (without fail–safe protocol) via the telephone network.

During an RLP connection, the data is stored intermittently at the base station. When the connection is ended, all data at the base station that has not been delivered is deleted! Therefore, you should wait for an answer from the remote station (e.g. with MEWTOCOL) before ending the connection.

By using fail–safe RLP connections, considerable delays can occur because of the intermittent storage and the error–handling procedure. This must be considered in the appropriate timeouts of the user software (☛ section 2.4.5).

With data connections from one mobile station to another, various radio connections can be used, i.e. one M20 can communicate with its base station using RLP while the other M20 does not.

The M20 is pre–configured to establish a non–transparent connection to the base station. In order to turn off the RLP, use the command AT+CBST=7,0,0 (or for ISDN AT+CBST=71,0,0). The factory setting (with RLP) can be restored by using AT+CBST=7,0,1.

Voice telephony and SMS messages are not effected by the problems concerning RLP and IWF.

1.3 SIM Card and Provider

Since the GSM network offers so many different services and functionality, it makes sense to ask for the Hotline or service number of your provider after signing a contract for an SIM card. In Germany the numbers are:

- D1: 0130/0171
- D2: 0172/1212

An overview of the individual providers' GSM services in the various countries can found at the following website:

http://www.gsmworld.com/gsminfo/gsminfo.htm

The heading there states: "... GSM Info Online provides detailed information about GSM network operators worldwide. Details include network, roaming, services and coverage information for over 300 operators in 133 countries/areas of the world. The information found within GSM Info Online is supplied by and approved by the GSM Association and its members."

Nearly all standard SIM cards that are currently offered for voice telephony are also enabled for SMS reception and transmission. Thus you do not need to have it enabled if you are only going to send and receive SMS messages.

Various providers (e.g. D2 in Germany) allow data transmission from an M20 with the normal SIM card for voice telephony without having to apply for it extra.

Most GSM providers now provide the possibility of sending SMS messages to a fax machine or an email address. These SMS messages have to be sent from a mobile telephone device (M20). For examples see below.

No other approvals or fees are necessary. The SMS center calculates a supplementary fee for each SMS message that is rerouted.

There are some providers that offer prepaid cards. These SIM cards have no monthly fee and you can remotely add a desired amount to your balance. (The SIM card need not be removed from the machine.) Unfortunately, there are only a few providers that also permit SMS messages with such prepaid cards. In Switzerland, for example, there are such prepaid cards.

There are also data–only cards that permit data and SMS transmission, but that are not enabled for voice telephony. These cards have the advantage of being able to turn off the PIN inquiry, so that if they are lost or stolen, one need not fear excessive losses (due to cellular telephone calls).

In order to carry out tests with various national GSM providers with only one SIM card contract, a contract had to be signed with a foreign provider. Thereby the roaming behavior of the M20 could be tested.

Various GSM providers also provide a second SIM card with identical parameters and phone numbers, usually free of change or with a nominal, one–time fee. This service is often called TwinCard. However, only one card can be logged on at a time. The card already logged on will be logged out automatically. The advantage here is that if one SIM card is defective, you can continue to work with the replacement card. This second card is also handy if you use both the M20 and a cellular phone. You also need not constantly remove the SIM card from one device and put it in the other during the test phase, which is better for the card, the card holder and your nerves.

In contrast to analog modems, only one data–transmission speed is possible (usually 9600bps) per GSM data telephone number. When applying for data transmission approval, it is possible to arrange for additional phone numbers for data–transmission speeds of 2400bps or 4800bps. Usually this service is free. Data–transmission speeds of less than 9600bps may possibly improve transmission security for critical radio connections.

It also makes sense to enable two different GSM data phone numbers, one for non–transparent and one for transparent mode. See also the next section.

1.4 GSM Standards

For more information, the following ETSI publications are recommended:

- GSM 03.40
  Digital cellular telecommunications system (Phase 2+)
  Technical realization of the Short Message Service (SMS)
  Point–to–Point (PP)

- GSM 03.41
  Digital cellular telecommunications system (Phase 2+)
  Technical realization of the Short Message Service Cell Broadcast (SMSCB)

- GSM 04.22
  Radio Link Protocol (RLP) for data and telematic services on the Mobile Station – Base Station System (MS – BSS) interface and the Base Station System – Mobile–services Switching Centre (BSS – MSC) interface.

- GSM 07.05
  Digital cellular telecommunications system (Phase 2+)
  Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE – DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)

- GSM 07.07
  Digital cellular telecommunications system (Phase 2)
  AT command set for GSM Mobile Equipment (ME)

These documents can be obtained directly from ETSI or downloaded from the internet. The address is:

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Tel.: +33 4 92 94 42 41
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Internet: http://www.etsi.org/eds/
http://webapp.etsi.fr/publicationssearch/

Chapter 2

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2.1 The Siemens M20 Terminal

The M20 terminal is a GSM900 phase–II speech, data, FAX Gr. 3 and SMS terminal. It unifies the functionality of a cellular phone and a modem. Remote control via GSM is easily achievable when the M20 is combined with a PLC from Matsushita.

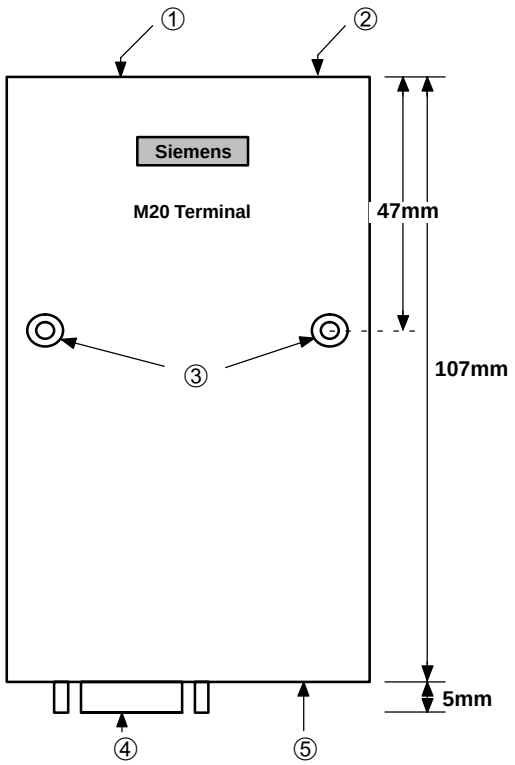
The M20 can be connected to the available 24V DC power supply or powered by a 12V DC power supply. An LED in robust plastic housing indicates the operational status of the terminal. The M20 can be mounted from above or below with 2 screws.

Matsushita Electric Works (Europe) AG offers an MEW GSM Library, M–CG–LIB (Product number: NCL–CG–LIB), for NAiS Control FPWIN Pro and FP series PLCs.

Note

Matsushita does not provide technical support for any other GSM module than the M20.

2.1.1 Parts and Dimensions



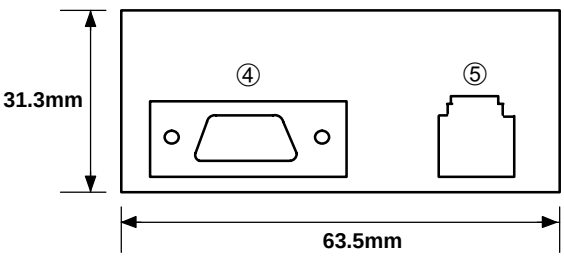
① 4–pin Western connector

② antenna

③ sunken screw holes

④ 9–pin Sub–D socket

⑤ 6–pin Western connector



2.1.2 Technical Data M20

Item		Description
Supported GSM Service		TS11 Speech (Full Rate & Enhanced Full Rate / DTMF)
		TS12 Emergency call
		TS21 SMS Mobile Originated (SMS MO) Text Mode und PDU Mode
		TS22 SMS Mobile Terminated (SMS MT)
		TS23 SMS Cell Broadcast
		TS62 FAX Group 3
Transmission speeds		BS24/25/26 2400, 4800, 9600, 14400bit/sec
Transmission modes		transparent / non–transparent V.42bis data compression
Connections		Single input voltage (8 to 28.8V DC) via 6–pin Western connector
		V.24/V.28 interface on the 9–pin Sub–D socket
		FME–Antenna connection
		Integrated mini–SIM–card reader (☛ note)
		Studio Audio interface (600Ohm) on a 6–pin Western connector
		Operational status via LED (no voltage, device ready, device is logged into GSM network)
		Ignition wire on a 6–pin Western connector: to protect the chip card
		Receiver audio interface on 4–pin Western connector
		Instruction set according to AT–Hayes, GSM07.07 and GSM07.05
Dimensions		107 x 63.5 x 31.3mm (W x L x H)
Weight		145g
Current consumption		**Speech mode** **Idle mode**
	at 12V	<200mA <45mA
	at 24V	<100mA <35mA
Temperature range		–20°C to +55°C

☛ Note

3V SIM cards, i.e. old chip cards, do not work.

2.1.3 Hardware Information and History

Since mid–1999 a new hardware version of the M20 terminal has been available. The following things were adapted or changed:

- The internal SMD fuse was improved so that the M20 terminal has now been approved for a voltage supply of 8 to 28V DC (100mA / 24V DC).
- Reverse battery protection was integrated.

- The pins that have to be bridged for a firmware download lead through a connector.
- The reset input also leads through a connector (function similar to Powerup).
- The lower identification plate with the heading M20 Terminal was also brought up to date:
  - The mark L5 can be found after the long product number (old hardware L1).
  - In the cell 'Supply Voltage' one finds 8 – 28V= (old hardware 8 – 15V=).

In order to safely operate the old hardware with the identification mark L1 at 24V DC (max. 30V DC), Siemens recommends integrating a 1–ohm resistor into the plus line. The reason why the old M20 terminal hardware was only certified for 15V DC was that the internal SMD fuse was of somewhat limited dimension. A large power surge that might have resulted from turning it on could have blown the fuse.

The following reference values apply to the dimensions of the power supply unit for the M20 terminal:

- Normal average: 100mA at 24V DC
- During transmission operation, a rise in current up to approx. 500mA at 24V DC
- Peak loads up to 2A (at 24V DC) should be able to be checked (Elko) so that the M20 does not log out.

The M20 terminal's SIM card holder (Molex type) has a CCIN switch. As a result, the SIM card cannot be damaged like it was with the M1. Nevertheless, the SIM card should not be removed when the power is on.

The 'Ignition' impulse is not only necessary then the M20 should be able to be shut off via command AT+SMSO (low power). Moreover, the 'Ignition' input can be permanently set to plus. The 'Ignition' function has nothing to do with the SIM card.

Because of the unusual power supply connector, sometimes it is a good idea to buy a finished cable. The company GAP AG, for example sells a power supply cable for approx. 15DM and a complete network for approx. 90DM (prices for individual orders).

Handshake lines for the M20 terminal are not necessary when operating it with a PLC. You can bridge these directly on the 9–pin Sub–D connector of the M20 terminal (7–8; 1–4–6), or better yet, turn off the handshake lines of the M20 terminal using the command AT+IFC=0,0. Apparently there are still unresolved problems with the LED when the handshake lines are bridged.

For voice transmissions, a standard handset from Siemens can be used. These handsets are also used for 'Hicom' and 'Gigaset'. They can be ordered from Siemens using product number HB8.7.1.

The command ATD1234567i; (via RS232C or terminal) can be used to dial, and the command ATH to hang up.

In the meantime there are tertiary companies that assemble the M20 with its own base plate in a special housing. For example, the companies "OPC" and "InSys" offer GSM modules with top–hat rail mounting and terminal screws for industrial applications.

2.1.4 M20 Manual

An up–to–date manual (.PDF file) can be obtained from the M20 distributor. This manual refers to the M20 firmware with version number 1.03. A complete update of the manual that corresponds to the current firmware version 2.3 is not yet available. The current manual was expanded with the release notes of each firmware update:

- Release Notes V2.0.doc 62kB
- Release Notes V2.3.doc 95kB

☞ Note

The manual describes an old software that is no longer used to download a new firmware onto the M20. The description of the new firmware version's downloading procedure (beginning with version 2.0) can be found in the accompanying firmware update archive.

The current manual (English or German) and the most recent firmware version can be downloaded from the following internet websites:

http://www.siemens.at/ce_hotline/en/index.htm
http://www.siemens.de/ic/products/cd/english/index/products/cellular/index.html
http://www.gapag.de/ehome.htm
http://www.komsa.de/de/download/welcome.htm

A free SMS administration software called SMSplus that supports the M20 (and the Falcom A2) is offered by KomSa (☛ internet address above).

2.1.5 Software Information and AT Commands

For new users, the following offers an overview of the most important AT commands for using the M20. The parameters of the individual commands can be found in the manual. It is recommended that you familiarize yourself with the following commands:

Configuration	
Command	**Meaning**
AT&F	Factory setting
AT&V	List of the current settings
AT&W	Store settings for the next powerup
ATE	RS232C echo on / off
ATV	RS232C answers in text format or as numbers

Establishing the connection	
Command	**Meaning**
ATD	Dial remote station
ATA	Accept incoming call
ATS0=	Automatic call receive on / off
+++	From online data mode to command mode
ATH	End data connection

GSM network	
Command	**Meaning**
AT+CPIN	PIN status report and PIN code entry
AT+CREG	Inquiry if logged into the network
AT+CSQ	Inquiry into radio signal strength / reception quality
AT+CBST	RLP fail–safe protocol (transparent) on / off

SMS configuration	
Command	**Meaning**
AT+CMGF	Select SMS PDU or text mode
AT+CSCA	Enter SMS Service Center Number
AT+CNMI	Store incoming SMS on SIM card or signal via RS232C

SMS send / receive / register	
Command	**Meaning**
AT + CMGS	Send SMS message
AT +CMGL	List SMS messages received
AT +CMGR	Read SMS message (stored on SIM card)
AT +CMGD	Delete SMS message on SIM card

Expanded error messages and diagnostic possibilities are made possible with the commands: AT+CMEE=2 AT+MONI AT+MONP
See manual.

To test the reception quality, the command AT+CSQ? can be used. The indications of the signal strength can be roughly divided thus:

Values	Meaning
5 to 7	Data communication borderline
10 to 12	Data communication should proceed without trouble
over 12	Reception very good. Trouble–free data connection

With the command AT+CRC=1 the RING message is replaced by another identification signal when a call comes in:

- +CRING: VOICE For a voice call
- +CRING: REL ASYNC For a data call
- +CRING: FAX For a fax call

Error 500 ’unknown error’ can result from the following:

- The M20 is not yet registered in the GSM network (enter PIN to log in; wait)
- The SIM card has not yet been read completely (check SIM card; wait)
- The format of the number called is incorrect (Compare with example +491705717543)
- In the SMS PDU mode, the syntax was not adhered to (see PDU encoding in manual)
- The SMS text parameters are incorrect. (Set previous setting with AT+CSMP=17,167,0,0)

Error 513 indicates that there are unread data records on the SIM card.

The description of error 512 in the manual is incorrect. The reason for 512 is that the SIM card cannot be accessed, the SIM card is full or has not been completely read, or that another process is accessing the SIM card at the same time (telephone book administration). It is recommended not to store SMS received on the SIM card (in the manual, see command AT+CNMI=2,2).

2.1.6 The M20 and ISDN Communication

Communication between an ISDN terminal adapter and the M20 must employ V.110 protocol. The connection between the ISDN telephone network and the GSM network is realized with the IWF (Inter Working Function or Unit) in the radio base station. In addition, the IWF adapts the bit rate according to the standard V.110, i.e. the ISDN data transmission rate of 64kbps is adapted to the GSM data transmission rate of 9600bps and vice–versa.

The M20 provides the user with two possibilities of establishing a V.110 connection:

1. Switch the M20 to the V.110 mode with the command
   AT+CBST=71,0,1
   Dial the ISDN terminal with the standard command ATDxxxxx
2. Leave the M20's factory setting of the CBST command as is (CBST07,0,1)
   Use the modified dial command ATDIxxxxxx to dial the ISDN terminal adapter.

Fail–safe connections via ISDN are possible, independent of V.110. For more information on RLP, ☛ section 1.2.

2.1.7 Further Information and Support

Siemens mentions a support CD that can be obtained from the company GAP for a nominal cost. This CD contains mainly (along with the M20 manual) setups for a special terminal program. You should also be able to obtain most files from Siemens via the internet.

The following internet sites offer M20 support:

http://www.siemens.at/ce_hotline/en/index.htm
http://www.siemens.at/ce_hotline/dt/technik/index.htm
http://www.siemens.at/ce_hotline/en/index.htm
http://www.siemens.de/ic/products/cd/english/index/products/cellular/index.html
http://www.gapag.de/ehome.htm
http://www.komsa.de/de/download/welcome.htm
http://www.gsmworld.com/gsminfo/gsminfo.htm

Naturally, MEW will help you configure the M20, too.

2.2 First Steps with the M20 GSM Module

The M20–Terminal (Siemens GSM Module) can be set up to simulate a standard telephone modem. After the M20 is configured in the following way, it can be used like a normal modem to transfer data. The M20 will accept the standard ATD dial commands and will prompt with the standard connect messages.

Following general conditions must be fulfilled.

- The 'GSM–data' service must have been enabled by the network service provider.
- It is recommend to use the 'non–transparent' GSM–data mode (if provided by the network). The GSM–data 'transparent' mode can also be used.
- The remote station can be a second M20, an analog modem or an ISDN terminal adapter.
- For the setup it is recommend to use Terminal.Exe from Windows 3.1 (☛ note) and the setup file M20_1.TRM (function key definition).
- This description was developed using the M20 firmware revision 2.0 or 2.3. The M20 firmware revision can be displayed with the command ATI.

☛ **Note**

You can download the shareware Terminal.exe from the Microsoft website. Or, using Hyperterminal.exe for Windows '95 or later, carry out the steps in a similar, logical manner.

2.2.1 Connections, Cables and Other Hardware

A 1:1 cable can be used to connect the RS232C port of the M20–Terminal to the 9–pin connector of the computer.

A standard 9/25–pin converter can be used if the computer uses a 25–pin connector.

Also RS232C cables without handshake lines (only three wires) are acceptable because the M20 will be set up in the following sections to not use handshake lines. But on the computer end the handshake inputs should be shortened: connect pin 7 to 8 on a 9 pin connector or pin 4 to 5 on a 25 pin connector.

