Operating Manual

October 2004 - Version 1.84

GSM-1 Module

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1 GENERAL

This GSM-1 unit is a battery-operated module for the remote transmission of sensor data. It has been specially designed for connecting to KELLER data loggers and level sensors. The data is transmitted by SMS, e-mail or fax.

2 USING THE HARDWARE FOR THE FIRST TIME

2.1 Connecting the DCX-22 Data Logger

The DCX-22 data logger can be directly bolted on to the casing of the module (1). To do this, it is first necessary to remove the knurled nut. The O-ring (2) (see Accessories, Product No.: 508610.0024) must be used to ensure a watertight seal between the two components. When the DCX has been bolted on, the knurled nut can be screwed back on and tightened (Figure. 2)

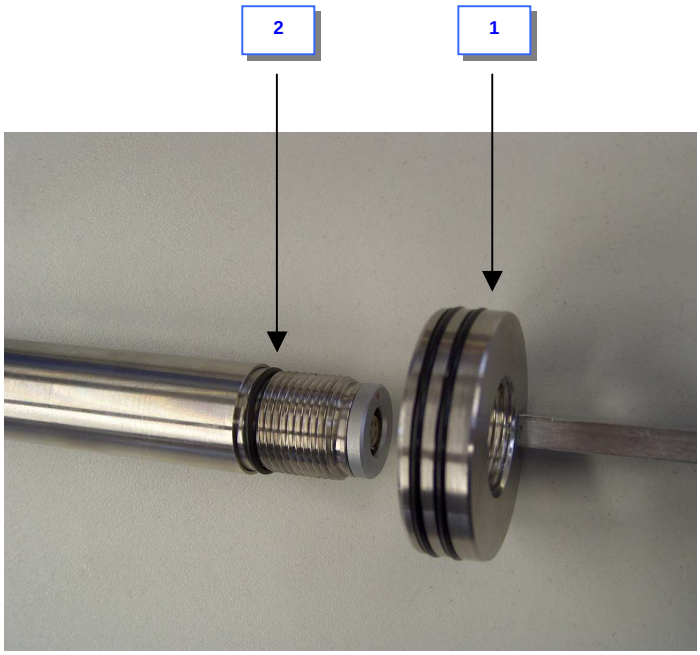
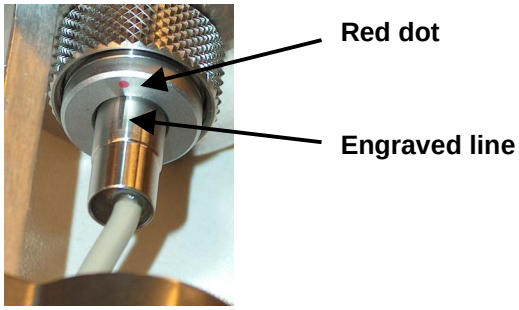


Fig. 1: Connecting the DCX-22 data logger

The data connection is made by means of the Fischer plug connector. In the module, the corresponding connector cable (Accessory No.: 320020.0009) is already connected to the green terminal.

Brown lead :	Terminal A
White lead:	Terminal B

To insert the plug connector, the battery must first be removed from the battery holder. When plugging in the connector, the engraved line on the plug body must be aligned with the red dot on the sleeve terminal (reverse polarity protection).



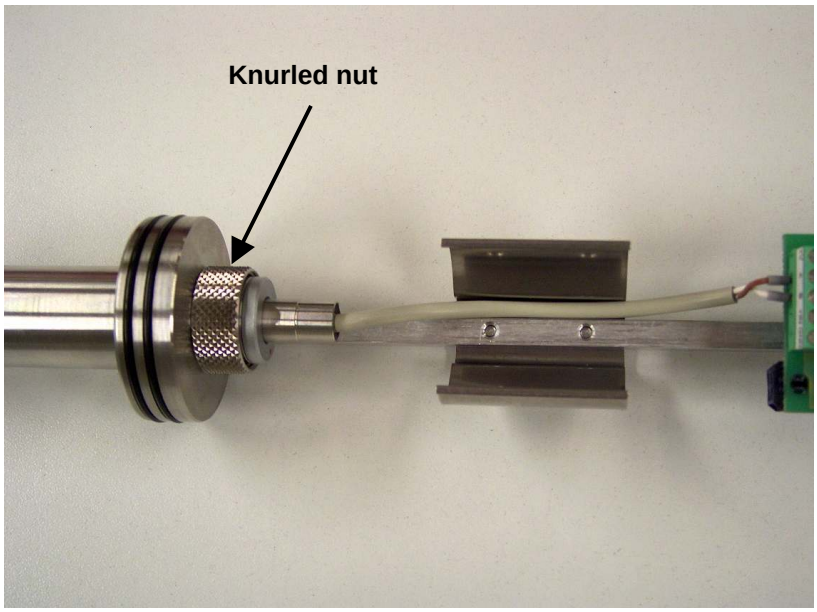


Fig. 2: Data connection to the DCX-22 data logger

2.2 Connecting the Series 30 Level Sensor

To connect a Series 30 level sensor, the adaptor socket (see Accessories, Product No.: 320020.0007) is required. Feed the sensor cable through the sleeve, and connect the relevant cable ends to the terminal strip in accordance with the following arrangement:

blue:	A
yellow:	B
white:	GND
black:	+V

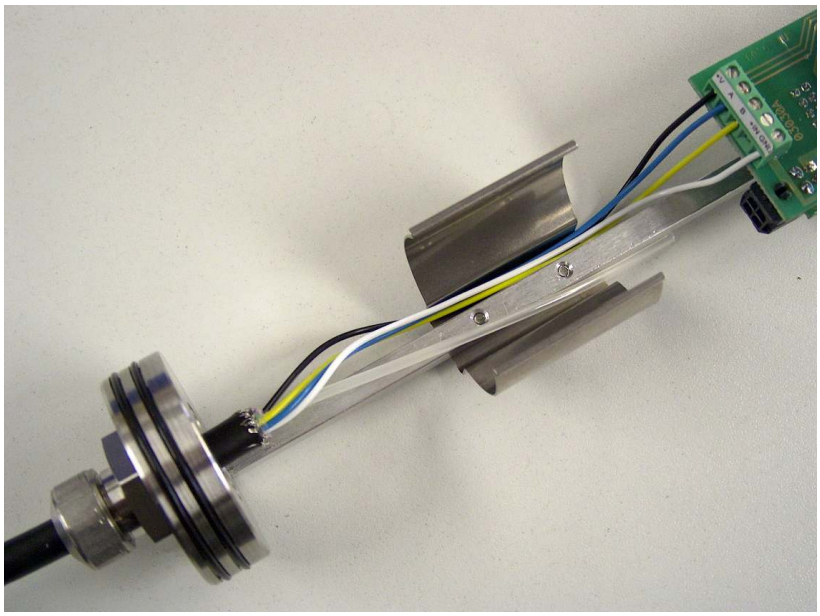


Fig. 3: Data connection to the level sensor

The adaptor sleeve has to be tightened very well with an open-ended spanner, because the whole weight of the level sensor has to be carried by this adaptor sleeve.

If a level sensor with a reference tube is used, the adaptor sleeve with hole (see Accessories, Product No.: 320020.0008) must be used. The hole guarantees that the air pressure inside the case is the same as the air pressure outside the case (pressure equalisation).

2.3 SIM Card

As with a mobile phone, a SIM card is required to transfer data. We recommend the use of a prepaid card. In this way, if the configuration is incorrect, only the amount of credit on the card can be used.
Before starting to use the SIM card, all SMS messages still on the card should be deleted (both sent and received SMS).

Abb. 4a: GSM-1 without SIM interlock

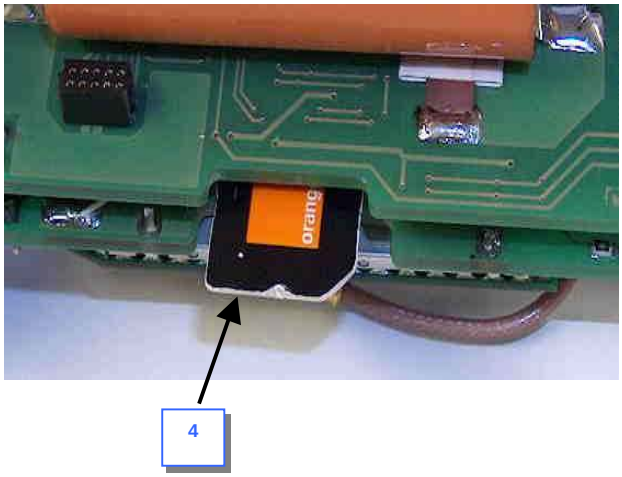
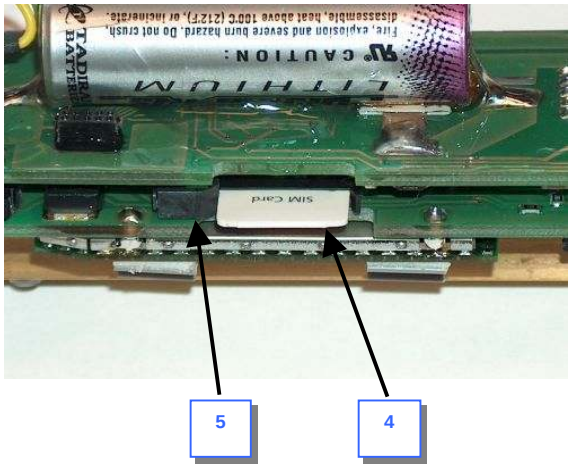


Abb. 4b: GSM-1 with SIM interlock



The SIM card [4] is pushed as far as it will go into the slot which can be found between the two printed circuit boards (check for the gap). The gold contacts on the SIM card must face down. For GSM-1 without SIM interlock the chamfer is on the right hand side, for GSM-1 with SIM interlock [5] the card has to be inserted chamfer first (see Fig. 4a and 4b).

Ensure that there is always sufficient credit on your card. Your telephone provider will tell you about the various possibilities for topping up credit.

2.4 Power Supply

To power the unit, the black four-pole battery plug must be connected to the corresponding socket on the circuit board. Ensure that the plug tab is pointing down (see Fig. 5).

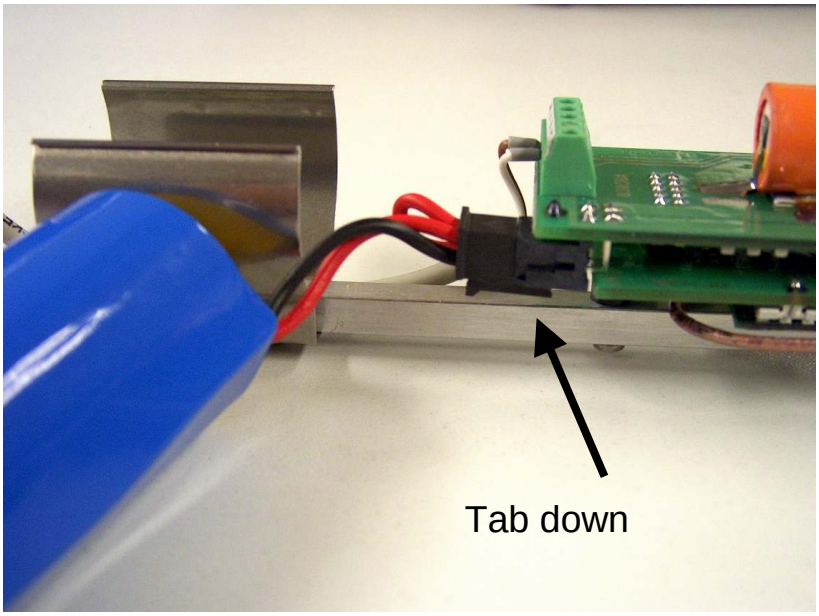


Fig. 5: Inserting the battery

Now push the battery into the battery clip as shown in Fig. 6. The grey cable from the data logger runs in the slot in the battery clip (see also Fig. 2).

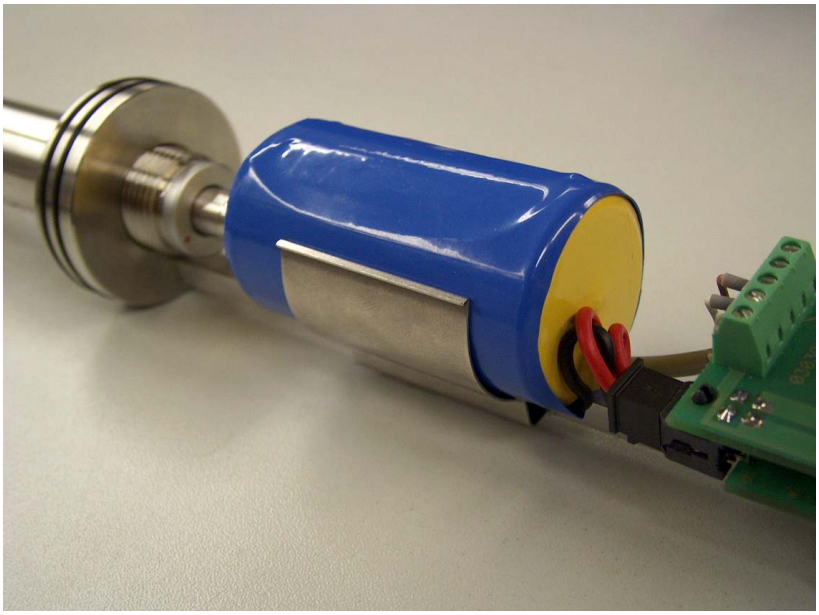


Fig. 6: Inserting the battery

Battery life:

The battery life is greatly dependent on the configuration of the GSM-1: how many SMS messages are sent per week, whether data connections are made, etc. A total of around 3,000 SMS messages can be sent with one battery, or 30 hours data connection used. New batteries can be ordered from KELLER AG (see Accessories, Product No.: 557005.0012).

2.5 Flat Antenna

Either the supplied flat antenna (see Accessories, Product No.: 320020.0004) or any other antenna with an SMA connection can be used.

If you wish to use the flat antenna, we advise you to first completely unscrew the cover, using an Allen key. This allows the upper part and lower parts of the cover to be prepared separately. The antenna cable on the upper part of the cover is now fed through the conduit gland (6), two washers (7) and the seal (8) into the inside of the unit and pressed into its counterpart piece (9) until it engages.

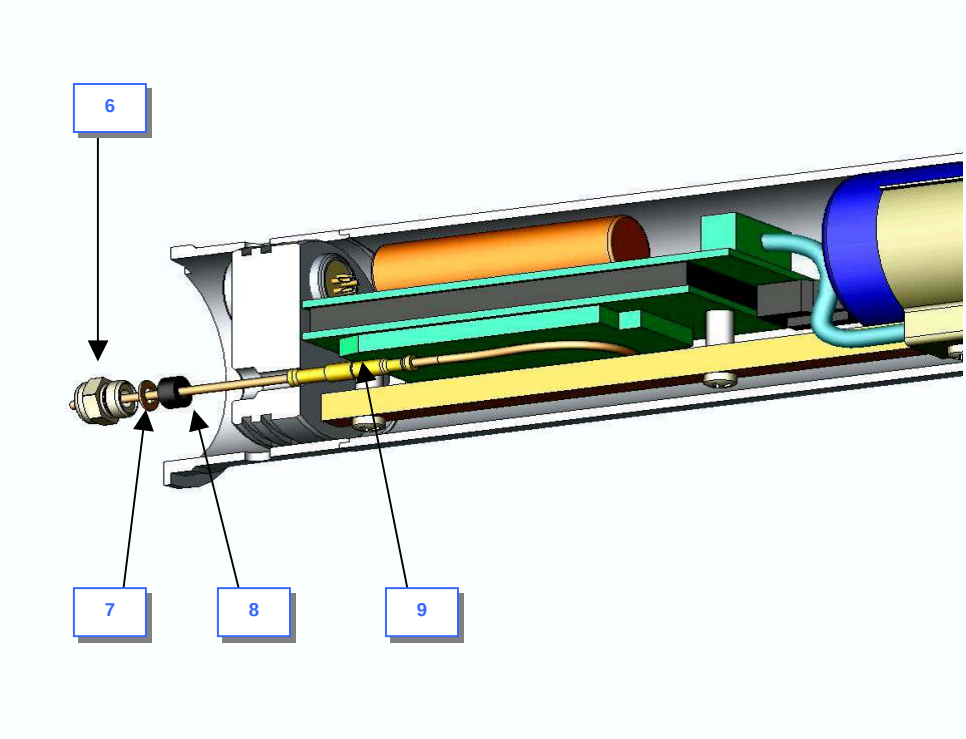


Fig. 7: Connecting the flat antenna

Please ensure that the conduit gland is properly screwed in, to ensure that no water penetrates into the inside of the unit. The conduit gland must be properly tightened.

Use the cable clip to secure the plug (Fig. 8).