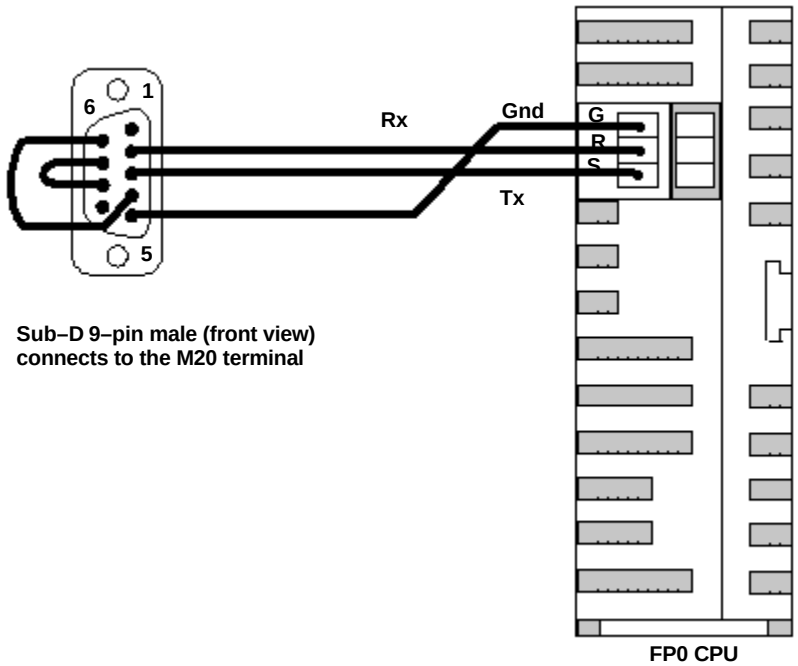
Please see the M20 manual on how to connect the supply voltage to it! A mini Western JR11 connector is used:

- Pin 6 goes to ground (–)
- Pin 1 and 4 go to the positive (+) supply, which should be in the range of 8 to 15V DC

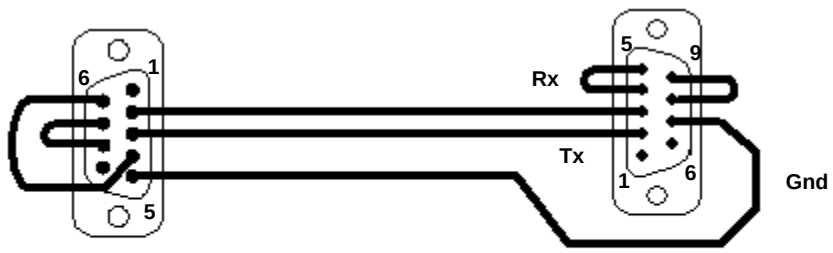
Notes

- **Never insert or remove the SIM card while power is supplied to the M20 because important data could be lost.**
- **Do not forget to connect the antenna to the M20.**

2.2.2 RS232 Cable: M20 Terminal – FP0 COM Port



2.2.3 RS232 Cable: M20 Terminal – FP1, FP10SH COM Port



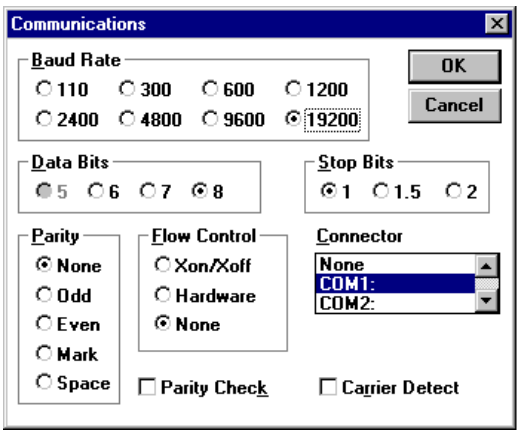
2.2.4 Finding the RS232C Baud Rate for the M20

The M20 has no automatic baud rate detection for the RS232C port! The RS232C baud rate and data format of the M20 can only be changed by using the AT+ICF and AT+IFC commands. Of course the M20 can understand these commands, but only if you know the current M20 baud rate setting.

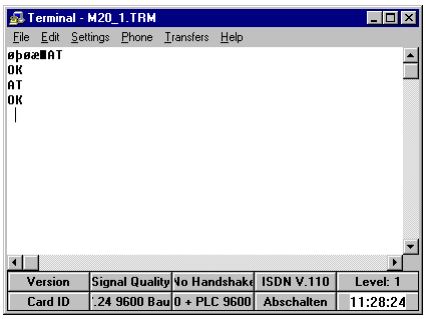
With a new M20 or after a factory reset, the M20 RS232C port is set to 19200 baud and 8N1 (8 data, none parity and one stop bit).

If the current baud rate setting is not known, then the only possibility to find it out is by trying different settings. To find out this, carry out the following steps:

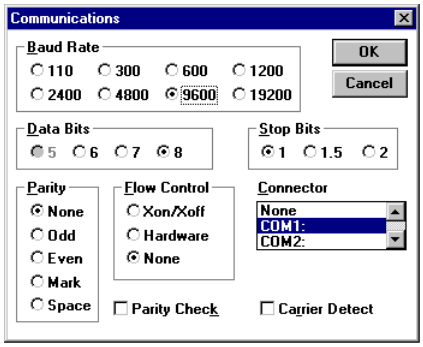
1. **Start Terminal.Exe, click on menu point ”Settings” and open ”Communications...”, select 19200 8N1 (8 data, none parity and one stop bit)**



2. **Enter the AT command (AT plus the Enter or Return button) multiple times to check if the M20 is responding. If the M20 answers with OK or 0 then you have found the current baud rate of the M20.**



3. **Try a different setting if the M20 does not answer or only strange characters are seen on the terminal screen. Repeat the test after setting the terminal to 9600 8N1 or 9600 7O1 (7 data, odd parity, 1 stop). Continue with the next step when the M20 responds with OK or 0 (zero).**



Once the current baud rate of the M20 is known, the AT&F command can be entered to reset the M20 to the factory setting. This is the basis for the following set–up procedure.

1. AT&F
   Reset the M20 to factory default (and to use 19200 8N1)
2. Now set the terminal to 19200 bps and 8N1
3. AT+CLCK=”SC”,0,”xxxx”
   Switch off the PIN entry (xxxx is the PIN ID) on power–up.

Note

Your SIM card is now unprotected!

4. AT+IFC=0,0
   Do not use RS232C handshake lines.
5. [AT+CBST=7,0,1]
   Use this command only to switch off the RLP if a ’non–transparent’ is not working! For additional information on RLP, ☛ section 1.2.
6. [AT+CBST=71,0,1]
   Set the M20 to V.110 mode. Use this command only if the remote end is using a ISDN terminal adapter!
7. AT+IPR=9600
   Fix the RS232C to 9600 bps.
8. Now set the terminal to 9600 bps and 8N1
9. ATS0=1
   Set the M20 to auto answer mode only if the M20 should automatically answer all incoming calls.
10. ATE0V0
    Set the M20 to not echo back and respond with numbers only if the M20 is later connected to a PLC.

11. AT&W
    Save all the above settings in a user profile for the next power–up.
12. ATZ
    Restart the M20 to activate all the above settings.

2.2.5 Equipment Setup at the Remote Site

If an analog modem is used it should be initialized by using a terminal program so that it uses ’Error correction’ protocol (reliable mode).

If an ISDN terminal adapter is used it should be initialized (by the use of a terminal program) to work with the V.110 standard.

If the FP–ISDN 64k from Matsushita is used, it should be initialized with the terminal set to 9600 baud and 8N1 using the following commands:

1. AT&F3F64
   Factory reset (disabling the handshake lines). Use V.110 only.
2. ATE0V0
   Set the FP–ISDN to not echo back and respond with numbers only if the FP–ISDN is later connected to a PLC.
3. ATS0=1&W
   Auto answer. Save all the above settings in user profile 0 for the next power–up.
4. ATZ
   Restart the FP–ISDN to activate the above settings.

If an M20 is also used at the remote end, it should be set up in the same way as described above for the first M20.

2.2.6 Dial–Up Test / Signal Quality / Standard Dial Commands

With the above setup the M20 can be used like a standard modem. The standard modem commands for establishing a connection can be used. The M20 will return standard modem answers. Use a terminal program set to 9600 8N1 for the first tests.

The M20 is ready for data communication if the green LED is constantly on. Otherwise check the PIN ID setting and the antenna connection.

Before a connection can be made, it is a good idea to check if cellular radio communication is possible. For this, the field strength of the nearest radio repeater can be tested with the command AT+CSQ which displays the signal quality. It should be not less than 10.

Use the command ATDxxxxx to dial up the remote station with telephone number xxxxx.

The M20 answers like a standard modem:

- CONNECT 9600 at the time a connect was established
- BUSY if the remote station is busy
- NO CARRIER if the remote station cannot be connected

The +++ and ATH commands can be used to close a connection.

Use the ATZ command to restart the M20 and to reestablish the above setup.

2.3 Remote Programming the FP1 / FP–M with the M20

The M20 Siemens GSM Module can be set up to simulate an analog modem. Together with the new NAiS Control Version 2.3b and an analog modem it is easy to set up a PLC–M20 system which can be remotely controlled and programmed.

No problems were seen for the combinations FP0–M20. However, a timeout problem occurs if an FP–M or FP1 is combined with the M20.

The following setup prevents this problem.

2.3.1 System Setup

To set up the system, you will require the following items:

- NAiS Control version 2.3 or higher.
- Analog modem (e.g. Induline or FP–Modem) at the computer end (RS232C runs at 9600 baud).
- M20–Terminal connected to the COM port (second RS232C) of an FP–M or FP1 (Cable without handshake lines).

Note

The latest version of NAiS Control is NAiS Control FPWIN Pro V3.0. All libraries, projects, etc. designed for NAiS Control can also be used by NAiS Control FPWIN Pro.

2.3.2 FP1 / FP–M RS232C Port Setup

Use NAiS Control and edit the ’COM Port’ settings of your PLC application under ’PLC Config / Systemregister’:

- Systemregister 413 ’data length’ = 8
- Systemregister 413 ’parity check’ = None
- Systemregister 413 ’stop bit’ = 1
- Systemregister 413 ’terminator’ = CR
- Systemregister 413 ’header’ = No–STX
- Systemregister 414 ’baud rate’ = 9600
- Systemregister 416 ’modem connection’ = Disable

2.3.3 M20–Terminal Setup

Use a standard terminal program (Terminal.Exe or HyperTerminal) to enter following commands:

- AT&F — Reset the M20 to factory default (RS232C now at 19200 Baud)
- AT+CLCK=”SC”,0,”xxxx” — Switch off the PIN entry (xxxx is the PIN ID)
- AT+IFC=0,0 — Do not use RS232C handshake lines
- AT+IPR=9600 — Fix the RS232C to 9600 baud (RS232C now at 9600 Baud)
- ATS0=1E0V0&W — No echo back to PLC; number response answer; save setup
- ATZ — Restart the M20

2.3.4 Finding the SC.INI Files on the Computer

For this information, ☛ section 2.4.8.

2.3.5 Setting Up Timeout Values Within All SC.INI Files

Use a standard text editor (**do not use a word processor like WINWORD!**) to edit the two or three SC.INI (☛ note) files and enter the timeout values needed in milliseconds:

- Find the communication section and append a new line with the ”ReplyTimeOut” value:
  [Communication Parameters]
  ReplyTimeOut=3000
- Find or create the timer section and generate the ”ValidDataTimeout” line:
  [TIMER]
  ValidDataTimeout=10000

☞ **Note**

The latest version of NAiS Control, namely NAiS Control FPWIN Pro, uses NC.INI files instead of SC.INI files.

2.3.6 NAiS Control and Modem Setup

The analog modem connected to the computer must be initialized by using a terminal program so that it uses an 'Error correction' protocol (reliable mode). For information on initialization strings, ☛ ACGM0136END, PLC–Modem Communication. For an alternative modem initialization, ☛ section 2.3.7.

1. Load the NAiS Control project, select FP1 or FP–M. Check the COM port settings (see above).
2. Within the NAiS Control menu item 'Online / Communication parameters', activate the modem support and enter the telephone number of the M20.
3. Select appropriate COM port, disable automatic baud rate detection and fix baud rate to 9600 baud. (Rem.: NAiS Control version 2.3b is needed to select a higher baud rate than 2400).
4. Set the 'Timeout' value within the 'Communication Parameter' window to 3000.

2.3.7 Optional Initialization String Sent Out by NAiS Control

If the analog modem connected to the computer should be initialized by NAiS Control:

1. Find the initialization string for the modem used so that it uses an 'Error correction' protocol (reliable mode). If no initialization string can be found then use the following: ATE0Q0 or ATX3E0Q0
2. Edit the two or three NAiS Control initialization files SC.INI (☛ note) by using a standard text editor. To find the SC.INI files, ☛ section 2.4.8.
3. Find the communication section and append two lines with the "ModemParity" and "ModemInitString " parameters (xxxx stands for the initialization string):
   [Communication Parameters]
   ModemParity=N
   ModemInitString=ATxxxx
4. Be careful never to use the V0 command within the initialization string!
5. Make sure that the modem connect answer is in the standard (one line) format, e.g. CONNECT 9600

NAiS Control will not work with extended modem connect messages.

☛ Note

The latest version of NAiS Control, namely NAiS Control FPWIN Pro, uses NC.INI files instead of SC.INI files.

2.4 Connecting the M20 to the TOOL Port of a PLC

The M20 (Siemens GSM Module) can be set up to simulate an analog modem. Together with the new NAiS Control (version 2.3b) and an analog modem at the computer end, it is easy to set up a PLC / M20 system which can be remotely controlled and remotely programmed via 'GSM data'.

For connecting the M20 to the TOOL port of a PLC it must support the RS232C format with an odd parity check bit. The M20 also must use an odd parity if it is connected to a COM port (second RS232C port of the PLC), which is set up to directly communicate with NAiS Control via RS232C (i.e. the TOOL port is used by an operating panel).

2.4.1 System Configuration

To test this example, you need the following items:

- NAiS Control 2.3 (new beta Version or final version 2.3b).
- Analog modem (e.g. Induline) at the computer side (RS232C runs at 9600 7O1).
- PLC having the M20–Terminal connected to the TOOL port or COM port (using a cable without handshake lines).

2.4.2 PLC TOOL Port Setup

Use NAiS Control and edit the 'TOOL Port' settings under 'PLC Config / Systemregister' before downloading the PLC application program into the PLC:

- Systemregister 411 'data length' = 7
- Systemregister 411 'modem connection' = Disable
- Systemregister 414 'baud rate' = 9600 (some PLCs use DIP switches instead)

2.4.3 PLC COM Port Setup

Use NAiS Control an edit the 'COM Port' settings under 'PLC Config / Systemregister' before downloading the PLC application program into the PLC:

- Systemregister 412 'port function selection' = Computer–Link
- Systemregister 413 'data length' = 7

☛ next page

- Systemregister 413 ’parity check’ = With–Odd
- Systemregister 413 ’stop bit’ = 1
- Systemregister 413 ’terminator’ = CR
- Systemregister 413 ’header’ = No–STX
- Systemregister 414 ’baud rate’ = 9600
- Systemregister 416 ’modem connection’ = Disable

2.4.4 M20–Terminal Setup

Use a standard terminal program (Terminal.Exe is recommended) to enter the following commands:

1. Set the terminal program to 19200 bps, 8 data bits, none parity and 1 stop bit (8N1). Enter the AT<cr> command multiple times to check if the M20 is responding. If no OK<cr> answer comes back, repeat the test after setting the terminal to 9600 8N1 or 9600 7O1 (7 data, odd parity, 1 stop). Continue when the M20 responds with OK or 0 (zero).
2. AT&F Reset the M20 to factory default
3. Now set the terminal to 19200 bps and 8N1
4. AT+CLCK=”SC”,0,”xxxx” Switch off the PIN entry (xxxx is the PIN ID)

Note

Your SIM card is now unprotected!

5. AT+IFC=0,0 Do not use RS232C handshake lines
6. AT+IPR=9600+ICF=5,0 Fix the RS232C to 9600 bps, 7 data, odd parity and 1 stop bit (7O1)
7. Now set the terminal to 9600 bps and 7O1
8. ATS0=1E0V0&W No echo back to PLC; number response answer; save settings
9. ATZ Restart the M20

2.4.5 Setting NAiS Control Timeout Values and Modem Parity

To prevent timeouts (FP1 or FP–M or disturbed communication) the timeout values within the NAiS Control SC.INI (☛ note) files should be adapted. See below on how to find the two or three SC.INI files on your hard disk. Use a standard text editor (do not use a word processor like WINWORD!) to edit all the SC.INI files:

Find the communication section and append two new lines with the ”ReplyTimeOut” value and the ”ModemParity” setting:

[Communication Parameters]
ReplyTimeOut=3000
ModemParity=O (This is the character O and not the number zero.)

Find or create the timer section and generate the ”ValidDataTimeout” line:

[TIMER]
ValidDataTimeout=10000

☞ **Note**

The latest version of NAiS Control, namely NAiS Control FPWIN Pro, uses NC.INI files instead of SC.INI files.

2.4.6 NAiS Control and Modem Setup

The analog modem connected to the computer must be initialized by the use of a terminal program so that it uses a ’Error correction’ protocol (reliable mode). For information on initialization strings, contact your national Matsushita office. For an alternative modem initialization, ☛ section 2.3.7.

1. Load the NAiS Control project. Double check the COM port and TOOL port settings (see above).
2. Within the NAiS Control menu item ’Online / Communication parameters’ activate the modem support and enter the telephone number of the M20.
3. Select the appropriate COM port, disable automatic baud rate detection and fix baud rate to 9600 baud.
4. Set the ’Timeout’ value within the ’Communication Parameter’ window to 3000. (Remember, the ’SyncTimeout’ within the SC.INI (☛ note) will be adapted automatically).

☞ **Note**

The latest version of NAiS Control, namely NAiS Control FPWIN Pro, uses NC.INI files instead of SC.INI files.

2.4.7 Optional Initialization String Sent Out by NAiS Control

If the analog modem connected to the computer should be initialized automatically every time NAiS Control is started:

1. Find the initialization string for the modem used so that it uses an 'Error correction' protocol (reliable mode).
   - For the Induline modem: AT&FX3E0Q0S30=0
   - If the FP–Modem is used at the computer end use the initialization string: AT&FX3E0Q0
   - If no initialization string can be found then use the following: ATE0Q0 or ATX3E0Q0
2. Edit the two or three NAiS Control initialization files SC.INI (☛ note) by using a standard text editor. To find the SC.INI files, ☛ section 2.4.8.
3. Find the communication section and append a line with the "ModemInitString " parameter (xxxx stands for the initialization string from above):
   [Communication Parameters]
   ModemInitString=ATxxxx
4. Be careful never to use the V0 command within the initialization string!
5. Make sure that the modem connect answer is in the standard (one line) format, e.g. CONNECT 9600.

NAiS Control will not work with extended and multi–line modem connect response messages.

Note

The latest version of NAiS Control, namely NAiS Control FPWIN Pro, uses NC.INI files instead of SC.INI files.