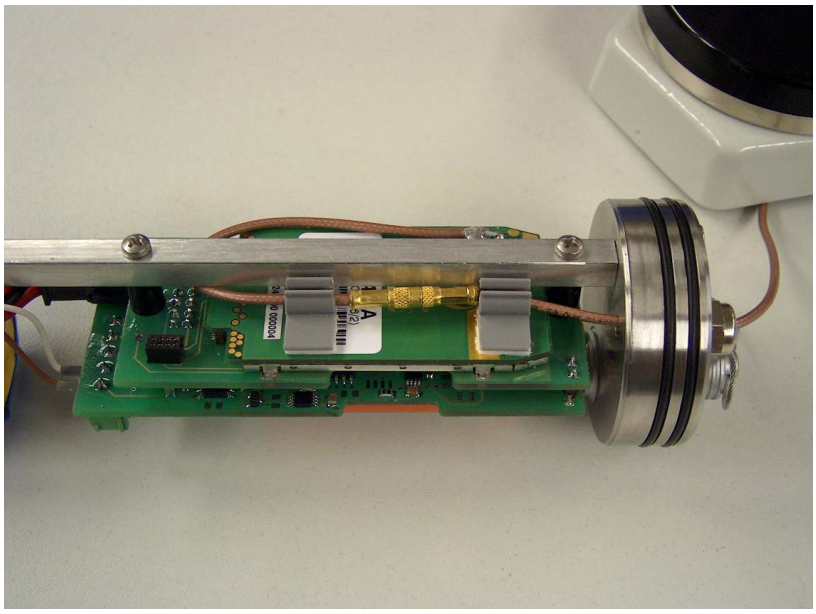


Fig. 8: Securing the antenna cable

A bag containing silicate desiccant is used to protect the sensitive electronics from humidity. Push this bag together with the GSM module into the sleeve. Ensure that the holes (10) on the top of the casing are completely visible. These are provided to allow water to drain off, so that it does not collect inside the unit.

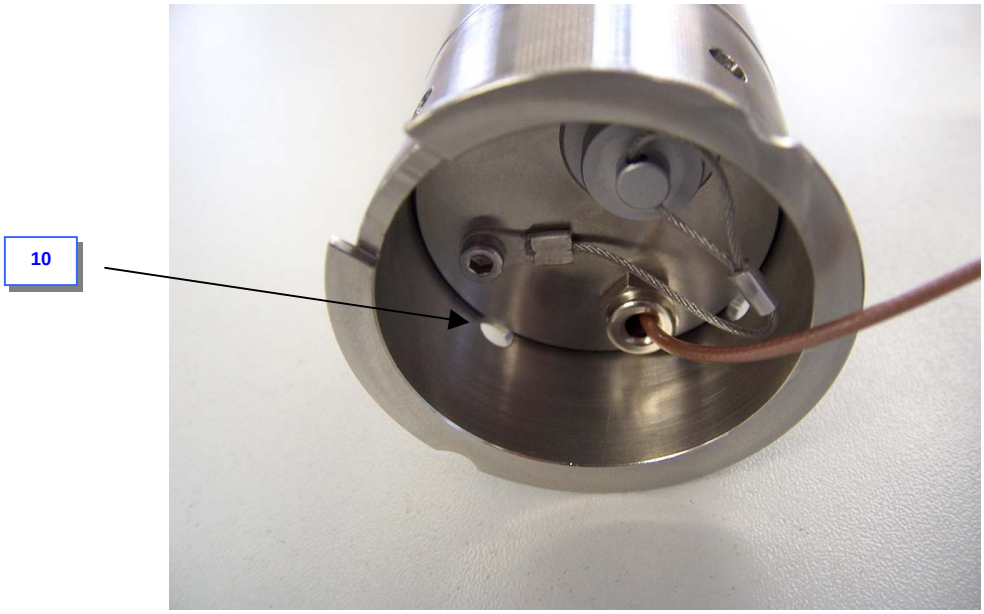


Fig. 9: Fitting the GSM-1 module in the sleeve

The bottom part of the cover is fitted at the installation site. The module can now be installed, together with the appropriate sensor, at the measuring point, and secured in place by screwing on the upper cover.

2.6 Antenna for SMA Connection

This can be connected by means of the supplied adapter cable (see Accessories, Product No.: 320020.0006).

It is also possible to use a stub antenna (see Accessories, Product No.: 320020.0003). If the adapter cable is used, this should be protected by means of the supplied shrink sleeve. The small shrink sleeve is pulled over the rear part of the SMA plug, and the large shrink sleeve over the entire connection (see Fig. 10). The shrink sleeves are now heated uniformly with a hot-air gun. This protects the unit from the ingress of dirt and moisture.
To feed the plug on the other end of the cable into the unit, first unscrew the conduit gland from the unit (see installation of the flat antenna).

The GSM module is then pushed into the sleeve (see installation of the flat antenna).

If it is now necessary to configure the pressure transmitter (level adjustment), this can be done directly with the converter cable via the plug on the GSM-1. The data is transmitted from the GSM module direct to the pressure transmitter.

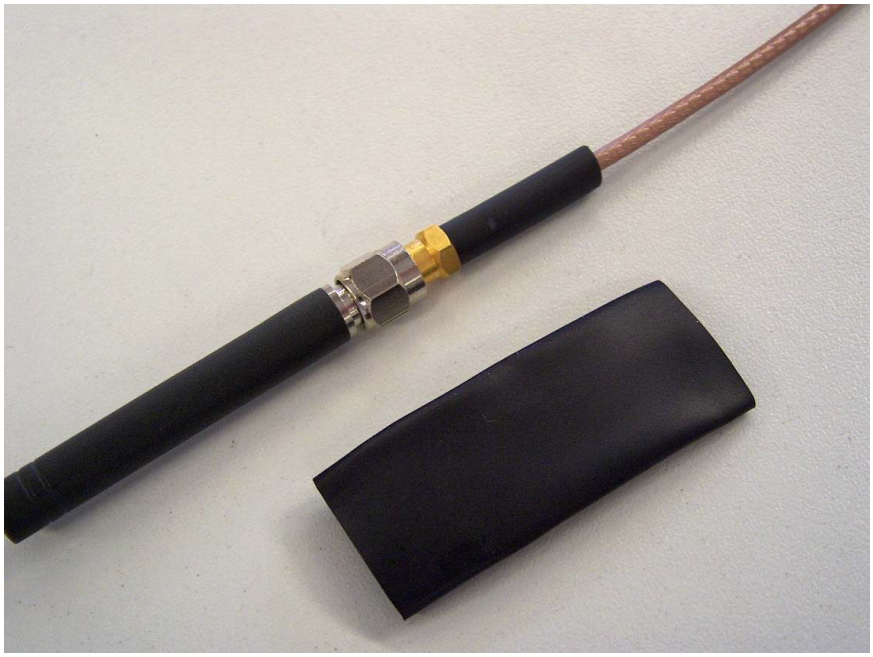


Fig. 10: Connection of the stub antenna

3 CONFIGURATION OF THE MODULE

3.1 General Settings

The GSM-1 can be configured at any time. To carry out the configuration, plug the battery into the module and connect it to your PC via the K-103A or K-104A converter.

☞ **ATTENTION:**
Once the module has been configured, it must not be disconnected from the power supply. This would result in the loss of parts of the configuration!

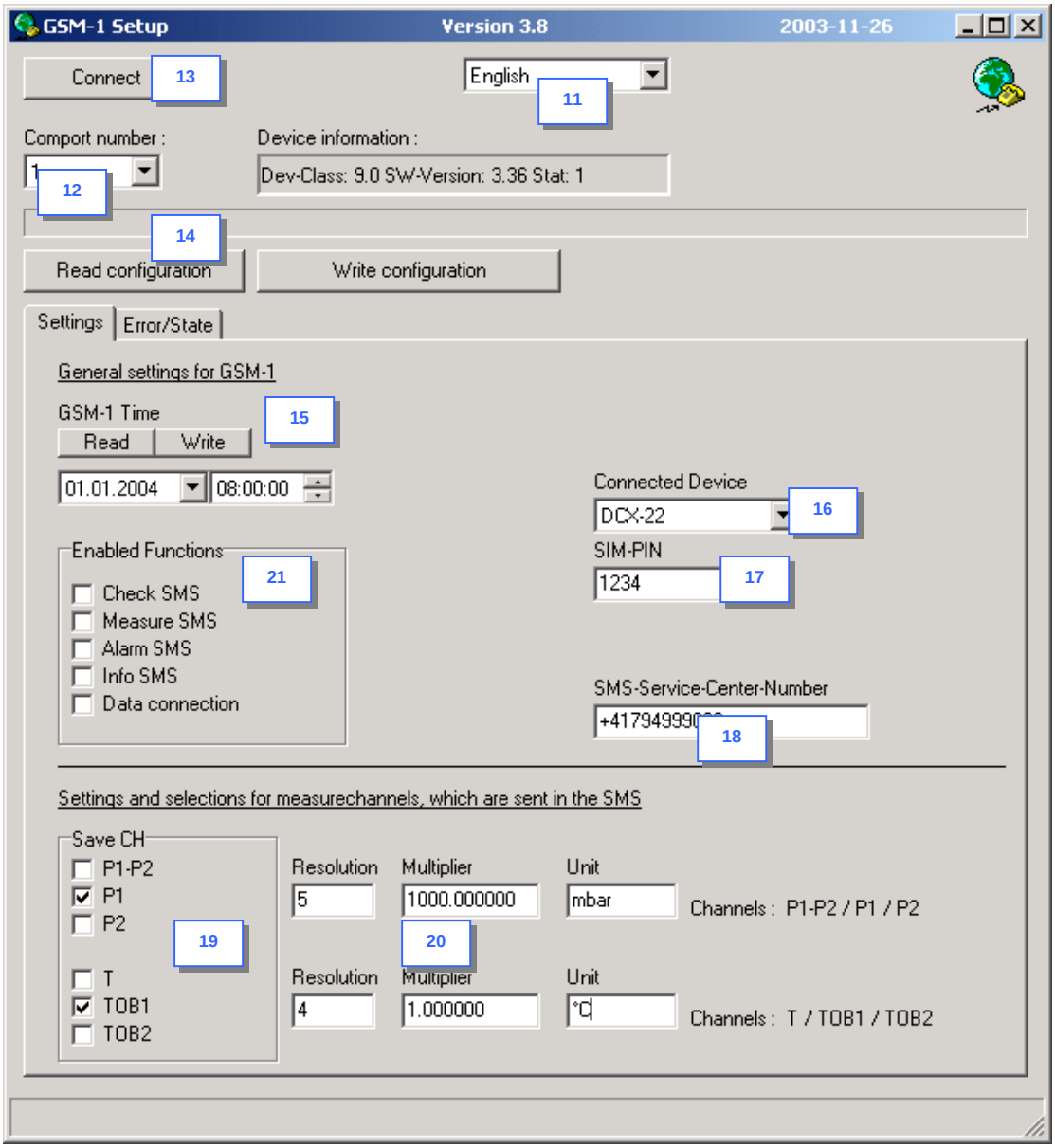


Fig. 11: Configuration

The following information on the “Settings” register card is essential for configuring the unit. To configure the unit, start up the configuration software: “GSM-1 Setup” and click through the options.

11 This is used to select the language.

12 *Comport number*:
This is used for determining the serial port to which you have connected the module via the converter

13 *Connect:*
When this button is pressed, the module is automatically recognised. If it is not recognised, the message *Communication error* is displayed.

14 *Read configuration:*
Press this button to read the current configuration.

15 *GSM-1 time:*
This is used to set the current date and time. Press the *Write* button to save these values in the GSM-1. Attention: these values are lost if the power supply is disconnected! To read the current time in the GSM, press *Read*.

16 *Connected device*:
This is used to select the connected measuring device. The GSM-1 can be connected to a DCX-22 or a Series 30.

17 *SIM PIN*:
If your SIM card is protected by a PIN, enter the PIN at this point.

18 *SMS-Service-Center-Number:*
Enter the telephone number of your telephone company's SMS center here. SMS messages cannot be sent without this number!

19 *Save CH:*
This is used to highlight the channels, from which you wish to save the values. **The values will be received in an SMS in listed order.** The exception is the Info-SMS, where **all** values will be sent.

20 *Channel resolution:*
The resolution is set as standard for five-character pressure values and four-character temperature values. The decimal point is counted as a character.

Channel multiplier:
This is used to enter a factor for other units. The unit [bar] is pre-entered as standard for pressure values. To change the unit to [mbar], the factor must be set at 1,000 (1 bar = 1,000 mbar). This arrangement allows the creation of individual units, such as may occur due to different liquid densities.

Channel unit:
This unit is dependent on the factor: e.g. [mbar] for pressure or [℃] for temperature.

21 *Enabled functions:*
Click on the various options to add the relevant register cards to the user interface. The corresponding settings can then be made via the relevant register cards (see Fig.: 12).

3.2 Example Working Settings

The following example is intended to illustrate the settings that are required to allow the unit to carry out two measurements every day and transmit the measured data by SMS. In addition, a check is to be made every day at 8.30 a.m. for whether the GSM-1 has received any commands via SMS.

- ***Settings*** **register card: see also the above explanations**

21 *Enable functions:* Highlight the *"Check SMS"*, *"Measure SMS"* and *"Data connection"* functions. The relevant register cards can now be selected.

- ***Check SMS*** **register card: (to check for received commands)**

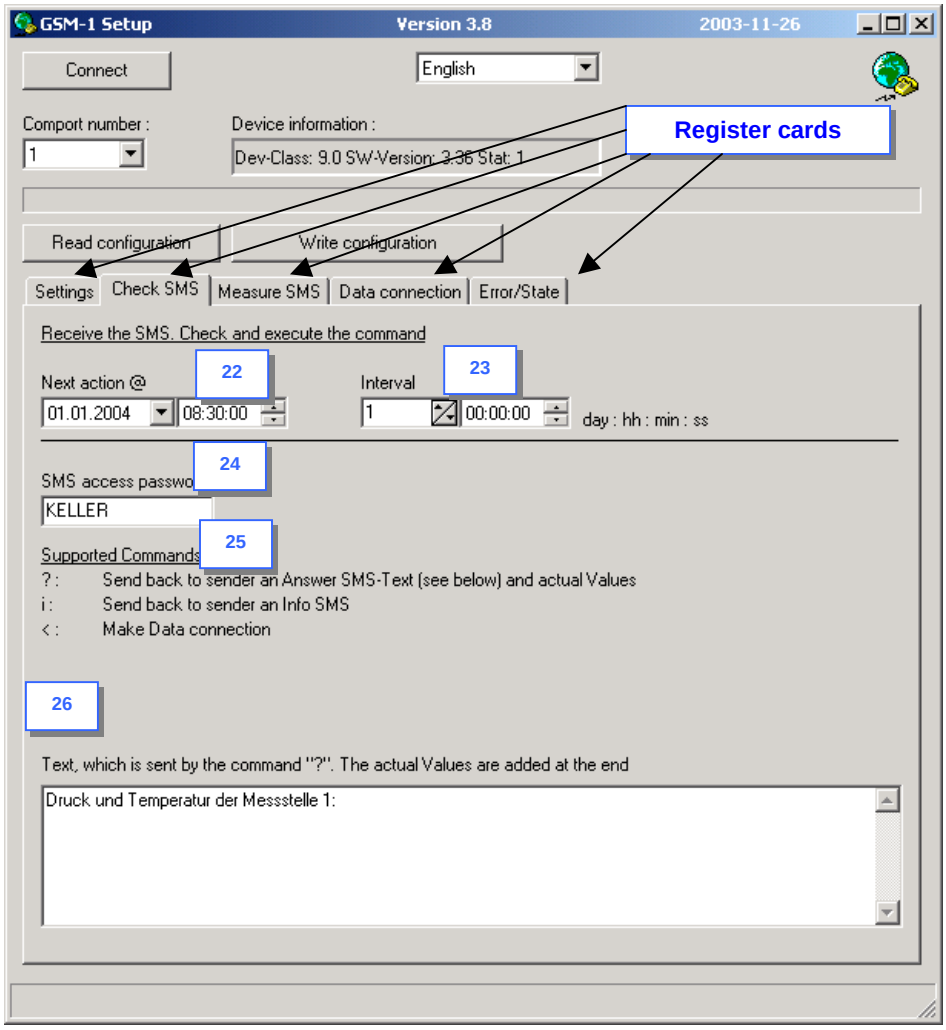


Fig. 12: Check SMS register card

22 *Next action:*
Enter the date and time when an SMS is to be accessed the first time, e.g. 8.30 a.m. (08:30:00)

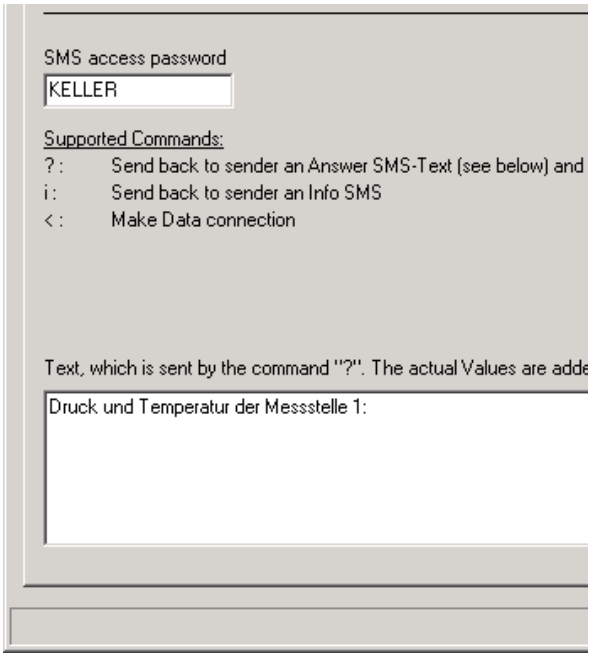
23 *Interval*:
Enter the time interval at which the messages are to be accessed (e.g. 1 day).