2.4.8 Finding the SC.INI Files on the Computer

There are two or three SC.INI files (☛ note) on the computer. To find these use a standard text editor to analyze the WIN.INI file which can be found within the Windows subdirectory (C:\WINDOWS or C:\WIN95 or C:\WINNT):

- Find the DDE–Server section [MEWNET] and note the path to the DDE–Server SC.INI file:
  [MEWNET]
  CONFIGFILE=C:\NAISCTRL\SC.INI
- If this CONFIGFILE entry cannot be found then there are only two SC.INI files on your computer. If this entry can be found then normally the DDE–Server uses the SC.INI within the NAiS Control directory:
  C:\NAISCTRL\SC.INI
- Find the NAiS Control section and note the path to the NAiS Control SC.INI file:
  [NAiS Control 1131]
  INI=C:\NAISCTRL\SC.INI
- Normally NAiS Control uses the SC.INI found within the NAiS Control directory:
  C:\NAISCTRL\SC.INI
- The third (or second) SC.INI file can be found within the Tools subdirectory of the NAiS Control directory (see above). So normally the tools SC.INI file is in:
  INI=C:\NAISCTRL\TOOL\SC.INI

☞ **Note**

The latest version of NAiS Control, namely NAiS Control FPWIN Pro, uses NC.INI files instead of SC.INI files.

2.4 Connecting the M20 to the TOOL Port of a PLC

Chapter 3

SMS

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3.1 SMS

The M20 offers the possibility of administering SMS (**S**hort **M**essage **S**ystem) messages in PDU (**P**rotocol **D**ata **U**nit) or in text mode:

- The PDU mode permits adding additional parameters to the SMS message. However, encoding the PDU data is relatively time consuming.
- Text mode permits entering text (~ASCII) characters for generating SMS messages. However, the addition parameters must be defined by additional commands. For example, the maximum retention time or duration of validity (until a non–deliverable SMS message is deleted) is defined with the command AT+CSMP Factory setting: AT+CSMP=17,167,0,0

Some ’500 unknown errors’ can be caused by an incorrect SMS text mode parameter setting.

For each SMS message, a report can be requested from the SMS center on when the SMS message was received, deleted or delivered. These reports are likewise sent as SMS messages from the SMS center to the sender (M20).

In order to request these reports in SMS text mode, some providers have defined special ASCII characters that have to be placed at the beginning of an SMS message. For example, the character string *N# in front of the actual SMS text points most providers towards the desired SMS status report.

If the M20 is not to save the SMS messages received on the SIM card, but rather should transmit them immediately via the RS232C, the command AT+CNMI=2,2 can be used to configure the M20.

The most important AT commands for administering SMS messages are provided in the following tables.

SMS Configuration	
Command	**Meaning**
AT + CMGF	Select SMS PDU or text mode
AT +CSCA	Enter SMS Service Center Number
AT +CNMI	Store incoming SMS on SIM card or signal via RS232C

SMS send / receive / register	
Command	**Meaning**
AT + CMGS	Send SMS message
AT +CMGL	List SMS messages received
AT +CMGR	Read SMS message (stored on SIM card)
AT +CMGD	Delete SMS message on SIM card

3.2 SMS Center

A valid SMS service center number is needed for sending an SMS message. This is a special telephone number where a computer (SMS server) can be called up. The M20 will send the SMS information to this SMS server and it will then distribute the message to the final destination. This telephone number can only be dialed up by a GSM unit (there are different numbers for ISDN and analog modem connections available). Also every GSM network provider has its own SMS service center with its own SMS server telephone number. Please ask your GSM network provider for the actual SMS server telephone number. Here are some examples:

Country	Network	Number	Comment
Germany	D1 T–Mobil	+49017076000	transmission to other networks possible, although expensive
	D1 Talkline	+4901710760345	transmission to other networks possible, although expensive
	D2	+491722270000	within D2
	D2	+491722270333	other networks
	The E network uses other frequencies, therefore communication with the M20 is not possible.		
Denmark	Sonofon	+4540590000	—
Italy	Omintel	+393492000200	—
Austria	Mobil Austria	+436640501	—
	Max Mobil	+43676021	—
Poland	Polkmtel	+48601000310	—
	ERA	+48602951111	—
Hungary	Pannon GSM	+3620300099	—
	Westel 900	+3630303100	—

3.3 Sending and Receiving SMS Messages with the M20

The M20–Terminal (Siemens GSM Module) can be used for data transfer and to handle text messages via the GSM 'Short Message Service' (SMS).

The data transmission mode (via GSM–data) can be used for remote control and remote programming of a PLC. Section 2.2 describes how to set up the M20 and test the data transfer functions.

In this section, the SMS setup and SMS functions (together with some diagnostic commands) of the M20 are described. Such SMS messages can have up to 160 ASCII characters. The main purpose is to send alarm messages from a PLC to a mobile phone or, the other way around, to send telecontrol commands to a PLC.

To send and receive SMS messages with the M20, the following general conditions must be fulfilled:

- The 'GSM–data' service (or at least the SMS functions) must have been enabled by the network service provider (☛ section 1.3).
- For the setup it is recommend to use Terminal.Exe from Windows 3.1 and the set–up file M20_1.TRM (function key definition).
- To use the M20 for the first time and to get familiar with it, is recommended to first read section 2.2. How to use the Terminal.Exe is also explained here.
- This description was developed using the M20 firmware revision 2.3. The M20 firmware revision can be displayed with the command ATI.
- For the following tests it would be good to have a second GSM terminal unit (mobile phone or M20) which can receive and send SMS messages, but it is also possible to generate and receive one's own SMS messages with the same M20.

☞ **Note**

Never insert or remove the SIM card while power is supplied to the M20, or important data could be lost.

3.4 M20 Commands for Diagnosis and PIN Entry

3.4.1 M20 Working OK?

Start Terminal.Exe and open the 'M20_1.TRM' set–up file. Open menu 'Settings / Communications...' and check if the correct COM port and RS232C data format is set up. Enter the AT command (AT plus the Enter or Return button) to check if the M20 is responding.

AT	(entered)
OK	(answer)

If the M20 does not answer with 'OK' or '0' then try different RS232C settings. To find out the current RS232C baud rate, ☛ section 2.2.4 .

3.4.2 Check PIN Code

Use the '+CPIN?' command to check if the PIN code needs to be entered. The M20 answers with '+CPIN: READY' if the PIN code was correctly entered before or if the PIN code security is disabled.

AT+CPIN?	(entered)
+CPIN: READY	(answer if the PIN was correctly entered before)
OK	(second line of the answer)

If the PIN code is missing (green LED is blinking) the M20 answers with '+CPIN: SIM PIN'.

AT+CPIN?	(entered)
+CPIN: SIM PIN	(answer if the PIN code is missing)
OK	(second line of the answer)

To use the M20 the PIN code must be entered with the '+CPIN=' command or the PIN code security must be disabled with '+CLCK="SC",' command (see below).

3.4.3 Enter PIN Code

To enter the PIN code use the command '+CPIN='.

AT+CPIN="1234"	(entered; also *AT+CPIN=1234* will work)
OK	(answer)

1234 stands here for the individual PIN code of the SIM card used. Directly after entering this command the M20 tries to connect to the GSM network. This can take a while (around 10 seconds) and, if the M20 is successfully logged into the GSM network, the green LED stops blinking and is continuously lit. At the next power–up of the M20 the PIN code must be entered again.

AT+CPIN="1237"	(entered)
ERROR	(answer)

If the M20 answers with 'ERROR' then the wrong PIN code was entered or the PIN code was already entered before (see the LED or the CPIN? command).

3.4.4 Disable PIN Code

The PIN code security and the PIN code request can be disabled completely by using the '+CLCK' command. A valid PIN code must have been entered (see command '+CPIN=' above) before this command can be used:

AT+CLCK="SC",0,"1234"	(entered)
OK	(answer)

On the next power–up of the M20 the PIN code does not need to be entered again. The M20 will automatically try to connect to the GSM network.

If the M20 answers with an error:

AT+CLCK="SC",0,"1237"	(entered)
ERROR	(answer)

then the wrong PIN code was entered or the '+CPIN=' command before is missing (see above).

3.4.5 Re–enable PIN Code

To re–enable the PIN code security, the following command can be used:

AT+CLCK="SC",1,"1234"	(entered)
OK	(answer)

Following this command the PIN code must be entered again at the next power–up of the M20.

If the M20 answers with an error:

AT+CLCK="SC",0,"1237"	(entered)
ERROR	(answer)

then the wrong PIN code was entered.

3.4.6 Test Radio Signal Quality

To test the GSM radio signal quality the command '+CSQ' can be used:

AT+CSQ	(entered)
+CSQ: 19,0	(answer; signal quality level is at 19)
OK	(second line of the answer)

The first value of the answer (here 19) stands for the received signal strength. The signal quality is better if the value is higher. The range of this value is from 0 to 31. The value 99 stands for a unknown signal quality. It should not be less than 10 for good and reliable communication.

For example, the German GSM network operators D1 and D2 use the following gateway numbers:

- D1 gateway: **8000**
- D2 gateway: **3400**

3.4.7 Information Needed from the GSM Network Provider

This information includes:

- The telephone number of the SMS (☛ section 3.2).
- A prefix for redirecting the SMS to a fax machine (☛ section 3.6).
- A gateway number for redirecting an SMS to an email address (☛ section 3.7).

3.5 M20 Commands for Sending and Receiving SMS

3.5.1 Check SMS Center Entry

To check if the correct SMS service center telephone number is stored within the M20:

AT+CSCA?	(entered)
+CSCA: ”+491710760000”	(answer)
OK	(second line of the answer)

In this example the M20 is set up to use the German D1 SMS center. If an SMS server number is not yet pre–stored, the M20 answers with:

AT+CSCA?	(entered)
+CSCA: ””	(answer; no SMS possible)
OK	(second line of the answer)

3.5.2 Enter the SMS Center Number

To store the SMS server number within the M20 for further outgoing SMS messages, use the command:

AT+CSCA=”+491710760000”	(entered)
OK	(answer)

In this example the M20 is set up to use the German D1 SMS center.

3.5.3 Switch to SMS Text Mode

To set up the M20 to generally use the text mode for further outgoing SMS messages, use the command:

AT+CMGF=1	(entered)
OK	(answer)

Note

The following examples only work if this command was used to set the M20 to SMS text mode.

3.5.4 General SMS Procedure

The commands +CSCA and +CMGF must have already been executed (see above).

The following steps are necessary to send SMS messages with the M20:

Procedure:

1. **Enter the '+CMGS' command along with the destination GSM telephone number**
2. **The M20 answers with the prompt character '>' and waits for any text to be entered**
3. **The text message is to be entered (maximum 160 characters)**
4. **To finish the text entry, the special character ctrl–Z must be used**
5. **The M20 sends the message to the SMS server and if successfully transferred**
6. **The M20 answers with the '+CMGS:' response plus a consecutive SMS reference number**

Notes

- **The special character ctrl–Z can be generated by holding the 'control' key and pressing the 'Z' button on your computer keyboard. For computer or PLC applications, the ctrl–Z character has the hexadecimal code 1A (26 decimal).**
- **For test purposes, the SMS can be sent to its own (originating) station. The process is the same as sending to a different destination. Also the delivery time can be tested like this.**

3.5.5 Example for Sending an SMS Message

To send an SMS message with the text 'Alert at PLC 1' to the German D1 mobile phone having the telephone number 01705717543, the following command can be used:

AT+CMGS="+491705717543"	(command entered)
> Alert at PLC 1 »	(prompt; entered text; ctrl–Z)
+CMGS: 64	(answer from M20; consecutive SMS reference number)
OK	(second line of the answer)

Note

The '> 'character was output by the M20 as the text prompt. The following text '*Alert at PLC 1'* was entered as the message itself. The '»' stands here for the ctrl–Z character, which finished the text entry.

3.5.6 SMS Reception

Any incoming SMS will be indicated with the '+CMTI' response followed by an SMS number (M20 standard setup). For example:

```
+CMTI: "SM", 11                (automatic response from M20)
```

This indicates that an SMS message was just received and stored on the SIM card at position 11. The SIM card can only store up to 15 SMS messages! This position number is needed to display or to delete this SMS message.

3.5.7 Display a Received SMS

To display an SMS message which was stored on the SIM card, the command '+CMGR' is used. For example to display the SMS message which was stored at position 11 on the SIM card use the command:

```
AT+CMGR=11                     (entered)
+CMGR: "REC
UNREAD","+491705717543",,"99/07/21,16:14:02+04"
Alert at PLC 1                 (two line answer of the M20)
OK                             (answer)
```

In the first line, the M20 displays the telephone number *"+491705717543"* of the sending station, the date and time when this message was received by the SMS server and the remark *"REC UNREAD".* This remark is only seen the first time this message is read. The received SMS itself is displayed on the second line of the '+CMGR' response. If the same message is read a second time:

```
AT+CMGR=11                     (entered)
+CMGR: "REC READ","+491705717543",,"99/07/21,16:14:02+04"
Alert at PLC 1                 (two line answer of the M20)
OK                             (answer)
```

The remark *"REC READ"* indicates that this message was already read before (at least one time).

If an SMS message number (SIM card storing position) is selected with the '+CMGR' command where no SMS message was stored before:

```
AT+CMGR=12                     (entered)
OK                             (answer)
```

No message is displayed – only the OK answer comes back from the M20.

3.5.8 Display all SMS Stored on the SIM Card

Use the command '+CMGL' to list all SMS stored on the SIM card.

```
AT+CMGL="ALL"                    (entered)
+CMGL: 11,"REC
READ","+491705717543",,"99/07/21,16:14:02+04"
Alert at PLC 1
+CMGL: 12,"REC
READ","+491705717543",,"99/07/21,16:24:05+04"
Alert at PLC 2                   (multiple line answer of the M20)
```

The answer depends on the number of SMS stored on the SIM card.

3.5.9 Delete SMS

Use the command '+CMGD' to delete an SMS from the SIM card. For example, delete the SMS message at SIM card position 12:

```
AT+CMGD=11                       (entered)
OK                               (answer)
```

The M20 answers with OK even if no SMS was stored at this position number.

3.5.10 Reception without Storing Message on SIM Card

If an incoming SMS should not be stored on the SIM card, the command:

```
AT+CNMI=2,2                      (entered)
OK                               (answer)
```

can be used. After this command every received SMS is directly sent out over the RS232C:

```
+CMT: "+491705717543",,"99/07/21,16:34:12+04"
Alert at PLC 1                   (two line answer of the M20)
```

3.6 Send SMS to Fax Machine

In order to execute the example below, the M20 has to be configured with the following commands:

- Set the SMS center, e.g. for D1: AT+CSCA=”+491710760000”
- Command AT+CMGF=1 sets the M20 SMS text mode

More and more providers now offer the possibility of directing an SMS message to a fax machine. In order to utilize this function, certain parameters have to be obtained from the provider in question. For example, with the German GSM network operators D1 and D2, the number of the SMS message receiver should be replaced by the national fax number, which is identified by the prefix 99.

Example:

The text **’This is an SMS from the M20 to a Fax machine’** is to be sent with the M20’s SMS function to a fax machine at Matsushita Electric Works (Europe) AG. Only the national phone number 08024/648–222 and not the international phone number +49 8024 648 222 can be entered.
Use the following M20 commands:

AT+CMGS=”9908024648222” (The > is a prompt from the M20)

> This is a SMS from the M20 to a Fax machine (Text end with ctrl–Z)

As soon as the SMS center (or gateway) has received the message, the M20 registers, for example, **+CMGS: 164**
The number 164 is an ID number of this SMS message (running number). As soon as the SMS center has delivered the SMS message to the fax machine, an SMS report is sent to the transmitter (M20):

+CMTI: ”SM”, 3 (No. of the SMS received on the SIM card)

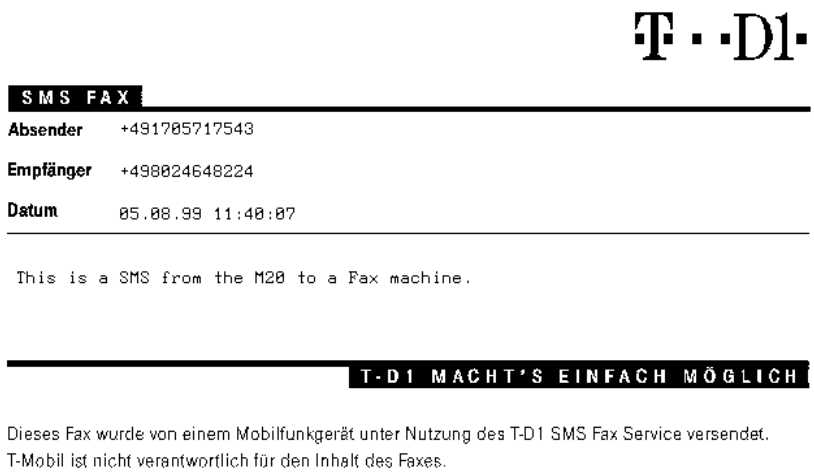
at+cmgr=3 (Command to indicate SMS message on the SIM card)

+CMGR: ”REC UNREAD”,”8000”,”D1–Gateway”,”99/08/05,1 1:18:09+04”

Vielen Dank. Ihr Fax wurde am 05.08.1999 um 11:17:46 an 08024648222 ubertragen.

3.6 Send SMS to Fax Machine

The fax sent / received is automatically given a header a provider sign (text in German due to German provider):



T · ·D1·

SMS FAX

Absender +491705717543

Empfänger +498024648224

Datum 05.08.99 11:40:07

This is a SMS from the M20 to a Fax machine.

T-D1 MACHT'S EINFACH MÖGLICH

Dieses Fax wurde von einem Mobilfunkgerät unter Nutzung des T-D1 SMS Fax Service versendet.
T-Mobil ist nicht verantwortlich für den Inhalt des Faxes.

3.7 Send SMS to an Email Address

In order to execute the example below, the M20 has to be configured with the following commands:

- Command AT+CSCA="+491710760000" stores the SMS center (here D1)
- Command AT+CMGF=1 sets the M20 SMS text mode

More and more provides now offer the possibility of directing an SMS message to an internet email address. In order to utilize this function, the specific gateway number has to be obtained from the provider in question. For example, with the German GSM network operator D1, this number is 8000. With the German GSM network operator D2, this number is 3400.

The email address of the person receiving the message has to be entered as text before the actual message. The @ character in the email address causes problems with some providers and can be replaced by the ! sign in many cases. Ask the provider to be sure.