24 *SMS access password*:
If you enter a password here, only those messages will receive a reply which begin with this password (case sensitive!). It is advisable to use a password, as otherwise replies will also be sent to SMS messages from the provider (e.g. SMS charges and advertising SMS messages).

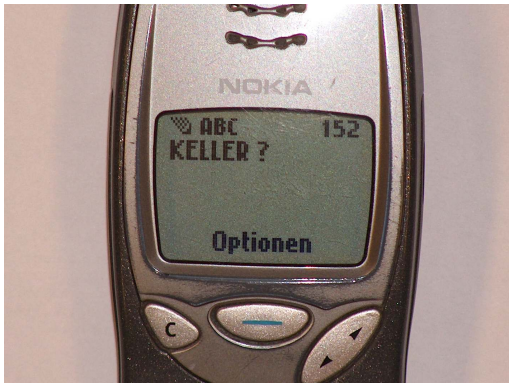
25 *Supported Commands*:
An instruction is a character. If this character is transmitted from any mobile phone to the GSM module, the GSM module carries out the corresponding task. For example, if an SMS, with the text “password i”, is sent to the GSM-1 telephone number, then the next time the SMS messages are accessed, the module returns an SMS with the current measured values to the sender (in this case, “password” stands for any password to be freely selected by the user. This is entered in the *SMS access password* field.).

26 *Text, which is send by the command “?”*: This text is sent as a reply SMS. The current measured values are automatically appended to this text.

Configuration with password “KELLER” and reply text:



Query with password and command “?”:



Reply to query. Pressure (in mbar) and temperature with positive/negative sign separately:

Measure SMS register card: (for transmission of the data)

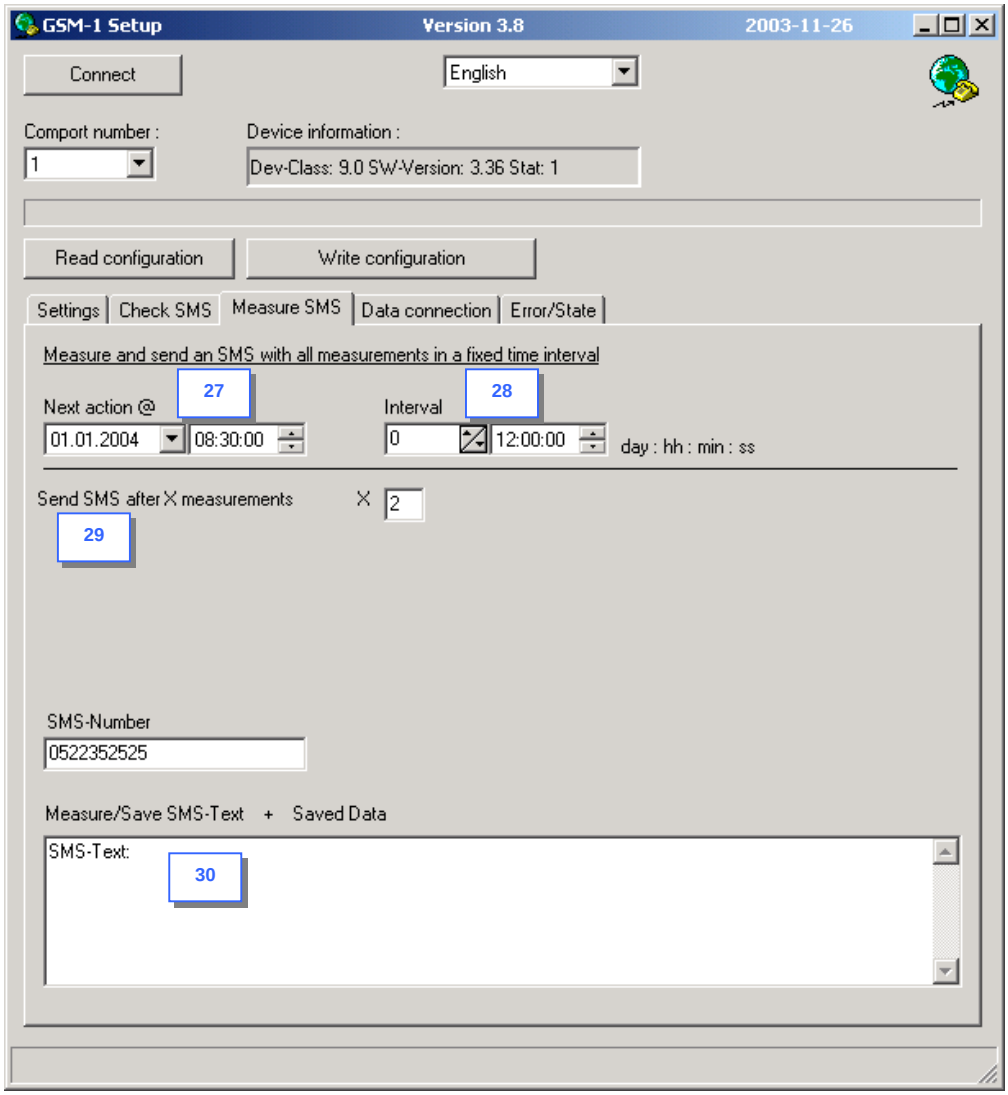


Fig. 13: "Measure SMS" register card

27 *Next action:*
Enter the time for the first measurement.

28 *Interval:*
Enter the time interval at which the measurement is to be repeated (e.g. 12 h)

29 *Send SMS after X measurements:*
After how many measurements an SMS is to be sent with the measured data (e.g. 2)

30 *Measure/Save SMS-Text + Saved Data:*
The text entered here is placed at the start of the SMS message.

- ***Data connection*** **register card**

ATTENTION:
These settings must be made to allow a query to be made via a data connection, using *Check SMS.*