Example:

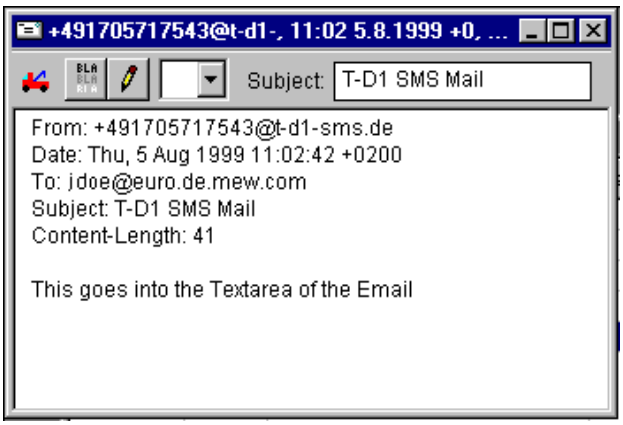
The M20's SMS function is to send the text **'This goes into the Textarea of the Email'** to the email address of JDoe at Matsushita Electric Works (Europe) AG (jdoe@euro.de.mew.com).
Use the following M20 commands:

AT+CMGS="8000" (The > is a prompt from the M20)

> johndoe@euro.de.mew.com
This goes into the text area of the email. (Text end with ctrl–Z)

As soon as the SMS center (or gateway) has received the message, the M20 registers, for example, **+CMGS: 168**
The number 168 is an ID number of this SMS message (running number).

The following email was received:



The Subject line is automatically filled in by the provider.

If an error is detected in the email address, the Gateway reports this to the M20 with an SMS. (The text in the following example is in German due to a German provider.)

Example:

at+cmgs=”8000”

> abcdef (invalid email address)

+CMGS: 169

+CMTI: ”SM”, 5 (SMS reception stored on SIM)

at+cmgr=5 (and show these)

+CMGR: ”REC UNREAD”,”8000”,”D1–Gateway”,”99/08/05,10:50:36+04”
Ihre Nachricht enthalt keine gultige E–Mail–Adresse oder Kommando. Setzen Sie OPEN, CLOSE, ALIAS, STATUS oder eine E–Mail–Adresse an den Anfang Ihrer Nachricht.

3.8 Receive Email as SMS

More and more providers offer the possibility of sending an email as an SMS message to a cellular telephone (or M20). To utilize this function, you need to obtain the command that enables email reception in addition to the gateway number mentioned above. With the German GSM network provider D1, you have to send an SMS with the text 'OPEN' to the gateway one time. (The text in the following examples are in German due to a German provider.)

Example:

This example shows email / SMS reception was enabled with an SMS at the D1 Gateway.

at+cmgs="8000"	(SMS to Gateway)
> OPEN	(Text OPEN ended with ctrl–Z)
+CMGS: 171	
+CMTI: "SM", 6	(SMS report from Gateway)
at+cmgr=6	

+CMGR: "REC UNREAD","8000","D1–Gateway","99/08/05,1 1:06:38+04"
Sie erhalten maximal folgende Anzahl von E–Mails:
10 pro Tag, 100 pro Monat.

If the email reception was successfully enabled, the gateway reports this with an SMS message (see above). This message also states that you have a limited number of emails / SMS (depending on the provider).

It is also possible afterwards to request the status (Open / Close) and the number of emails / SMS already received from the gateway with an SMS using the text STATUS.

Example:

at+cmgs="8000"	(SMS to Gateway)
> STATUS	(Text STATUS ended with ctrl–Z)
+CMGS: 175	
+CMTI: "SM", 7	(SMS report from Gateway)
at+cmgr=7	

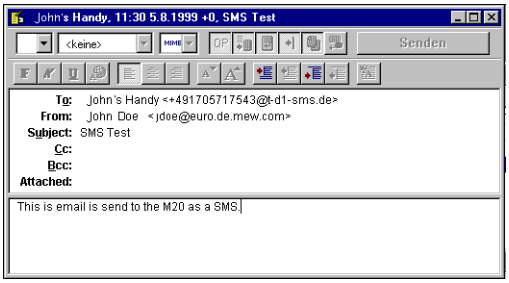
+CMGR: "REC UNREAD","8000","D1–Gateway","99/08/05,10:54:08+04"
Ihre E–Mail–Adresse: +491705717543@t–d1–sms.de.
Empfang: aktiviert. Max empfangbare Mails: 10/Tag,
100/Monat. Bereits empfangen: 4/Tag, 13/Monat

In addition, the structure of the email address must be provided to the mobile station (M20). This can happen by:

- The above status inquiry showing the corresponding email address (here +491705717543@t–d1–sms.de)
- By asking the provider. For example, with the German provider D1 '@t–d1–sms.de' is added to the email address from the mobile telephone number.
- The structure of the email address can also be transmitted by sending an SMS to an email address (☛ section 3.7).

Example:

An email from J. Doe (jdoe@euro.de.mew.com) is to be sent to an M20 (German provider D1) with the phone number +491705717543. Remember the entry for the Subject line.



The M20 addressed receives the following information:

+CMTI: "SM", 8

at+cmgr=8

+CMGR: "REC UNREAD","8000","D1–Gateway","99/08/05,11:32:55+04"

jdoe@euro.de.mew.com SMS Test This is email is send to the M20 as a SMS.

3.9 SMS Reports

It is possible to also get reports about the recent SMS delivery. Further information can be found in the M20 manual and from the GSM Network provider.

Some providers accept the string *N# at the beginning of the message to actuate the SMS reports.

3.9 SMS Reports

Chapter 4

GSM User Library

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4.1 GSM User Library M_CG_Lib

The GSM library, part number NCL–CG–LIB, was designed for the following purposes:

- Data transmission PLC–PLC, PLC–PC, Cellular phone–PLC for telemetry, status report, alarm, remote maintenance and remote programming of the PLC.
- Downloading and monitoring using the worldwide GSM network.
- **SMS:** transmitting plain–text messages to cellular phones.
  Receiving SMS / Remote control with SMS.

This library is necessary whenever the controller itself has to call up a remote station, do an alarm or spontaneous status report. This library is not necessary for mere remote inquiry (visualization) and remote programming via GSM, i.e. the Slave controller is called by a Master.

The GSM function block collection provides convenience for operating a GSM modem (especially the M20 GSM module from Siemens) from the COM Port of a Matsushita FP Controller.

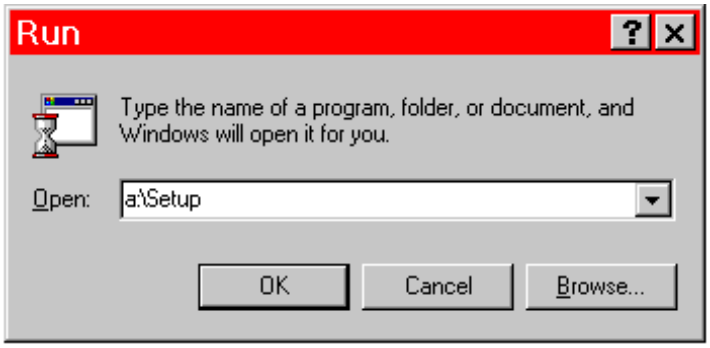
Initialization is carried out by a separate function block **M_CG_ini**. The PIN number must be entered in the transmission dialog. By separating the initialization sequences, normal modem function blocks, e.g. M_CM_Lib, can be integrated into a GSM application. Everything particular for GSM is carried out by M_CG_ini. Thereafter the M20 module operates like a normal modem.

In essence, the software function blocks automatically initialize the modem, establish and disconnect the connection, switch to Slave mode, send an SMS and send alarms by ringing up the appropriate number.

In order to verify that global variables have been declared, importing the example programs M_CG_Tst.ASC after the user library has been installed is recommended.

4.1.1 Installing the Library

Start the file SETUP.EXE on the floppy disk ”NAiS Control 1131 GSM Library M_CG_Lib”, e.g. via the Start menu ”Run” (in Windows 95 or Windows NT).



The set–up program unpacks and copies the files M_CG_LIB.SUL, M_CG_LIB.HLP (which you started), README.TXT and the example programs (all in the import file) for NAiS Control 1131 M_CG_TST.ASC in the NAiS Control library directory (usually in C:\NAIS_LIB\M_CG_Lib\). Of course the file directory can be changed if you already created another director for user libraries. In addition, licensing and copyright information, as well as information from the file README.TXT appears.

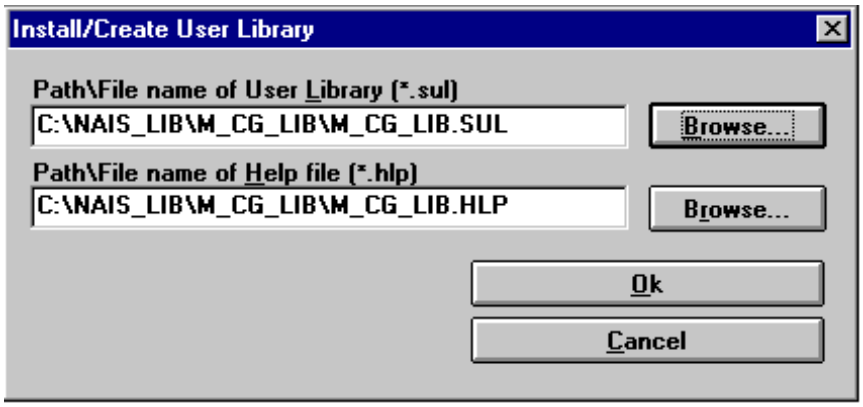
Note

The latest version of NAiS Control is NAiS Control FPWIN Pro V3.0. All libraries, projects, etc. designed for NAiS Control can also be used by NAiS Control FPWIN Pro.

4.1.2 Integrating a Library into a PLC Project

NAiS Control 1131 has to be running, and a project must be open. In the Project Navigator, click on ”Library Pool”, then ”Edit...User Library...Install/Create”.

The following window (Path\file_name of the user_library (*.sul)) appears in which you enter the path and file name of the library to be installed (M_CG_LIB.SUL).



If the library path is not known, you can find it by clicking Browse with the mouse. In the window Path\file name for Help (*.hlp) the path and name of the help file M_CG_LIB.HLP should be entered or searched for using the Browse function. SETUP installs the HLP file in the same directory as M_CG_LIB.SUL. In this way you can access these help files from NAiS Control. Clicking OK makes the POUs of the library accessible for the project. The library is now available in the Navigator.

Now the function blocks of the library can be entered into your own program. The status is reported as INSTALLED. For copyright reasons, the user libraries are password protected and cannot be opened! What can be viewed is the header and the Global Variable List so you can see which variables of which type are used for each function block.

It is recommended to also import the example and test programs C_CG_Tst.ASC to have the global variables setup correctly.

The function blocks of the library have been extensively tested and provide you with additional convenience by not having to trouble yourself with developmental details. For questions and comments, the Matsushita support team is at your service.

4.2 Example Application Programs in M_CG_Tst.Asc

Program	Description
Test1_Init	Example program ”Test1_Init” for testing the GSM M_CG_Lib library function block ”M_CG_ini”. Shows how to initialize the M20 and how to enter the PIN code.
Test2_Diagnose	Example program ”Test2_Diagnose” for testing the GSM M_CG_Lib library function block ”M_CG_Diag”. Shows how to find out the M20 firmware version and the actual radio signal strength.
Test3_RingAlert	Example program ”Test3_RingAlert” for testing the GSM M_CG_Lib library function block ”M_CG_ring” or ”M_CG_ring_FP1”. Shows how to use the M20 to dial up a (mobile) telephone and how to find out if the call was taken by an human operator.
Test4_Connect	Example program ”Test4_Connect” for testing the GSM M_CG_Lib library function block ”M_CG_connect” or ”M_CG_connect_FP1”. Shows how to use the M20 to dial up a modem (or second M20) to establish a connection for data transmission.
Test5_Slave	Example program ”Test5_Slave” for testing the GSM M_CG_Lib library function block ”M_CG_slave”. Show how to use the M20 to wait for incoming MEWTOCOL calls (while the M20 is not sending out a SMS).
Test6_SMS_Send	Example program ”Test6_SMS_Send” for testing the GSM M_CG_Lib library function block ”M_CG_SMS_Send” (or M_CG_SMS_Send_10” or ”M_CG_SMS_Send_11”). Show how to use the M20 to send out SMS messages to a mobile phone (or second M20).
Test7_SMS_Tx_Rx	Example program ”Test7_SMS_Tx_Rx” for testing the GSM M_CG_Lib library function block ”M_CG_SMS_Receive”. Show how to receive a previously send SMS message. The M20 is used to send out AND receive a SMS. The SMS (’YON’ or ’OFF’) is decoded and the Y0 is set accordingly.

4.2.1 Example Program GSM Quick Start

There is a collection of example programs to try out in M_CG_Tst.ASC. Import in NAiS Control as project.

The M20 is connected and the COM Ports system registers and input buffer have been configured as global variables as prescribed. The function block library is installed.

Is the PLC type correct? This can an be checked in the project navigator, changed in the menu Online ▶ PLC Type.

Note

Caution! With changes, the COM Port’s system register settings will be reset, among other things.

Procedure:

1. **Create new project.**
2. **Project ▶ Import Project ▶ C:\NAIS_Lib\M_CG_Lib\M_CG_Tst.ASC (By doing this the example programs are loaded).**

   In the task pool, the test program Test1_Init is already entered. You should begin with this. Otherwise select and save table.
3. **In the respective program function block body, enter the PIN and the telephone number that should be dialed.**
4. **Compile program and download to the controller.**
5. **Switch to RUN mode.**

If the M20 is hooked up correctly, the message **init_ok** comes and within a few seconds (depending on whether the PIN was already entered) the message **PIN_ok**.

If this is not the case, check to see that the cable is connected correctly. The control LED on the M20 should always be lit.

Then try out the example **Test4_Connect**. Do not forget to change the PIN and telephone number here as well. Check controller type and task pool entries.

4.3 The Function Blocks of the User Library M_CG_Lib

4.3.1 Main Function Blocks

Function Block	Description
M_CG_ini	PIN entry with verification and modem initialization.
M_CG_Diag	Function block for reading the firmware version of the M20 and reception field strength.
M_CG_ring	Alarming via ringing up and acknowledgement. Ringing up a (mobile) telephone.
M_CG_connect	Establishing the connection, bidirectional data exchange
M_CG_slave	PLC switches to Slave mode, remote access possible
M_CG_SMS_SEND	Sending of SMS messages to cellular phones. For any mobile telephone numbers with 1 to 16 digits.
M_CG_SMS_Receive	Reception of SMS. Receiving of SMS messages and the sender's number.

4.3.2 Additional Function Blocks

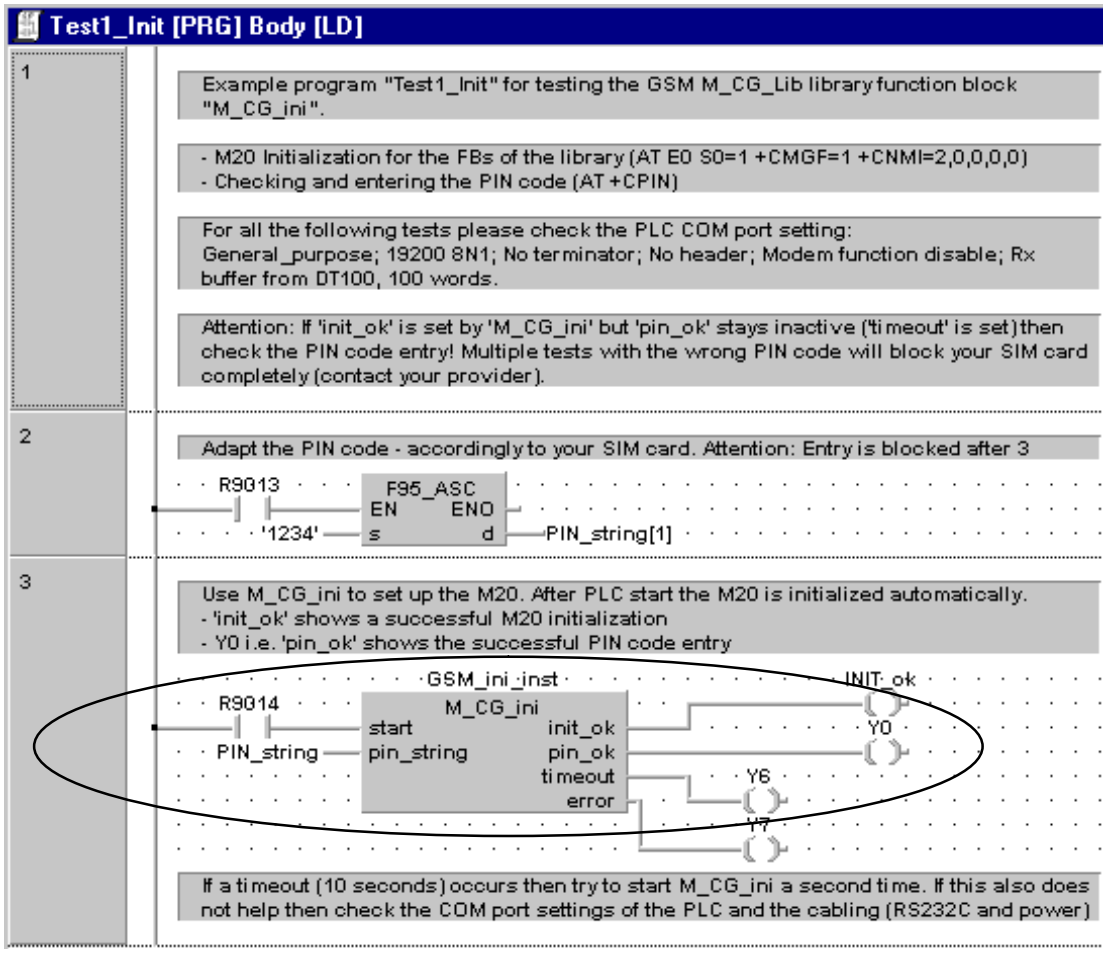
Function Block	Description
M_CG_ring_FP1	Version of FB M_CG_ring for PLC types FP–1 and FP–M (Difference in terminators)
M_CG_connect_FP1	Version of FB M_CG_connect for PLC types FP–1 and FP–M (Difference in terminators)
M_CG_SMS_Send_10	Version of M_CG_SMS_Send for GSM networks that use telephone numbers with 10 digits
M_CG_SMS_Send_11	Version of M_CG_SMS_Send for GSM networks that use telephone numbers with 11 digits

Detailed descriptions of the function blocks are given in the remainder of this chapter.

M_CG_ini

Initialization of the GSM module and PIN entry

The function block, circled below in the program body, automatically initializes the M20 module and thereby transmits the PIN.



For your program's POU header, declare a PIN_string as follows:

Test1_Init [PRG] Header

	Class	Identifier	Type	Initial	Comment
0	VAR	INIT_ok	BOOL	FALSE	M20 init done
1	VAR	PIN_string	ARRAY [1..6] OF WORD	[6(0)]	SIM PIN entry done
2	VAR	GSM_ini_inst	M_CG_ini		FB instance

Notes

- **In contrast to normal modems, the M20 module needs some time after the power is turned on to initialize itself. Therefore, at the earliest you should start the function block GSM_ini at the beginning of the second cycle (rising edge or static True (1) at start) by scanning special data register R9014 (becomes True at the start of the 2nd cycle).**
- **If you activate ”ignition” via a PLC output, you should wait at least 5 seconds to begin the initialization with the help of a timer (e.g. TM_1s). Otherwise the PLC could transmit instructions to the M20 that get lost!**
- **If ’Init_ok’ is set to true by M_CG_ini and the output ’pin_ok’ is not set (’timeout’ gets active) then check the PIN code entry! Multiple tests with the wrong PIN code will block the SIM card completely (contact your provider).**
- **After successful initialization the M20 tries to connect to the GSM network. This can take a wile (about one minute). A successful GSM radio connection is indicated by steady lit LED. After this the M20 can be used for communication and SMS handling.**

Variables

Input variables	Data type	Description
start	ARRAY [1..6] of WORD	Starts the initialization process.
PIN_string	BOOL	Declared as above, the PIN is transferred directly as a variable of the type ARRAY of WORD to the input pin pin_string. In so doing, no Index (e.g. [1]) need be entered. 4 digits are transferred via F95.

Output variables	Data type	Description
init_ok	BOOL	Initialization sequence was transmitted correctly and M20 was initialized All other GSM function blocks wait until the value at input contact init_ok becomes True.
pin_ok	BOOL	GSM_ini then checks whether the PIN number has already been entered or whether the M20 is still waiting for it. If this is so, the PIN is transmitted and verification is waited for. If the PIN had already been entered or was entered correctly, True is registered at this output.All other GSM function blocks wait until the value at their input contact pin_ok becomes True.
timeout	BOOL	Becomes TRUE if the modem shows no reaction within 1 minute. Check the cable and M20’s power LED (must be blinking slowly).
error	BOOL	Becomes TRUE if the PIN entry was incorrect or the M20 delivers another error message.

M_CG_Diag

Reads firmware version and current reception field strength

There are several versions of the M20, and significant differences exist in regard to functionality, e.g. with SMS reception. The function block is not meant to be incorporated permanently in a program, but rather mainly to diagnose difficulties or to clarify local conditions and version status.

For optimum reception, the correct antenna and its alignment are important (position antenna vertically!). The orientation or choice of the correct location can be eased with the help of this function block. The value is continually updated.

The header, body (function block circled), and variable accessed in the Global Variable List for a sample program are shown below:

Global_Variables

	Class	Identifier	Mats	IEC_Addr	Type	Initial	Au	Comment
0	VAR_GLOBAL	receive_buffer	DT100	%MW5.100	ARRAY [0..99] OF WORD	[100(0)]		Rx Buffer / Also see System registers for COM Port Settings

Test2_Diagnose [PRG] Header

	Class	Identifier	Type	Initial	Comment
0	VAR_EXTERNAL	receive_buffer	ARRAY [0..99] OF WORD	[100(0)]	
1	VAR	Inst1	M_CG_Diag		
2	VAR	Version	INT	0	
3	VAR	Signal_Level	INT	0	

Test2_Diagnose [PRG] Body [LD]

1

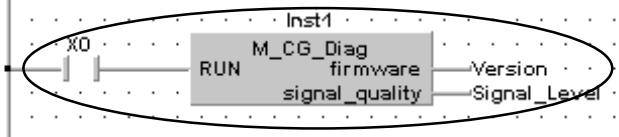
Example program "Test2_Diagnose" for testing the GSM M_CG_Lib library function block M_CG_Diag

- Firmware version 2.3 is recommended (1.03 is also possible)
- Radio signal quality should be higher than 9

Remark: The M20 should have been initialized before - at least with command ATE0&W (entered via terminal program). Or the function block 'M_CG_ini' was used before.

2

Actuate the X0 input of the PLC to continuously test the signal strength.



103=1.03 230=2.3

should be > 9

Signal_quality:
0 <= -113 dBm
1 = -111dBm
2...30 = -109 ... -53 dBm
31 >= -51 dBm
99 = undefined

Signal_quality:
0...4 not receiving
5...7 at the limit (can work)
10...12 receiving o.k.
12... perfect

Variables

Input variable	Data type	Description
Run	BOOL	Starts with a one–time scan of the firmware version number. Then, as long as RUN=1, the field strength is read from M20 every 6 seconds.

Output variables	Data type	Description
firmware	INT	Outputs the M20's version number, but without the decimal point. Example: 101 = Version 1.01
signal_quality	INT	Outputs the current reception field strength. (☛ note)

☞ Note

The integer returned for the signal quality indicate the following values:

0 = –113dBm
1 = –111dBm
2...30 = –109...–53dBm
31 ≧ –51dBm
99 = unknown

These range of these values can be interpreted as follows:

0...4, not receiving
5...7, at the limit (can work)
10...12, receiving OK
≧12, perfect

M_CG_ring

Serves to send an alarm via ring

This function block can be used to send out an alarm. To do so, the PLC calls up a telephone or cellular phone via the M20 module and produces a ring. If the station called answers, a connection is established. The station called hears silence, and simultaneously the M20 receives the message OK, i.e. the station called accepted the call: Output accepted is set to TRUE. After one hangs up, the function block acknowledges as call_terminated. The function block automatically hangs up after a while.

The header and body (function block circled) for a sample program are shown below.

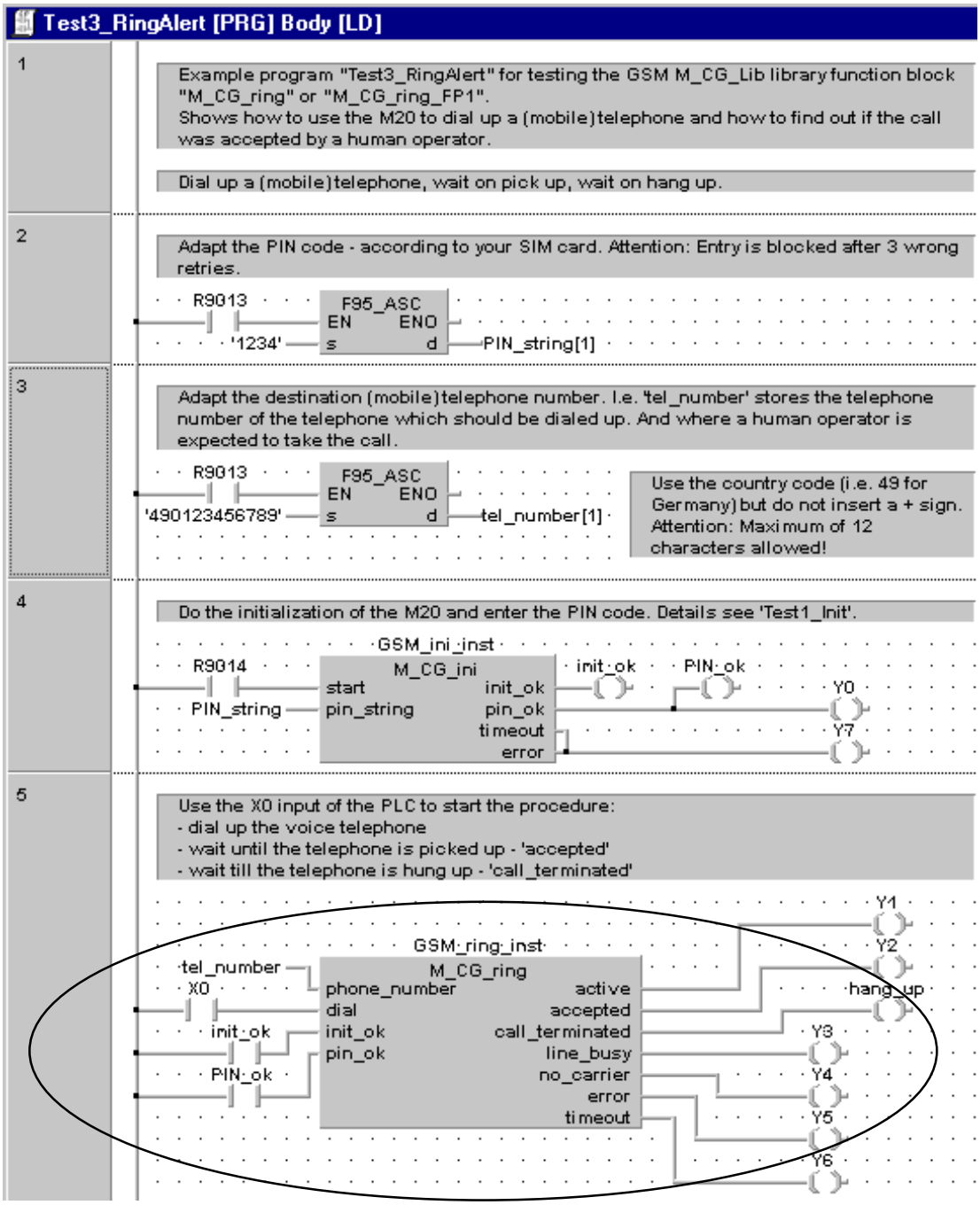
Note

For the use with FP1 or FP–M use the alternative function block M_CG_ring_FP1.

Test3_RingAlert [PRG] Header

	Class	Identifier	Type	Initial	Comment
0	VAR	init_ok	BOOL	FALSE	
1	VAR	PIN_ok	BOOL	FALSE	
2	VAR	PIN_string	ARRAY [1..6] OF WORD	[6(0)]	
3	VAR	GSM_ring_inst	M_CG_ring		
4	VAR	GSM_ini_inst	M_CG_ini		
5	VAR	hang_up	BOOL	FALSE	
6	VAR	tel_number	ARRAY [1..6] OF WORD	[6(0)]	

4.3 The Function Blocks of the User Library M_CG_Lib



Variables

Input variables	Data type	Description
phone_number	ARRAY [1..6] of WORD	The telephone number is transferred to this variable. It can handle up to 12 characters. You should use the function F95 in addition. The entry includes the country code, but neither 00 nor +, i.e. '491716326603' for Germany.
dial	BOOL	Begins dialing and the establishment of the connection.
init_ok	BOOL	Enable signal. Waits for the value True. Initialization sequence was transmitted correctly and M20 was initialized.
pin_ok	BOOL	Enable signal. Waits for the value True, i.e. that the PIN transmission was successful.

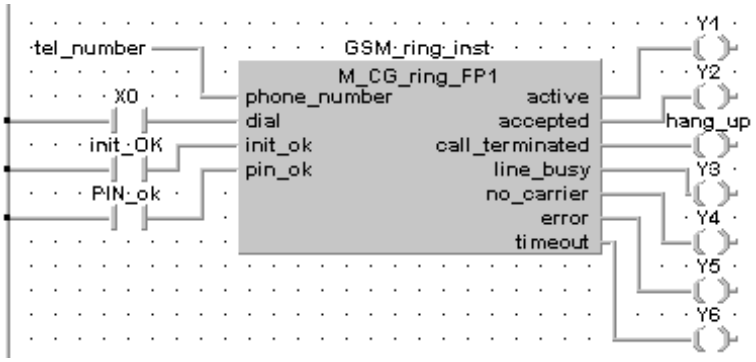
Output variables	Data type	Description
active	BOOL	As long as the function block is doing something, active is set to TRUE. Can be used to deactivate other function blocks for this period of time.
accepted	BOOL	Signals the successful establishment of the connection and that the call was accepted at the other end. Thereby it is guaranteed that the station called has been informed about the alarm.
callterminated	BOOL	Signals that the station called has hung up. In addition to accepted, it can be noted as a success.
line_busy	BOOL	If the station called is busy, TRUE is registered.
no_carrier	BOOL	In case no connection can be established to the station called, TRUE is registered. With GSM this can also mean that the network cannot be accessed or that radio contact is not possible.
error	BOOL	When the M20 module responds with an error message to a PLC command, error is set to TRUE. The error might be a memory, communications or network problem, for example.
timeout	BOOL	The establishment of the connection is being monitored. If no connection is established within 35 seconds, timeout is set to TRUE.

M_CG_ring_FP1

Serves to send an alarm via ring for the PLCs FP1 and FP–M

This function block can be used to send out an alarm. To do so, the PLC calls up a telephone or cellular phone via the M20 module and produces a ring. If the station called answers, a connection is established. The station called hears silence, and simultaneously the M20 receives the message OK, i.e. the station called accepted the call: After one hangs up, the function block acknowledges as success.

The function block is shown below.



Variables

Input variables	Data type	Description
phone_number	ARRAY [1..6] of WORD	The telephone number is transferred to this variable. It can handle up to 12 characters. You should use the function F95 in addition. The entry includes the country code, but neither 00 nor +, i.e. '491716326603' for Germany.
dial	BOOL	Begins dialing and the establishment of the connection.
init_ok	BOOL	Enable signal. Waits for the value True. Initialization sequence was transmitted correctly and M20 was initialized.
pin_ok	BOOL	Enable signal. Waits for the value True, i.e. that the PIN transmission was successful.

Output variables	Data type	Description
active	BOOL	As long as the function block is doing something, active is set to TRUE. Can be used to deactivate other function blocks for this period of time.
accepted	BOOL	Signals the successful establishment of the connection and that the call was accepted at the other end. Thereby it is guaranteed that the station called has been informed about the alarm.
callterminated	BOOL	Signals that the station called has hung up. In addition to accepted, it can be noted as a success.
line_busy	BOOL	If the station called is busy, TRUE is registered.
no_carrier	BOOL	In case no connection can be established to the station called, TRUE is registered. With GSM this can also mean that the network cannot be accessed or that radio contact is not possible.
error	BOOL	When the M20 module responds with an error message to a PLC command, error is set to TRUE. The error might be a memory, communications or network problem, for example.
timeout	BOOL	The establishment of the connection is being monitored. If no connection is established within 35 seconds, timeout is set to TRUE.

M_CG_connect Connecting and disconnecting with GSM

M_CG_connect is a function block for the automatic establishment and release of a connection to a remote station. Data exchange is accomplished in transparent mode via function F144 (one thereby writes directly to the communication interface).

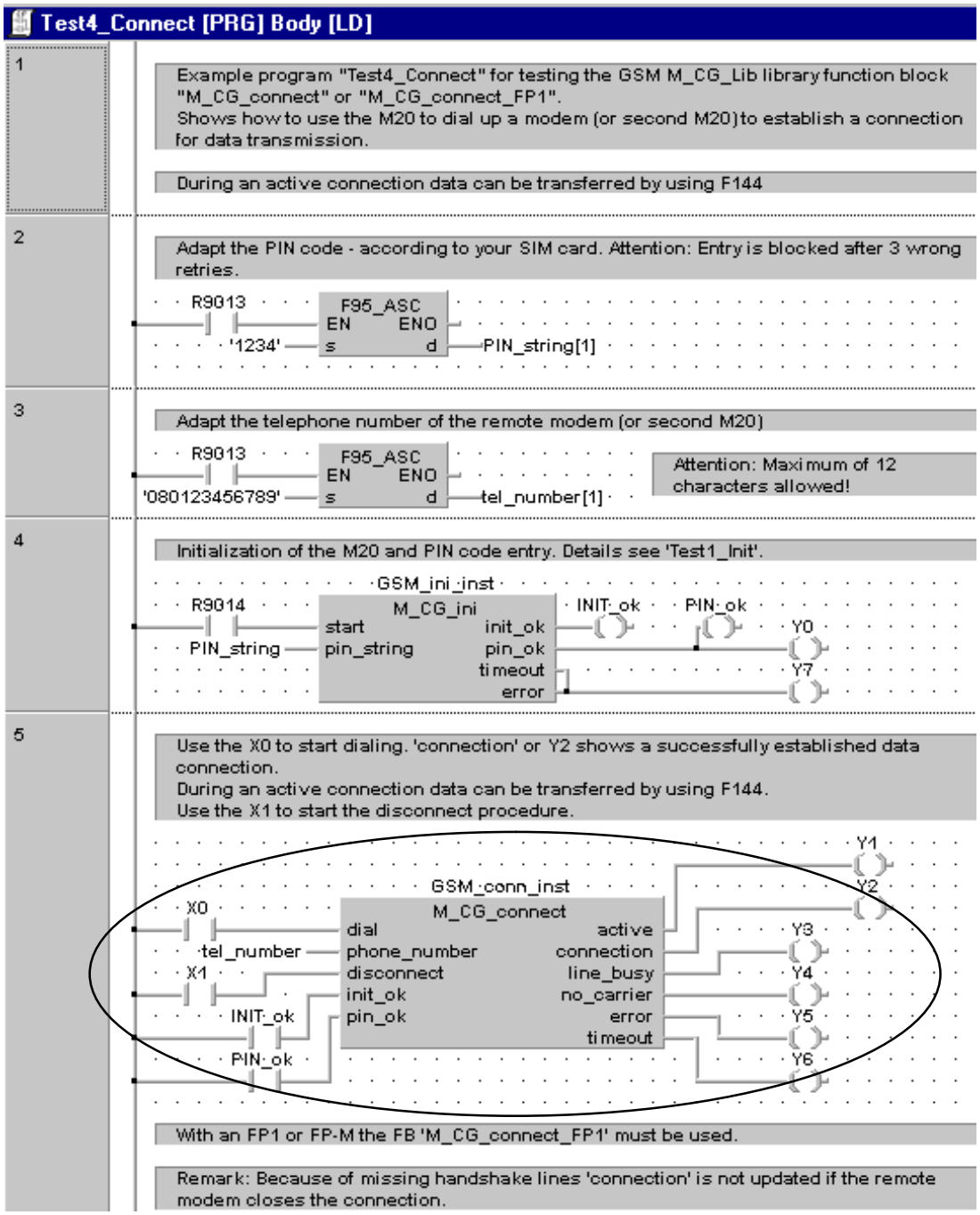
Note

For the use with FP1 or FP–M use the alternative function block M_CG_connect_FP1.

The header and body (function block circled) for a sample program are shown below.