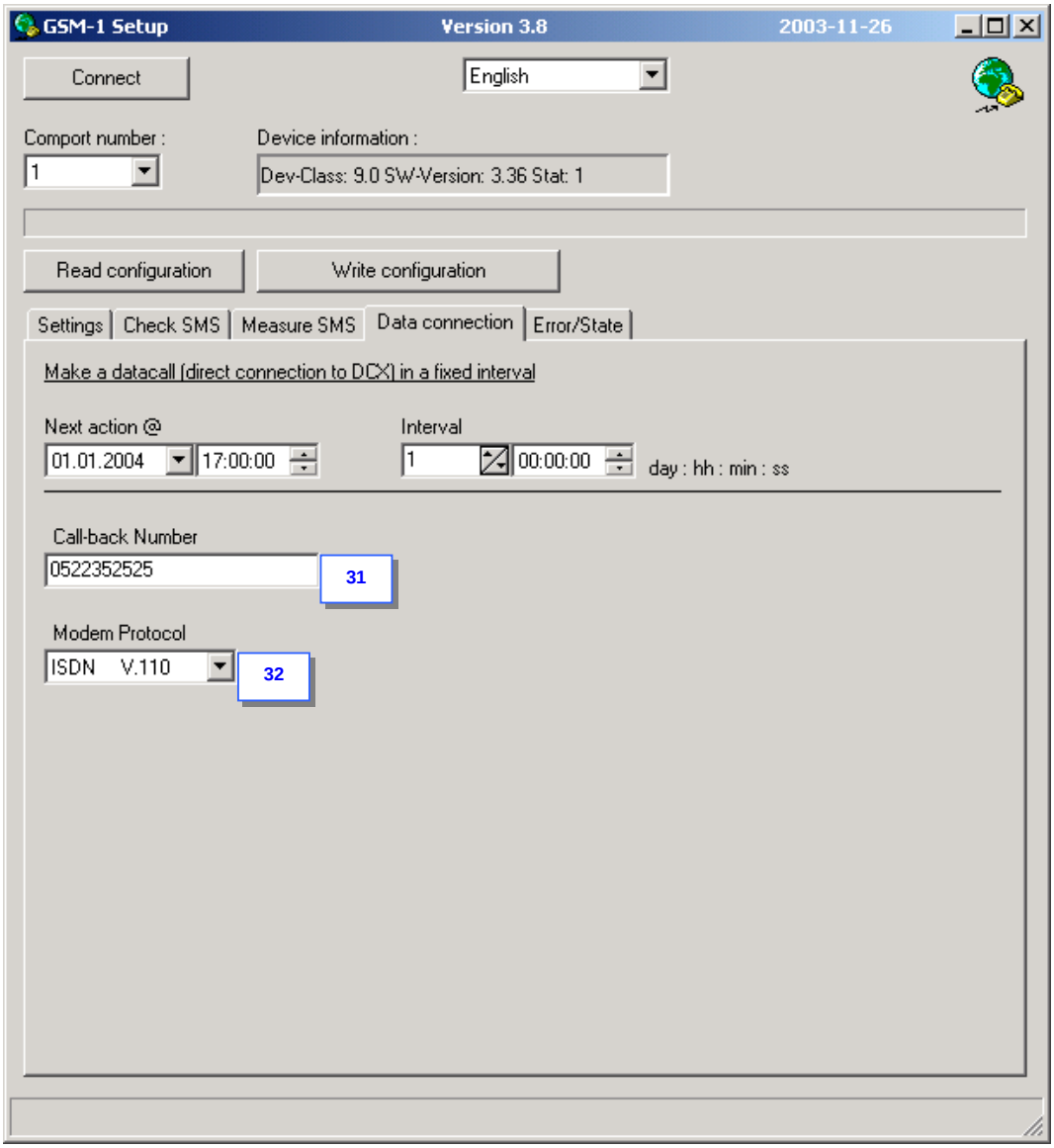


Fig. 14: "Data connection" register card

31 *Call-back Number:*
Enter the number of the modem which you wish to contact.

32 *Modem Protocol:*
The data protocol used by the called modem.

When you have completed this, return to the *Settings* register card:
Under *Enable functions* delete the flag of *Data connection*. Finally, press *Write configuration*.
The settings are now written to the unit. The required configurations are made, and the GSM-1 is set to working mode.

3.3 Remaining Configurations

The remaining configuration possibilities, which were not included in the above example, are explained below.

- ***Settings*** **register card** (see Fig. 11)

21 *Enable functions:*
Highlight all functions.

- ***Alarm SMS*** **register card**

This is used for defining an alarm condition. When this occurs, an SMS is sent. The alarm condition can result from values in excess of or below a particular measured value or from a defined change of a parameter (pressure or temperature).

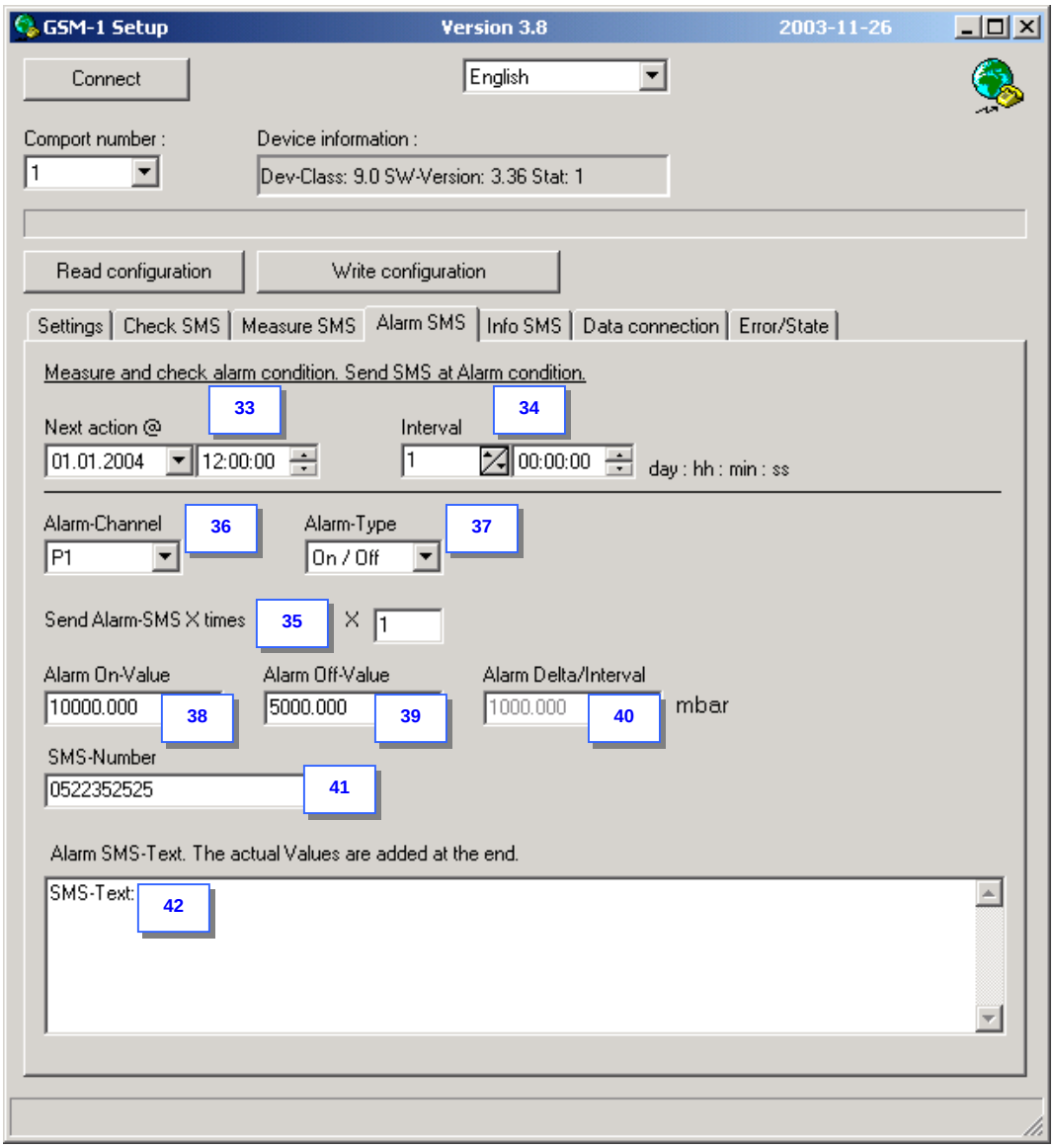


Fig. 15: "Alarm SMS" register card

33 *Next action:*
Enter the time when the alarm condition is to be checked for the first time.

34 *Interval:*
Enter the time interval at which the channels are to be measured and the alarm condition checked.

35 *Send Alarm-SMS X times:*
How often an SMS message is to be sent when the alarm condition occurs (only with On/Off alarm)

36 *Alarm-Channel:*
Enter the channel which is to be checked.

37 *Alarm-Type:*
On/Off hysteresis or value change (Delta/time: pressure or temperature change between two measurements)

38 *Alarm On-Value:*
With the On/Off type of the switch-on value in the unit specified in *Settings* (only with On/Off alarm)

39 *Alarm Off-Value:*
With the On/Off type of the switch-off value in the unit specified in *Settings* (only with On/Off alarm)

☞ **If the switch-on value is greater than the switch-off value, the alarm is triggered when the switch-on value is exceeded.**
If the switch-off value is greater than the switch-on value, the alarm is triggered when the signal falls below the switch-off value.

40 *Alarm delta/interval:*
The minimum value by which a parameter must have changed since the last alarm measurement to trigger the alarm. The parameter must be specified as a positive value. This value then applies both to positive and negative changes by this amount.

41 *SMS-Number:*
Number of the mobile phone to which the alarm SMS is to be sent.

42 *Alarm SMS-Text:*
The text to precede the measured values

- ***Info SMS*** **register card**

The info SMS is used to transmit the antenna signal strength (range: 0 – 31, with 31 representing maximum reception), battery capacity and all measured values.