Test4_Connect [PRG] Header

	Class	Identifier	Type	Initial	Comment
0	VAR	PIN_ok	BOOL	FALSE	
1	VAR	INIT_ok	BOOL	FALSE	
2	VAR	id_string	ARRAY [1..12] OF WORD	[12(0)]	
3	VAR	PIN_string	ARRAY [1..6] OF WORD	[6(0)]	
4	VAR	temp	WORD	0	
5	VAR	temp1	WORD	0	
6	VAR	GSM_ini_inst	M_CG_ini		
7	VAR	GSM_conn_inst	M_CG_connect		
8	VAR	tel_number	ARRAY [1..12] OF WORD	[12(0)]	


Test4_Connect [PRG] Body [LD]
1
Example program "Test4_Connect" for testing the GSM M_CG_Lib library function block "M_CG_connect" or "M_CG_connect_FP1".
Shows how to use the M20 to dial up a modem (or second M20) to establish a connection for data transmission.
During an active connection data can be transferred by using F144
2
Adapt the PIN code - according to your SIM card. Attention: Entry is blocked after 3 wrong retries.
R9013
F95_ASC
EN
ENO
'1234'
s
d
PIN_string[1]
3
Adapt the telephone number of the remote modem (or second M20)
R9013
F95_ASC
EN
ENO
'080123456789'
s
d
tel_number[1]
Attention: Maximum of 12 characters allowed!
4
Initialization of the M20 and PIN code entry. Details see 'Test1_Init'.
GSM_ini_inst
R9014
M_CG_ini
start
pin_string
PIN_string
init_ok
pin_ok
timeout
error
INIT_ok
PIN_ok
Y0
Y7
5
Use the X0 to start dialing. 'connection' or Y2 shows a successfully established data connection.
During an active connection data can be transferred by using F144.
Use the X1 to start the disconnect procedure.
GSM_conn_inst
X0
M_CG_connect
dial
phone_number
disconnect
init_ok
pin_ok
tel_number
X1
INIT_ok
PIN_ok
active
connection
line_busy
no_carrier
error
timeout
Y1
Y2
Y3
Y4
Y5
Y6
With an FP1 or FP-M the FB 'M_CG_connect_FP1' must be used.
Remark: Because of missing handshake lines 'connection' is not updated if the remote modem closes the connection.

Variables

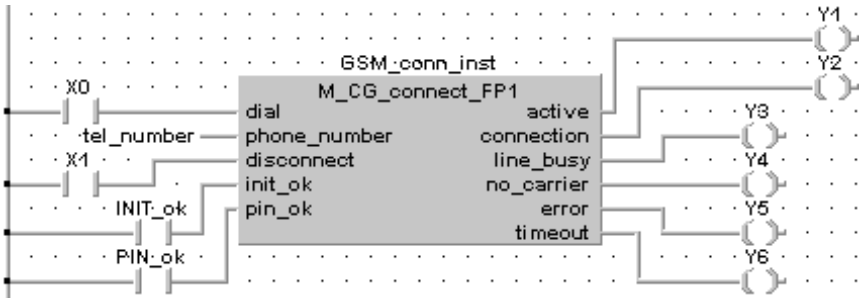
Input variables	Data type	Description
phone_number	ARRAY [1..12] of WORD	The telephone number is transferred with this variable. It can handle up to 24 characters. You should use the function F95 in addition. F95 can transfer 12 characters (6 words) at one time. With a longer phone number, you must use a second F95 (beginning with index 7).
dial	BOOL	Begins dialing and the establishment of the connection.
disconnect	BOOL	Ends connection.
init_ok	BOOL	Enable signal. Waits for the value True. Initialization sequence was transmitted correctly and M20 was initialized.
pin_ok	BOOL	Enable signal. Waits for the value True, i.e. that the PIN transmission was successful.

Output variables	Data type	Description
active	BOOL	As long as the function block is doing something, active is set to TRUE. Can be used to deactivate other function blocks for this period of time.
connection	BOOL	Registers a successfully established connection with TRUE.
line_busy	BOOL	If the station called is busy, TRUE is registered.
no_carrier	BOOL	In case no connection can be established to the station called, TRUE is registered. With GSM this can also mean that the network cannot be accessed or that radio contact is not possible.
error	BOOL	When the M20 module responds with an error message to a PLC command, error is set to TRUE. The error might be a memory, communications or network problem, for example.
timeout	BOOL	The establishment of the connection is being monitored. If no connection is established within 60 seconds, timeout is set to TRUE.

M_CG_connect_FP1 Connecting and disconnecting with GSM for the PLCs FP1 and FP–M

The function block M_CG_connect_FP1 takes care of the automatic establishment and release of a connection to a remote station. Data exchange is accomplished in transparent mode via function F144 (one thereby writes directly to the communication interface).

The function block is shown below.



Variables

Input variables	Data type	Description
phone_number	ARRAY [1..12] of WORD	The telephone number is transferred with this variable. It can handle up to 24 characters. You should use the function F95 in addition. F95 can transfer 12 characters (6 words) at one time. With a longer phone number, you must use a second F95 (beginning with index 7).
dial	BOOL	Begins dialing and the establishment of the connection.
disconnect	BOOL	Ends connection.
init_ok	BOOL	Enable signal. Waits for the value True. Initialization sequence was transmitted correctly and M20 was initialized.
pin_ok	BOOL	Enable signal. Waits for the value True, i.e. that the PIN transmission was successful.

Output variables	Data type	Description
active	BOOL	As long as the function block is doing something, active is set to TRUE. Can be used to deactivate other function blocks for this period of time.
connection	BOOL	Registers a successfully established connection with TRUE.
line_busy	BOOL	If the station called is busy, TRUE is registered.
no_carrier	BOOL	In case no connection can be established to the station called, TRUE is registered. With GSM this can also mean that the network cannot be accessed or that radio contact is not possible.
error	BOOL	When the M20 module responds with an error message to a PLC command, error is set to TRUE. The error might be a memory, communications or network problem, for example.
timeout	BOOL	The establishment of the connection is being monitored. If no connection is established within 60 seconds, timeout is set to TRUE.

M_CG_slave

Network login / Switching to receiving the incoming call while in Slave mode

After a successful initialization (INIT_ok=True) and PIN transmission (PIN_ok=True), the function block switches the COM Port to SLAVE mode. This is the prerequisite to read out data from the PLC via polling (e.g. with the MEWNET–DDE Server) or NAiS Control, or to carry out remote programming with MEWTOCOL commands.

The call can come from an analog, ISDN or another GSM terminal.

Since in this case access to the network may not have been successful after initialization, the function block transmits a command to login to the radio network.

The header and body (function block circled) for a sample program are shown below.

Test5_Slave [PRG] Header

	Class	Identifier	Type	Initial	Comment
0	VAR	PIN_ok	BOOL	FALSE	
1	VAR	INIT_ok	BOOL	FALSE	
2	VAR	PIN_string	ARRAY [1..6] OF WORD	[6(0)]	
3	VAR	GSM_ini_inst	M_CG_ini		
4	VAR	Inst1	M_CG_slave		
5	VAR	set_to_slave	BOOL	FALSE	

Test5_Slave [PRG] Body [LD]

1

Example program "Test5_Slave" for testing the GSM M_CG_Lib library function block "M_CG_slave".
Shows how to use the M20 to wait for incoming MEWTOCOL calls (while the M20 is not sending out a SMS).

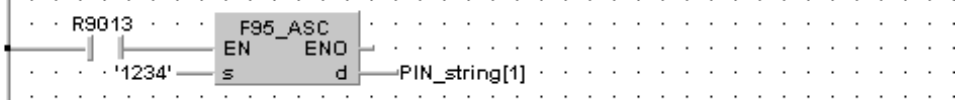
At the time a call from the Master station is received - the M20 automatically establishes a data connect.

During an active connection the Master should set the Online_Flag (R10; see global variables) to inform 'M_CG_slave' about an ongoing MEWTOCOL communication. This results in an active 'in_call' flag which can be analyzed by the user application program.

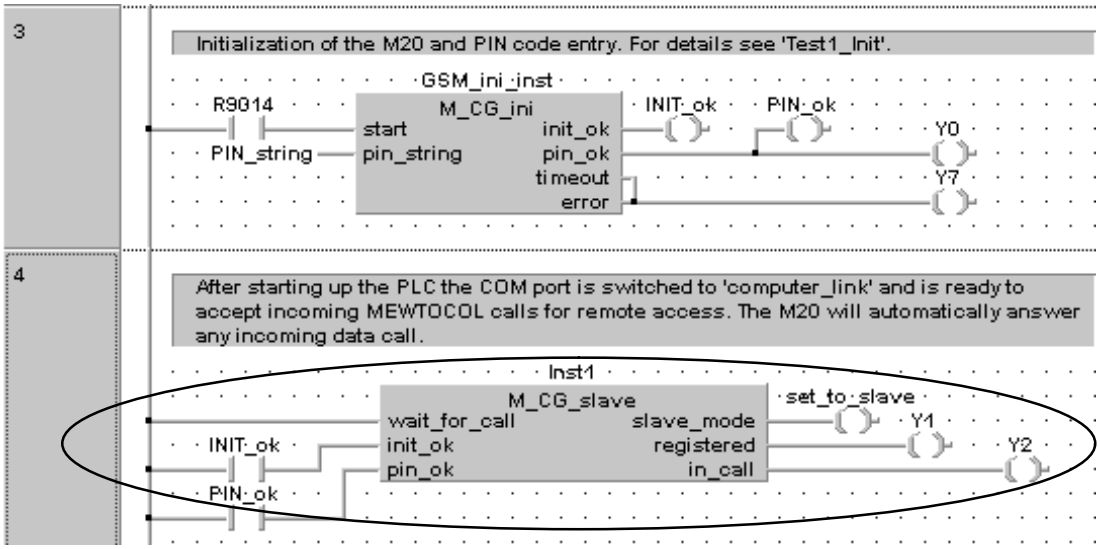
An inactive 'slave_mode' output informs the user application program that the COM port can be used for other, general purpose functions.

2

Adapt the PIN code - according to your SIM card. Attention: Entry is blocked after 3 wrong retries.



4.3 The Function Blocks of the User Library M_CG_Lib



Variables

Input variables	Data type	Description
wait_for_call	BOOL	This input causes the PLC to switch the COM Port to Slave_mode. As long as wait_for_call has the value TRUE, the SLAVE mode is retained. If the input is set to FALSE, the PLC switches the COM Port to Master Mode again.
init_ok	BOOL	Waits for TRUE. Initialization sequence was transmitted correctly and M20 was initialized.
pin_ok	BOOL	Waits for the value True, i.e. that the PIN transmission was successful.

Output variables	Data type	Description
slave_mode	BOOL	Indicates COM Port operation mode: in SLAVE mode TRUE, in MASTER mode FALSE.
registered	BOOL	Indicates if the M20 is registered in the network.
in_call	BOOL	Indicates when there is a call and a connection is established. The boolean variable is assigned to a globally addressed register with the name Online_flag.

M_CG_SMS_Send

Send plain–text messages to mobile telephones via GSM (1–...16–digit reception numbers)

The function block M_CG_SMS_Send can send an SMS to cellular phones that have a 10– to 15—digit telephone number. The function block can be applied universally, however it requires more of the PLC's resources.

If the cellular phone numbers have a fixed length of 11 or 10 numbers then the following alternative function blocks can be used to save memory capacity:

- Function block **M_CG_SMS_Send_11**
- Function block **M_CG_SMS_Send_10**

The additional function block 'IN_String' of the library can be used to find the position of a specific character within a character array. This function is used within 'M_CG_SMS_Send' to calculate the length of a cellular phone number.

The header and body (function block circled) for a sample program are shown below.

Test6_SMS_Send [PRG] Header

	Class	Identifier	Type	Initial	Comment
0	VAR	PIN_ok	BOOL	FALSE	
1	VAR	INIT_ok	BOOL	FALSE	
2	VAR	PIN_string	ARRAY [1..6] OF WORD	[6(0)]	
3	VAR	GSM_ini_inst	M_CG_ini		
4	VAR	GSM_SMS_inst	M_CG_SMS_Send		
5	VAR	tel_number	ARRAY [1..12] OF WORD	[12(0)]	
6	VAR	message	ARRAY [1..55] OF WORD	[55(0)]	
7	VAR	SMS_Gate	ARRAY [1..12] OF WORD	[12(0)]	

Test6_SMS_Send [PRG] Body [LD]

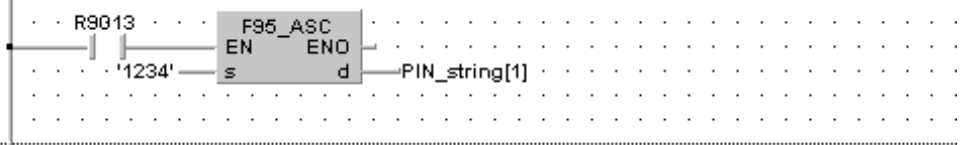
1

Example program "Test6_SMS_Send" for testing the GSM M_CG_Lib library function block "M_CG_SMS_Send".
Shows how to use the M20 to send out SMS messages to a mobile phone (or M20).

The alternative functions "M_CG_SMS_Send_10" and "M_CG_SMS_Send_11" are for fixed number of digits (10 or 11) of the telephone number of the destination mobile phone. The alternative functions need about 220 steps less than the "M_CG_SMS_Send".

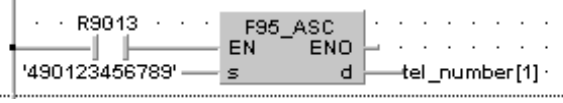
2

Adapt the PIN code - according to your SIM card. Attention: Entry is blocked after 3 wrong retries.



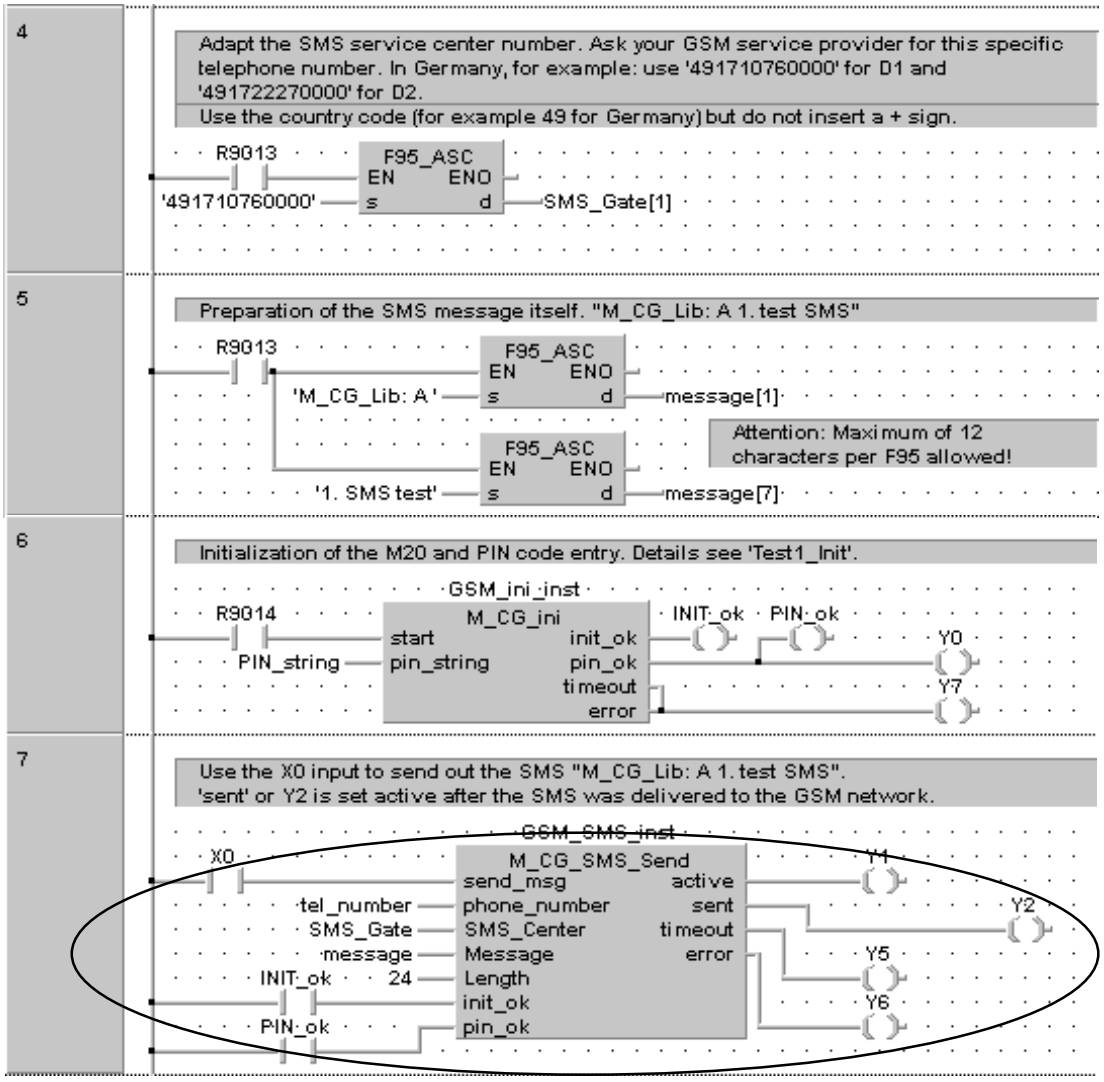
3

Adapt the telephone number (maximum 16 digits) of the destination mobile phone (or M20)
Use the country code (for example 49 for Germany) but do not insert a + sign.



Attention: Maximum of 12 characters per F95 allowed!

4.3 The Function Blocks of the User Library M_CG_Lib



Variables

Input variables	Data type	Description
send_msg	BOOL	Starts the encoding and sending process. One impulse at the input contact is sufficient. The function block only scans for a rising edge.
phone_number	ARRAY [1..12] of WORD	The telephone number of the receiving station is stored in this variable. It has to be declared with 12 words. You should use the function F95 in addition. F95 can transfer 12 characters (6 words) at one time. With a longer phone number, you must use a second F95 (beginning with index 7). The telephone number of the receiver must be a 10– to 15–digit number. For lengths of exactly 10 or 11 digits, you can use the function block M_CG_SMS_Send_11 or M_CG_SMS_Send_10 to save memory.
SMS_Center	ARRAY [1..12] of WORD	The telephone number of the SMS server is stored in this variable. You should use the function F95 in addition. However, you can only transmit 12 characters at one time. Contact your mobile–telephone service center for more details on SMS services. The entry includes the country code, but neither 00 nor +, i.e. ’491710760000’ for D1.
Message	ARRAY [1..55] of WORD	The text message is stored in this variable. You should use the function F95 in addition. However, you can only transmit 12 characters at one time. All together, up to 100 characters can be transmitted.
Length	INT	Here the total number of characters to be sent has to be entered as a whole number.
init_ok	BOOL	Enable signal. Waits for the value True. Initialization sequence was transmitted correctly and the M20 was initialized.
pin_ok	BOOL	Enable signal. Waits for the value True, i.e. that the PIN transmission was successful.

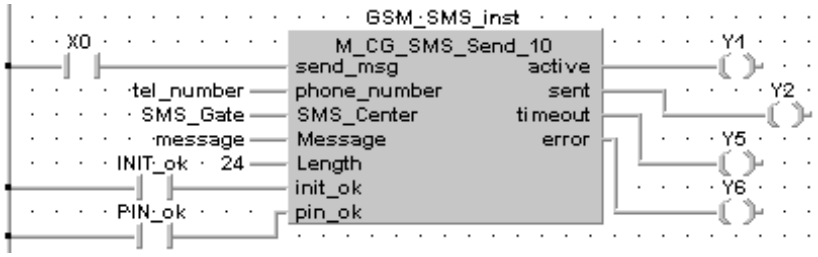
Output variables	Data type	Description
active	BOOL	Is TRUE (1) as long as the function block is working. Used to block other simultaneous access to the M20 module.
sent	BOOL	Signals that the SMS was sent successfully, however not the successful relay of the message! E.g. if the receiver switches off his cellular phone. When no radio contact is possible, the SMS is stored for 48 hours and delivered later.
timeout	BOOL	Becomes TRUE if the modem shows no reaction within 100 seconds. Check the cable and M20’s power LED (must be blinking slowly).

M_CG_SMS_Send_10

Send plain–text messages to cell phones via GSM (10–digit reception numbers) for Switzerland, France and Poland

The function block M_CG_SMS_Send_10 can send an SMS to cellular phones that have a 10–digit telephone number. The function block is functionally identical to M_CG_SMS_Send_11.

The function block is shown below.



Variables

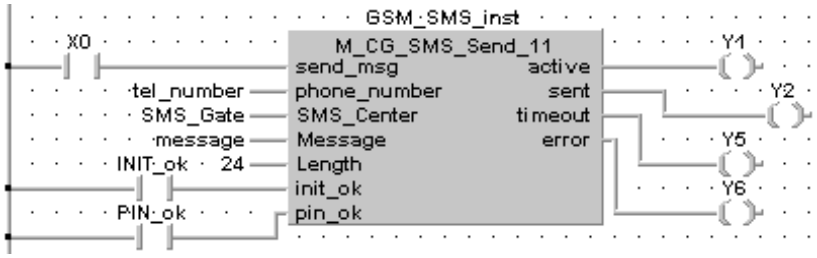
Input variables	Data type	Description
send_msg	BOOL	Starts the encoding and sending process. One impulse at the input contact is sufficient. The function block only scans for a rising edge.
phone_number	ARRAY [1..6] of WORD	The telephone number of the receiving station is stored in this variable. You should use the function F95 in addition. The telephone number of the receiving telephone must have 10 digits. For other lengths, you need to use the function blocks M_CG_SMS_Send_11 or M_CG_SMS_Send. The entry includes the country code, but neither 00 nor +, i.e. ’491716326603’ for Germany.
SMS_Center	ARRAY [1..6] of WORD	The telephone number of the SMS server is stored in this variable. You should use the function F95 in addition. Contact your mobile–telephone service center for more details on SMS services.
Message	ARRAY [1..55] of WORD	The text message is stored in this variable. You should use the function F95 in addition. However, you can only transmit 12 characters at one time. In total, 100 characters can be sent.
Length	INT	Here the total number of characters to be sent has to be entered as a whole number.
init_ok	BOOL	Enable signal. Waits for the value True. Initialization sequence was transmitted correctly and M20 was initialized.
pin_ok	BOOL	Enable signal. Waits for the value True, i.e. that the PIN transmission was successful.

Output variables	Data type	Description
active	BOOL	Is TRUE (1) as long as the function block is working. Used to block other simultaneous access to the M20 module.
sent	BOOL	Signals that the SMS was sent successfully, however not the successful relay of the message! E.g. if the receiver switches off his cellular phone. When no radio contact is possible, the SMS is stored for 48 hours and delivered later.
timeout	BOOL	Becomes TRUE if the modem shows no reaction within 100 seconds. Check the cable and the M20's power LED (must be blinking slowly).
error	BOOL	Becomes TRUE if an error message comes from the M20.

M_CG_SMS_Send_11 Send plain–text messages to cell phones via GSM (11–digit reception numbers)

The function block M_CG_SMS_Send_11 can send SMS to D1 as well as D2 cellular telephones. The special functionality of the M20 module is made use of here.

The function block is shown below.



Variables

Input variables	Data type	Description
send_msg	BOOL	Starts the encoding and sending process. One impulse at the input contact is sufficient. The function block only scans for a rising edge.
phone_number	ARRAY [1..6] of WORD	The telephone number of the receiving station is stored in this variable. You should use the function F95 in addition. This phone number has to be a normal 11–digit number, as they are in Germany. For other reception–number lengths (e.g. in other countries), the function blocks M_CG_SMS_Send_10 or M_CG_SMS_Send have to be used. The entry includes the country code, but neither 00 nor +, i.e. '491716326603' for Germany.
SMS_Center	ARRAY [1..6] of WORD	The telephone number of the SMS server is stored in this variable. You should use the function F95 in addition. Contact your mobile–telephone service center for more details on SMS services. The entry includes the country code, but neither 00 nor +, i.e. '491710760000' for D1.
Message	ARRAY [1..55] of WORD	The text message is stored in this variable. You should use the function F95 in addition. However, you can only transmit 12 characters at one time. In total, 42 characters can be sent.
Length	INT	Here the total number of characters to be sent has to be entered as a whole number.
init_ok	BOOL	Enable signal. Waits for the value True. Initialization sequence was transmitted correctly and M20 was initialized.
pin_ok	BOOL	Enable signal. Waits for the value True, i.e. that the PIN transmission was successful.

Output variables	Data type	Description
active	BOOL	Is TRUE (1) as long as the function block is working. Used to block other simultaneous access to the M20 module.
sent	BOOL	Signals that the SMS was sent successfully, however not the successful relay of the message! E.g. if the receiver switches off his cellular phone. When no radio contact is possible, the SMS is stored for 48 hours and delivered later.
timeout	BOOL	Becomes TRUE if the modem shows no reaction within 100 seconds. Check the cable and the M20's power LED (must be blinking slowly).
error	BOOL	Becomes TRUE if an error message comes from the M20.

M_CG_SMS_Receive

Receive plain–text messages from mobile telephones via GSM

The function block M_CG_SMS_Receive can receive SMS and process signals via the output text. This function can be used, for example, to wait for an answer in case of a disruption and react according to the wishes of the one called. The function was tested to work with 10 (Switzerland) and 11 (Germany) digit telephone numbers.

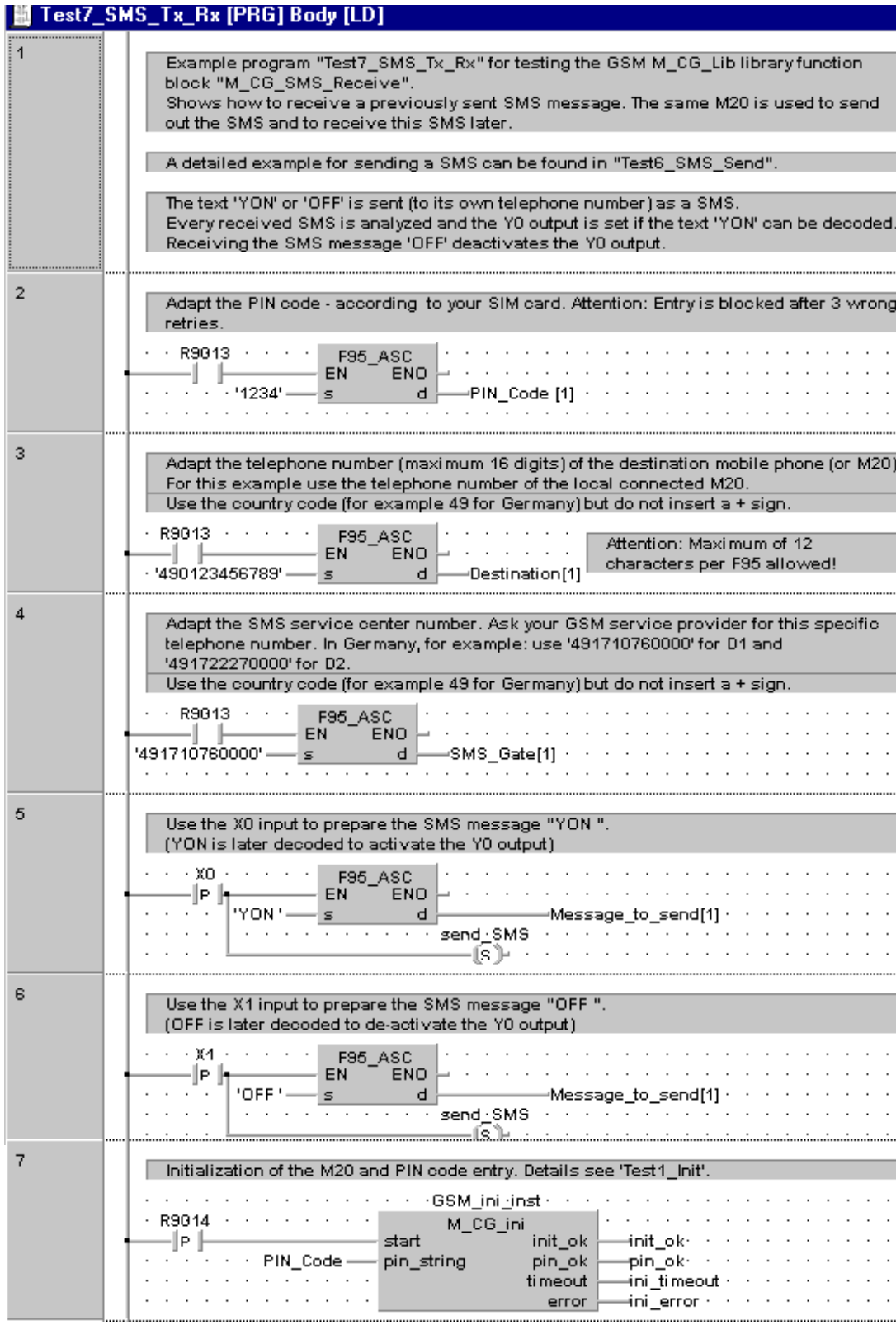
Notes

- **This function block should be enabled (input 'receive') only if no other FB for M20 communication is active! Disable it during use of other M20 function blocks are used. It is generally recommended to only have one M20 FB active at the time.**
- **All SMS messages on the SIM card will be deleted during the first usage with M_CG_SMS_Receive. It is recommended to delete all SMS from the SIM card before use with the M20.**
- **It is also recommended to have no entries stored within the telephone directory of the SIM card. I.e. the telephone book of the SIM card should be empty.**

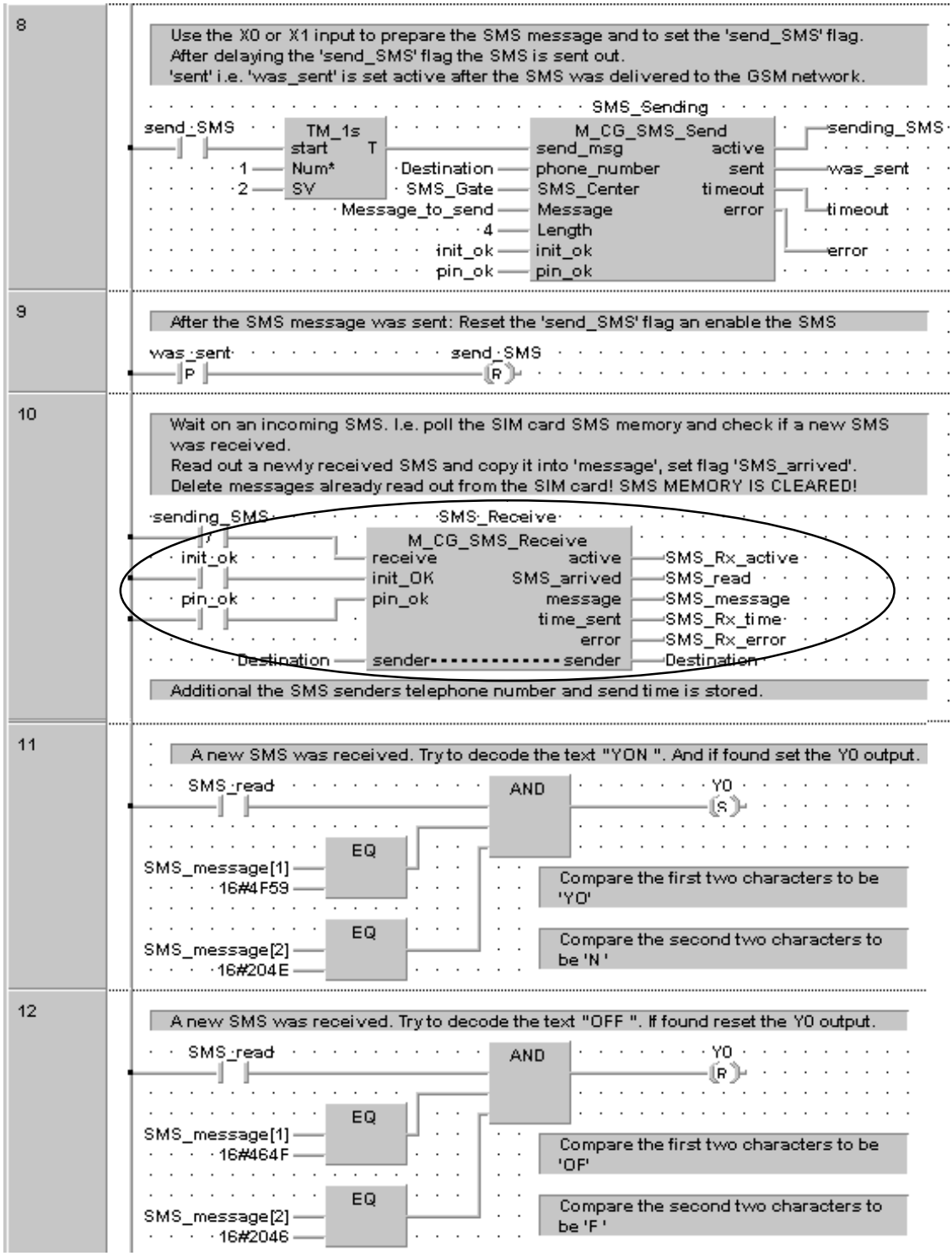
The header and body (function block circled) for a sample program are shown below.

Test7_SMS_Tx_Rx [PRG] Header

	Class	Identifier	Type	Initial	Comment
0	VAR	Destination	ARRAY [1..12] OF WORD	[12(0)]	
1	VAR	SMS_Rx_time	ARRAY [1..6] OF WORD	[6(0)]	
2	VAR	Message_to_send	ARRAY [1..55] OF WORD	[55(0)]	
3	VAR	SMS_message	ARRAY [1..55] OF WORD	[55(0)]	
4	VAR	GSM_ini_inst	M_CG_ini		
5	VAR	SMS_Sending	M_CG_SMS_Send		
6	VAR	SMS_Receive	M_CG_SMS_Receive		
7	VAR	PIN_Code	ARRAY [1..6] OF WORD	[6(0)]	
8	VAR	SMS_Gate	ARRAY [1..12] OF WORD	[12(0)]	
9	VAR	init_ok	BOOL	FALSE	
10	VAR	pin_ok	BOOL	FALSE	
11	VAR	SMS_read	BOOL	FALSE	
12	VAR	SMS_Rx_active	BOOL	FALSE	
13	VAR	SMS_Rx_error	BOOL	FALSE	
14	VAR	ini_timeout	BOOL	FALSE	
15	VAR	ini_error	BOOL	FALSE	
16	VAR	send_SMS	BOOL	FALSE	
17	VAR	sending_SMS	BOOL	FALSE	
18	VAR	SMS_was_send	BOOL	FALSE	
19	VAR	timeout	BOOL	FALSE	
20	VAR	error	BOOL	FALSE	
21	VAR	Instr	R_TRIG		
22	VAR	was_sent	BOOL	FALSE	


Test7_SMS_Tx_Rx [PRG] Body [LD]
1
Example program "Test7_SMS_Tx_Rx" for testing the GSM M_CG_Lib library function block "M_CG_SMS_Receive".
Shows how to receive a previously sent SMS message. The same M20 is used to send out the SMS and to receive this SMS later.
A detailed example for sending a SMS can be found in "Test6_SMS_Send".
The text 'YON' or 'OFF' is sent (to its own telephone number) as a SMS.
Every received SMS is analyzed and the Y0 output is set if the text 'YON' can be decoded.
Receiving the SMS message 'OFF' deactivates the Y0 output.
2
Adapt the PIN code - according to your SIM card. Attention: Entry is blocked after 3 wrong retries.
R9013
F95_ASC
EN ENO
'1234' s d PIN_Code [1]
3
Adapt the telephone number (maximum 16 digits) of the destination mobile phone (or M20)
For this example use the telephone number of the local connected M20.
Use the country code (for example 49 for Germany) but do not insert a + sign.
R9013
F95_ASC
EN ENO
'490123456789' s d Destination[1]
Attention: Maximum of 12 characters per F95 allowed!
4
Adapt the SMS service center number. Ask your GSM service provider for this specific telephone number. In Germany, for example: use '491710760000' for D1 and '491722270000' for D2.
Use the country code (for example 49 for Germany) but do not insert a + sign.
R9013
F95_ASC
EN ENO
'491710760000' s d SMS_Gate[1]
5
Use the X0 input to prepare the SMS message "YON ".
(YON is later decoded to activate the Y0 output)
X0
P
F95_ASC
EN ENO
'YON ' s d Message_to_send[1]
send_SMS
S
6
Use the X1 input to prepare the SMS message "OFF ".
(OFF is later decoded to de-activate the Y0 output)
X1
P
F95_ASC
EN ENO
'OFF ' s d Message_to_send[1]
send_SMS
S
7
Initialization of the M20 and PIN code entry. Details see 'Test1_Init'.
GSM_ini_inst
R9014
P
M_CG_ini
start init_ok init_ok
PIN_Code pin_string pin_ok pin_ok
timeout ini_timeout
error ini_error

4.3 The Function Blocks of the User Library M_CG_Lib



Variables

Input variables	Data type	Description
receive	BOOL	Enable signal. As long as this input is active, the M20 scans its registers for new messages. If a message arrives, this is indicated at output SMS_arrived.
init_ok	BOOL	Enable signal. Waits for the value True. Initialization sequence was transmitted correctly and M20 was initialized.
pin_ok	BOOL	Enable signal. Waits for the value True, i.e. that the PIN transmission was successful.