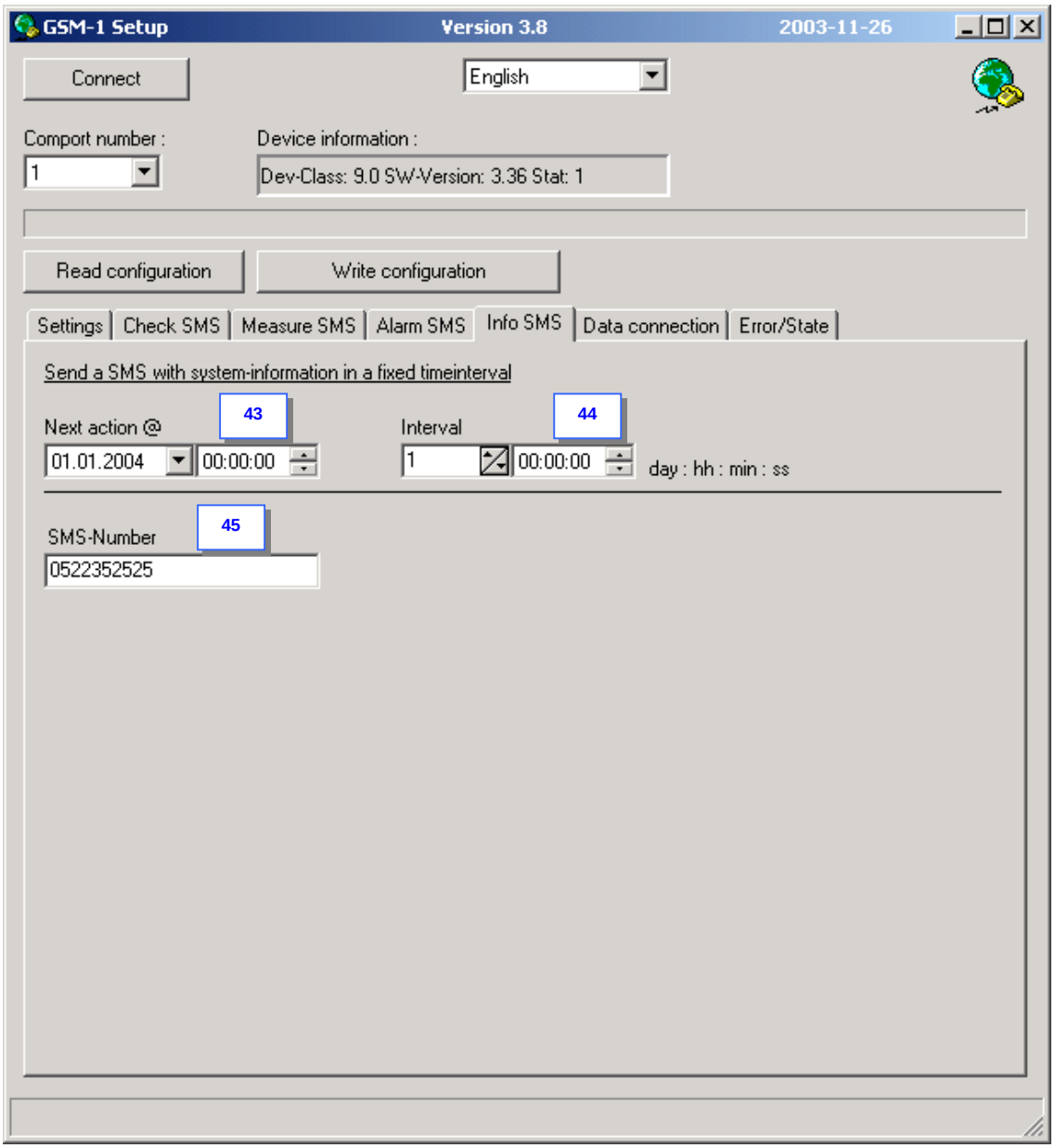


Fig. 16: "Info SMS" register card

43 *Next action:*
Enter the time when the first info SMS is to be sent.

44 *Interval:*
The time interval at which info SMS are to be sent.

45 *SMS-Number:*
The mobile phone number to which the SMS is to be sent.

- ***Data connection*** **register card**

This function is used to make a data connection between a PC and the operating module, allowing direct communication with the connected sensor. A modem is required for this purpose. Further information can be found under “Data Connection”.

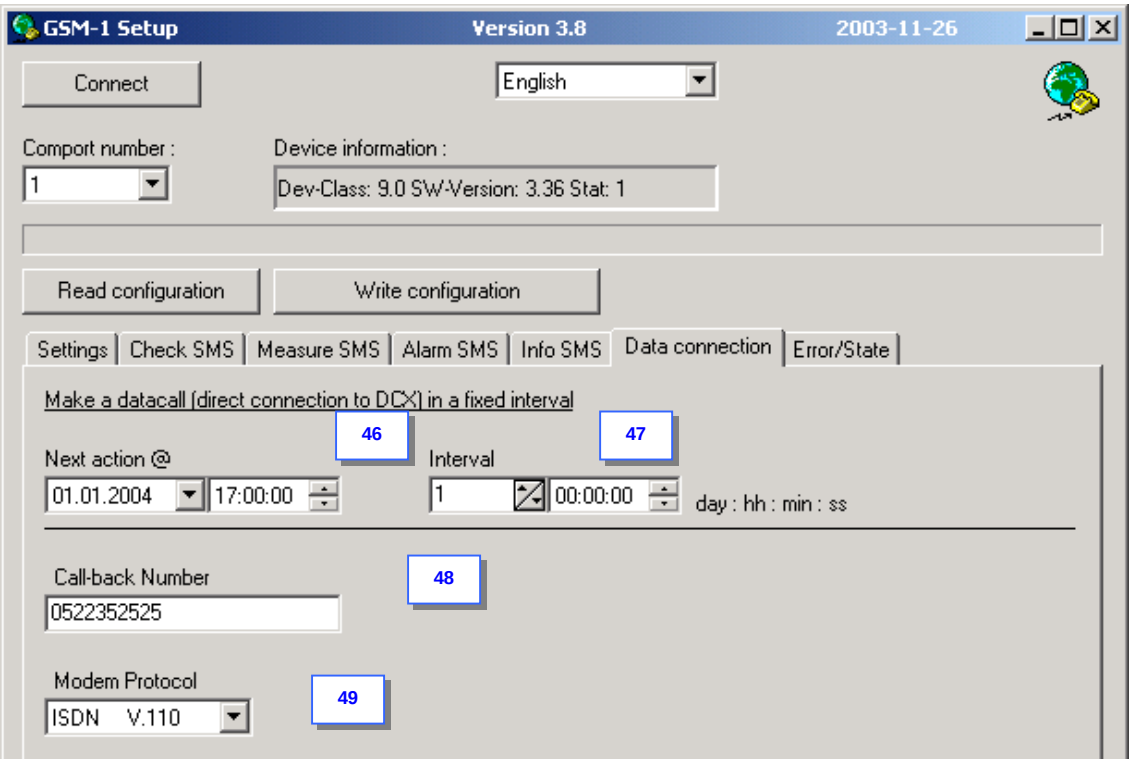


Fig. 17: “Data connection” register card

46 *Next action:*
Enter the first time a data connection is to be made.

47 *Interval:*
The time interval at which a data connection is to be made.

48 *Call-back Number:*
The telephone number of the modem to be called to make a data connection.

49 *Modem Protocol:*
The data protocol with which the user’s modem works.

3.4 Monitoring

- ***Error/Status*** **register card**

The *Error/Status* register card is used to monitor the status of the module for diagnostic purposes. To update the values, read the configuration by means of the *Read configuration* function.