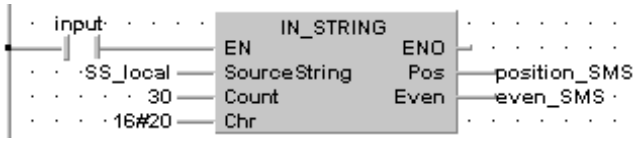
Output variables	Data type	Description
active	BOOL	As long as the function block is doing something, active is set to TRUE. Can be used to deactivate other function blocks for this period of time.
SMS_arrived	BOOL	Signals that a new message was received. With a rising edge an action can be started. Only when the rising edge occurs are the data from output and sender_no valid. The signal goes inactive automatically after about 3 seconds.
Message	ARRAY [1..55] of WORD	The text message is stored in this variable. All together, up to 100 characters can be received.
sender	ARRAY [1..6] of WORD	The message sender's telephone number. With this, security can be built in to hinder abuse. The numbers are stored as a character chain, although the sequence is turned around.
time_sent	ARRAY [1..6] of WORD	Output of the time stamp. Format: TTMMJJSSMMSS e.g. 050399120317 for 05.03.1999 12:03:17
error	BOOL	Becomes TRUE if an error message comes from the M20.

IN_STRING

Recognizes character's position in an ARRAY OF WORD

The function block searches for a character, indicates its position in an ARRAY OF WORD and whether the position is an even number or not. It is used internally by other function blocks, but is nevertheless available, e.g. to evaluate an incoming message text.

The function block is shown below.



Variables

Input variables	Data type	Description
SourceString	ARRAY [1..20] OF WORD	String to be analyzed. Remember to select identical String lengths. If there is a longer string to be analyzed, you have to use F10_BKMV and copy the appropriate section to an additional string to be analyzed.
Count	INT	Indicates the number of characters that the FB analyzes (max. 40).
Chr	HEX	Enter the hexadecimal code of the character to be searched for.

Output variables	Data type	Description
Pos	INT	Whole number result for the position of the String searched for.
Even	BOOL	Indicates whether the position (Pos) is an even number. This is important, for example, when you cannot work word–wise (2 bytes or characters). To work with an odd number of characters, use the function F6_DGT.

4.4 COM Port System Register Settings for M_CG_Lib

In order for the function block to be implemented successfully with the M20 module, the following system register settings for the COM Port have to be employed:

- COM Port interface: General purpose (No. 412)
- Sending data length: 8, Parity: none**,** Stop bit: 1
- COM port terminator (No. 413) depends on the PLC type:
  ETX for FP1 and FP–M
  None for all other
- Sending header: **No STX** (Nr. 413)
- Baud rate: **19200** (No.414)
- Modem connection: **NO** (The setting YES is meant for using the normal telephone modem when doing remote programming via the modem. However, M20 requires a PIN transmission dialog.)
- Receiver memory starting address is **100**, for example, receiver memory length **100**. This occupies the data words DT100–DT199. This area can be moved or its capacity changed at will. However, it has to agree with the entry in the **Global Variable List** and may not lead to overlapping other data areas, such as the send–buffer or compiler options areas.

4.5 Programming Notes on the M_CG_Lib

In order to run an M20 module on a PLC, you always require the initialization function block M_CG_ini. This block takes care of modem initialization, PIN verification and perhaps the transmission.

As with all modems, one differentiates between command and transparent mode. The commands transmit the function blocks as AT commands according to the usual instruction set compatible with the modem manufacturer Hayes. As a user of these function blocks, you need not bother with these commands. The function block M_CG_connect establishes the connection and when successful reports as ”connect”.

Remember to pay attention to the **System Register Settings** of the **COM Port** and the declaration of the **global variables** for the input buffer. Everything else that the function blocks require is described below.

Note

Also ☛ section 1.1, GSM Data Communication.

4.5.1 M_CG_ini and the PIN

First, **M_CG_ini** requires the PIN for its SIM chip card. You transmit this 4–digit number with the help of the **F95 function**.

The PIN_string need not be declared globally, see **M_CG_ini**.

4.5.2 Initialization

The initialization of the M20 module always happens immediately and is therefore not accessible, in contrast to other modem function blocks. That transmitted is:
AT E0 S0=1 +CMGF=1 +CNMI=2,0,0,0,0 <CR>
Furthermore, the settings for M20 require that the text mode for SMS transmission/reception is used and that there is no automatic reception signal, since this would disrupt the PLC at critical moments.

4.5.3 Baud Rate

The M20 is run with a fixed **19200 baud** rate according to V.32. This is important for communication with other modems (e.g. normal telephone modems in the normal network) because these are likewise supposed to be set to the same fixed communication rate.

Normal modems can automatically adjust themselves, but a fixed transmission rate setting is better. With a Matsushita FP modem 14.4 the command is called ATF8, with a KE Logem 928 ATF23. For help, refer to your modem manual. The settings only have to be entered once and can be stored with AT&W.

4.5.4 Preconfiguration Unnecessary

No pre–configuring is necessary with the M20 module! The function block **M_CG_ini** does this.

M_CG_ini and the other GSM function blocks can be directly connected to each other without having to define additional variables.

4.5.5 M_CG_connect, M_CG_SMS_Send, M_CG_ring and String

For the function blocks **M_CG_connect**, **M_CG_SMS_Send** and **M_CG_ring**, the String *phone_number* of the data type ARRAY of WORD is required. The String can handle up to 24 characters. You should use the function F95 for description. With a longer phone number, you must use a second F95 (beginning with index 7).

4.5.6 M_CG_SMS_Send

For the function block M_CG_SMS_Send, the message text is written into the String *Message* of the data type ARRAY of WORD. You should use the function F95 here. All together, up to 100 characters can be transmitted. Enter the number of characters to be sent at the input contact Length.

4.5.7 M_CG_connect

With a rising edge at the input ***dial***, establishing the connection is initiated. The modem dials the telephone number and attempts to attain a data connection to the remote station. During this period, the output ***active*** and can, if necessary, be used to locking purposes to guarantee that no multiple access to COM Port occurs. If the M20 recognizes a busy signal, the out ***line_busy*** is set. If the connection is successful, this can be read at output ***connection***. The opposite case, i.e. when the connection is not successful, is signaled via output ***no_carrier***. In the case the communication between the PLC and modem does not occur properly (e.g. there is a defective cable or the modem is initiated incorrectly), the output ***no_connection*** is not set, i.e. the output ***active*** remains on for a certain period of time.

A connection is properly disrupted via the input ***disconnect***. Because of the prescribed Hayes procedure and considering the time required for the first redial, this step takes a few seconds.

Note

If an established connection is cut off from outside, the function block cannot register this. Therefore it may be necessary to employ a monitoring procedure for the program doing the calling. One practical solution is to periodically set/reset an error flag, which produces, in effect, a kind of ”life check”. If the desired answer/action does not occur, the connection via the input signal *disconnect* is properly disconnected so that a defined initial status returns.

4.5.8 M_CG_slave

The function block **M_CG_slave** is meant to switch the PLC’s COM Port. One differentiates between Master and Slave mode. The output ***slave_mode*** indicates the successful switching of the interface. The controller is ready to carry out external polling, or possibly remote diagnosis or remote programming. Take care that when you switch over to slave mode, no other function blocks are active. It is best to activate the function block via the input ***wait_for_call*** at least 2 seconds after other actions have been completed: e.g. wait 2 seconds after the SMS transmission was confirmed at the sent output.

The output ***IN_CALL*** is related to address R10 and is named ***Online_flag*** (see global variables) in this example. The remote station station has to set this relay via MEWTOCOL. Thereby the successful establishment of the connection after a call is placed is recognized and registered. The address of the ***Online_flag*** can be changed as necessary in the global variable list of the application's program.

Note

The function block M_CG_slave does not access the global variable list of the user library! The register can also be used as a lifecheck if program resets it in intervals and waits for the remote station to set it again with MEWTOCOL.

4.5.9 M_CG_SMS_Send

Here the unique SMS functionality of the M20 module is utilized. Transfer the number of the SMS center via F95 to a variable of the data type ARRAY [0..] OF WORD to the input **SMS–Centers**. For transmitting SMS, always use the function block **M_CG_SMS_Send**. If the phone number length is fixed then the function blocks **M_CG_SMS_Send_10** and **M_CG_SMS_11** can be used.

4.6 Notes on the M_CG_Lib Version 1.0

This section provides observations, notes and update information for the NAiS Control library ’M_CG_Lib’ version 1.00 from MEW (Europe) AG.

4.6.1 M20 Firmware Versions

The ’M_CG_Lib’ is approved to work with the M20 firmware version 2.3. The new M20 firmware versions 3.3 and 4.2 have not yet been tested. In the worst case the newer firmware must be overwritten by version 2.3. Consult your national Matsushita office for current releases, approval notes and the different firmware archives.

4.6.2 Wait Before Using SMS Function Blocks

When the M20 is not connected to the GSM network and is being initialized for the first time with the ’M_CG_ini’ command, you should wait at least 10 seconds before using the SMS function blocks. This is because the M20 needs a few seconds to connect to the GSM network and completely read the SIM card.

4.6.3 The Initialization Function 'M_CG_ini'

Sometimes the initialization of the M20 using the function block 'M_CG_ini' does not work the first time, i.e. the PLC / M20 system is powered up and the 'M_CG_ini' is started, but after a while the 'M_CG_ini' error and/or timeout output is set because the M20 was not completely initialized. The following can help prevent this problem:

Procedure:

1. **Restart the PLC program without switching off the M20**
   — or —
   Start the 'M_CG_ini' a second time if it reports an error
   — or —
   Connect the M20 to a computer, use a terminal program and enter the command AT&FE0&W **before connecting the M20 to the PLC (This needs to be done only one time)**
   — or —
   Use the alternative initialization function 'M_CG_Big_ini' from the 'update' library 'M_CG_UP1.Sul' which can be obtained from your national Matsushita office. This function needs more steps but also restarts the M20 the first time and if it is online or in SMS mode. This function needs about 8 seconds for the M20 initialization.

Note

Refer to the online help of the 'M_CG_Lib' for how to use the test example programs and how to set up the global variable 'receive_buffer'.

4.6.4 SMS Receiving

Normally the 'M_CG_SMS_Receive' function block handles any SMS reception. But under certain conditions you should wait about one minute between receiving SMS messages. If a shorter time between the SMS messages is needed, using a mobile phone to fill up the SIM card's SMS receiving memory completely by receiving short SMS messages is one possible solution. Then delete SMS number 1 only and insert the SIM card into the M20. Thereby the M20 will only have one SMS memory free and the 'M_CG_SMS_Receive' function can delete this much quicker.

4.6.5 Receiving and Sending an SMS with the Same Application

The following precautions must be taken into account if an SMS is to be sent out just after receiving an SMS with the function block 'M_CG_SMS_Receive':

- The function block 'M_CG_SMS_Receive' should never be active at the same time as 'M_CG_SMS_Send'. Only one of these two function blocks may be active at a time!
- After an SMS was received, the 'M_CG_SMS_Receive' needs about 22 seconds to finish its operation. It should not be deactivated ('receive' input set to false) before this time! I.e. after receiving the last SMS, the application must wait at least 22 seconds before switching off the 'M_CG_SMS_Receive' function block. After this the 'M_CG_SMS_Send' function block can be used.
- The best solution would be to re–trigger a 25–second timer by the rising edge of the 'SMS_arrived' output of the 'M_CG_SMS_Receive' function block and to use the 'M_CG_SMS_Send' only if the timer has reached zero.

With the next version of the 'M_CG_Lib' a new function block is planned for sending and receiving SMS 'simultaneously'.

4.6.6 The Telephone Number of the 'M_CG_Ring' Function Block

The following points should also be mentioned regarding the 'M_CG_ring' and 'M_CG_ring_FP1' function blocks:

- Do not use the 'M_CG_ring' with an FP1. Use the 'M_CG_ring_FP1' instead.
- After the call was accepted ('accepted'=1 and 'call_terminated'=1) the user application program has to wait till the 'active' output goes to 0 (zero, false) before releasing the next call.
- The first two characters (country code, 49 or 39 or...) stored in the telephone number array are replaced by a 0 (zero) before the dial command is sent out to the M20. This means, at the time you set up the telephone number array – also in Italy – the leading 0 of the original telephone number must be replaced by a country code. This also means that you cannot call a telephone number outside of the country (of the SIM card).

Example:

Tel.no. in Germany: 08024648222 use 498024648222 for the F95 –-> 08024648222 is dialed.

Tel.no. in Italy: 0456700444 use 39456700444 for the F95 –-> 0456700444 is dialed.

4.6.7 FP2 Initialization Problems

The 'M_CG_Lib' can also be used for the FP2 if the following problem is avoided. For modem/M20 control via COM port, the 'F95_ASC' and the 'F144_TRNS' functions are often used in conjunction with the special relays R9013 and R9014. This construction is also used in the test example programs delivered with the 'M_CG_Lib'. In a test with an FP2 we found out that the R9013 does not seem to operate in one special situation. This FP2 problem can be demonstrated by the following program:

1. The system registers of the COM port of the PLC are set up in 'General' mode and to use a receiving buffer beginning at DT100.
2. In the first cycle (triggered with R9013) a variable is initialized by using the 'F95_ASC' or 'F0_MV' instruction.
3. In the second cycle (triggered by rising edge of R9014) the first character of the initialized variable is sent out to the COM port by using the 'F144_TRNS' function.
4. The external unit which is connected to the COM port echoes the one character back to the PLC.
5. The PLC receives the echoed character and stores it in DT101.
6. In the second cycle the variable which was initialized by the 'F95_ASC' instruction only contains zeros!

With exactly this combination of commands, the FP2 does not initialize the variable in the first cycle. It appears that the R9013 is no longer working correctly. There is no problem with the initialization if:

- an FP0, FP1 or FP10SH is used
- if no external unit is connected to the COM port of the FP2
- if no 'F144_TRNS' command is used
- if the R9014 (with rising edge trigger) is used instead of the R9013.

The problem was only seen with an FP2–C1 software revision 1.09. The problem is solved with FP2 software revision 1.10, which will be released at end of April 2000.

4.6 Notes on the M_CG_Lib Version 1.0

Appendix A

Matsushita Telecontrol Products

A.1 Products and Product Numbers . . . . . A – 3

A.1 Products and Product Numbers

The following table is meant to provide an overview of the telecontrol products Matsushita Electric Works (Europe) AG sells and/or supports.

Telecontrol product	Product number
Analog Modem, Induline IL 14k4	IL14K4–RS232MEW
Modem – FP0 cable – RS232	CAB–MOD–PLC101
Modem – FP1/2/2SH/10SH/M cable – RS232	CAB–MOD–PLC201
MEW analog modem library: M_CM_Lib	NCL–CM–LIB
MEW GSM library: M_CG_Lib	NCL–CG–LIB
PLC – (Analog) Modem Communication manual	ACG–M0136END
PLC – GSM Communication manual	ACG–M0137END
Telecontrol with PLC / TCL Compact catalog	4111 EUEN

A.1 Products and Product Numbers

Glossary

ASCII **A**merican **S**tandard **C**ode for **I**nformation **I**nterchange. A binary code system that defines 128 characters using combination of 0s and 1s.

BUS **B**inary **U**sed **S**ystem.

COM Port 2nd serial interface of a PC or PLC (not all PLCs) that is usually used to connect communications modules, in contrast to the TOOL Port, which is almost exclusively used as a programming interface.

DECT **D**igital **E**nhanced **C**ordless **T**elecommunications.

DTMF **D**ual–**T**one **M**ultiple **F**requency. The formal name given to the touch-tone technology of the telephone pushbutton keypad.

DP **D**ecentralized **P**eriphery.

FMS **F**ieldbus **M**essage **S**pecification.

Global variables are variables (place holders) that can be used by all POUs. They have a defined hardware address. Therefore all variables that are physically available should be defined as global variables in order to prevent multiple access.

GSM **G**lobal **S**ystem for **M**obile **C**ommunication. Worldwide mobile telephone network that allows access between national networks. Nevertheless, the system is not yet available everywhere (e.g. Eastern Europe). Moreover, accessing foreign networks has to be cleared by some network operators.

ISDN **I**ntegrated **S**ervices **D**igital **N**etwork. A digital network standard for telecommunications.

LAN **L**ocal **A**rea **N**etwork.

LCD **L**iquid **C**rystal **D**isplay.

LED **L**ight **E**mitting **D**iode.

MEWTOCOL is a communications protocol between various devices and a Matsushita PLC via a serial interface (TOOL Port or COM Port). NAiS Control also works with this protocol. It permits total access for writing and reading to the PLC.

MODEM Acronym that stands for **Mo**dulator/**Dem**odulator.

Operation mode of a modem in contrast to command mode. The connection has already been established and the modems behave as if they weren't there (transparent). All data sent to the serial data line is sent to the end device (PC or PLC) at the remote station.

PBX **P**rivate Telephone **Ex**change system.

PDU **P**rotocol **D**ata **U**nit. A message of a given protocol that consists of a payload and protocol–specific control information, usually in the header.

PIN **P**erson**a**l **I**dentification **N**umber.

PLC **P**rogramming **L**ogic **C**ontroller.

POU **P**rogram **O**rganization **U**nit.

PPSN **P**ublic **P**acket **S**witched **N**etwork.

PROFIBUS **Pro**cess **Fi**eld **BUS**. Standard for industrial computer networks.

PSTN **P**ublic **S**witched **T**elephone **N**etwork. It is totally analog.

RLP **R**adio **L**ink **P**rotocol. Provides for error security measures along the GSM radio pathway.

RTS 1) **R**adio **T**ransmitting **S**ignal.
2) RS232C handshake signal, **R**equest **T**o **S**end.

SDU **S**erial **D**ata **U**nit.

SIM Card. **S**ubscriber **I**dentity **M**odule card. A small ID card for mobile phones.

Slave mode refers to the mode of operation of the COM interface of the PLC. It is used, for example, to enable external polling of the controller after the successful establishment of a connection, or for remote diagnosis or remote programming. It can be accessed on the PLC via MEWTOCOL.

SMS **S**hort **M**essage **S**ervice. Short message service in plain text to mobile telephones.

Terminators 1) serve as control characters during communication especially for serial connections or interfaces. They indicate that the text block is finished and can now be processed or transmitted. 2) are resistors at the end of a network cabling.

TOOL Port Serial interface of a PLC (not all PLCs) that is usually used for programming.

Transparent communication means that data is fed through a unit without being changed.

User Library can be pictured as a separate POU_Pool where you can store POUs. As a general rule, functions and function blocks are stored there so that they can be retrieved as necessary for other projects, just as you do with FBs and FUNS in the standard libraries.

WDCT **W**orldwide **D**igital **C**ordless **T**echnology.

Yagi is a special unidirectional amplifying antenna.

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Record of Changes

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