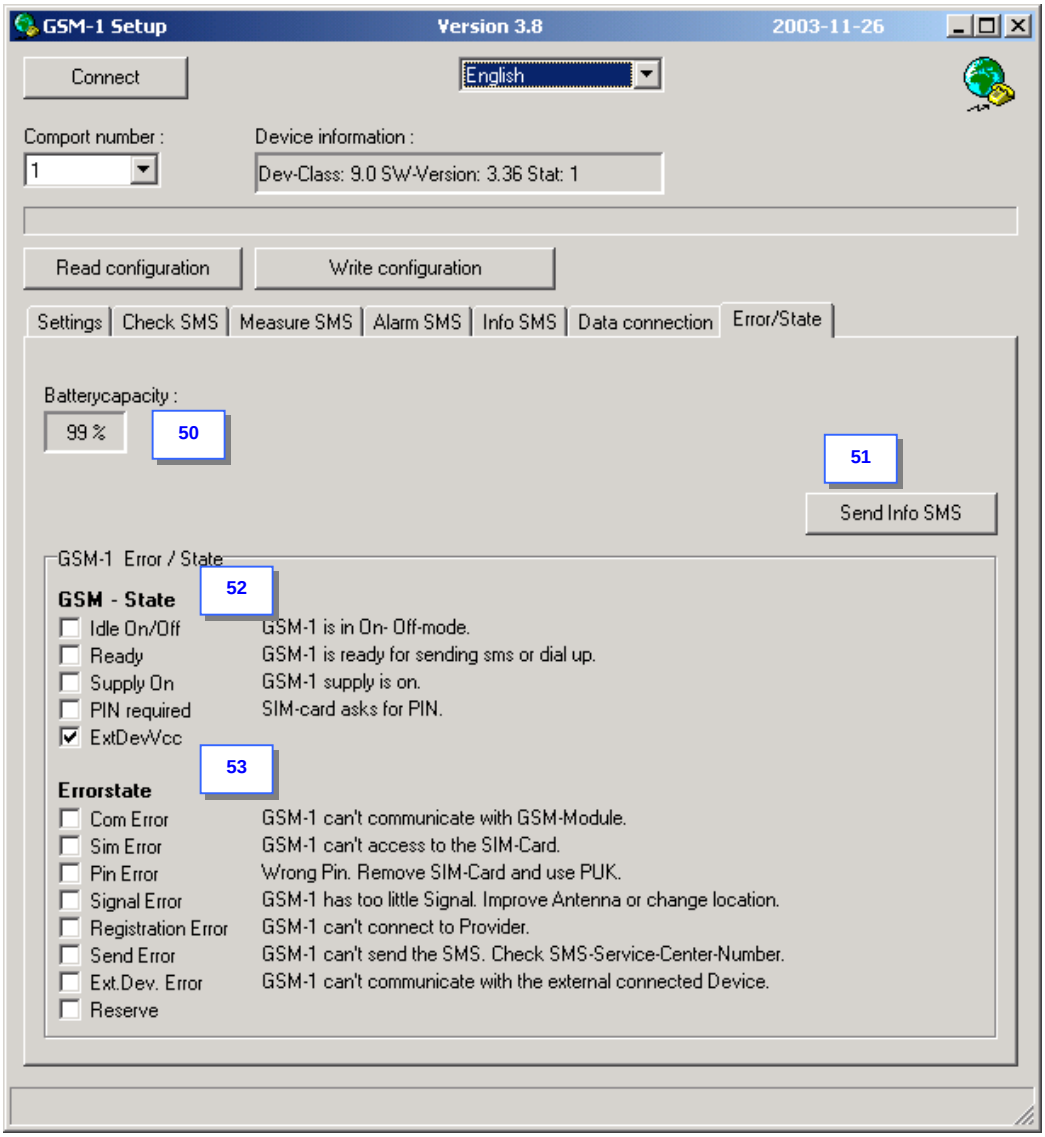


Fig. 18: "Error/Status" register card

50 *Battery capacity*:
Displays the battery capacity as a percentage. If the value is below 30%, it is recommended to change the battery. Once the battery has been changed, the value is again shown as 99%. However, this is also the case each time power is restored after a disconnection. For this reason, the battery should be disconnected only for replacement.

To ensure reliability, the battery should be replaced every four years.

48 *Send Info SMS:*
When you press this button, an Info SMS is sent to the receiver specified on the *Info SMS* register card, within 2 minutes. This is intended as a check when the system is installed on site.

49 *GSM-State:*
This shows the current mode of the modem. It also indicates whether a PIN is required to unlock the SIM card.

50 *Error state:*
If errors have occurred during operation, these are displayed in this function.

To check the reception quality and battery capacity at any time, an SMS can be sent to the module. To do this, the password entered under *Check SMS*, followed by a space and “i”, must be entered (e.g. PASSW i). The next time SMS messages are accessed, an Info SMS is sent back to the mobile phone number from which the request was received.

4. DATA CONNECTION

When a data connection is established, the data from the sensor connected to the GSM-1 can be accessed world-wide via modem. If a data logger is connected, the entire memory content can be read out. It is also possible to reconfigure the logger.

A data connection can be made only from the module. The user is always called from the GSM module. The call time can be specified in the configuration. An additional, more flexible possibility is to send an SMS to the module, which requests a data connection (with the instruction “<”). The next time the module checks incoming SMS messages, it recognises that a data connection has been requested. It immediately dials the relevant number and establishes the data connection with the user’s modem.

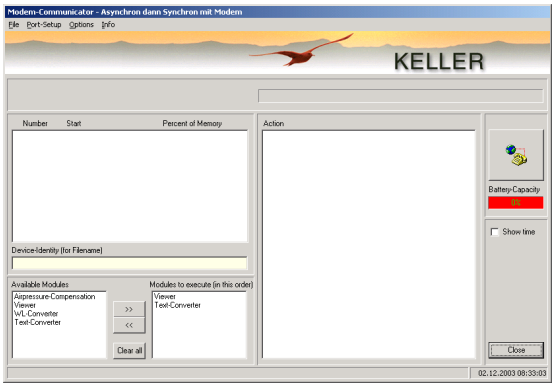
4.1 Preparation for connecting the call

The call can be made either with an analogue or a digital (ISDN) modem. The use of an external modem is recommended. The data cable must be connected to the PC via the modem adaptor (see Accessories, Product No: 320020.0005).

Using “Modem Reader” for automatic read-out

The “Modem Reader” software allows calls to be automatically received from the GSM-1, and the current record read from the DCX and saved. This all runs in the background.

Once the program has been started, it waits until a call is made to the modem, and starts to read the data. Once the record has been read and saved, the line between the GSM-1 and the modem is disconnected and the program waits for the next call.



Manual read-out

"HyperTerminal" can be used to check that the data connection is being correctly made. This program can be found in Windows 2000 at:

Start → Programs → Accessories → Communications

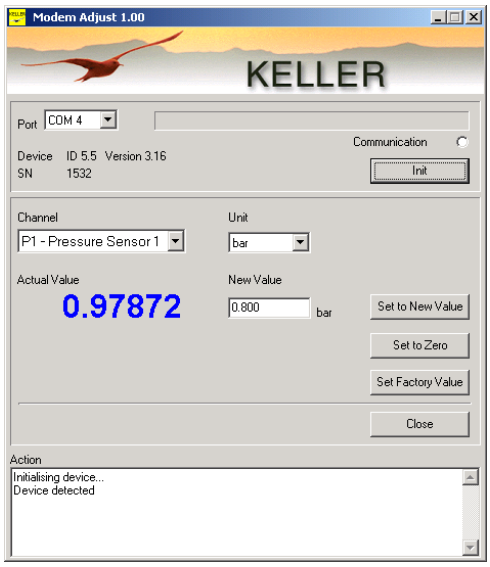
Any entry can be made for the name. It is important to specify the serial port (COM) of the modem for the setting, "Connect via". The following connection settings must be used:

- Bits per second: 9600
- Data bits: 8
- Parity: none
- Stop bits: 1
- Flow control: none

HyperTerminal can also be used to configure the modem. The command *ATS0 = 2* can be used to specify the number of rings before the modem answers. The figure (in this case 2) is the number of rings.

When the modem is called, and the data connection made, a check can be made whether everything is operating correctly. Once the connection has been made, the message: "Connection OK" is transmitted. "HyperTerminal" can now be closed and the sensor software (reader, writer) can be started. The COM port of the modem must be entered, and modem operation activated under *Connection settings*.
Communication can now be carried out with the data logger connected to the module, as though this were directly connected to the PC. If no data is requested for more than 1 minute, the GSM module automatically terminates the data connection.

Using "Modem-Adjust" to reset the zero point



The "Modem-Adjust" program allows the zero point of the transmitter connected to the GSM-1 to be reset from the office PC via modem. The connection is made manually as described in the above passage.
The serial port to which the modem is connected must be entered in the program. The "Init" command reads the configuration of the transmitter. The new level can now be set for the required measurement channel. "Set to New Value" is used to set the entered value to the current level. "Set to Zero" sets the current level as the zero point, and "Set Factory Value" resets the original factory settings.

Once "Init" has been selected, the current pressure value of the transmitter is permanently read out and displayed.
The modem connection remains constantly active, and is not disconnected until the program is exited!

5. ACKNOWLEDGEMENT VIA E-MAIL OR FAX

Instead of receiving an acknowledgement via SMS, this data can also be received via e-mail or fax. However, the data is sent via SMS. The procedure is dependent on the telephone provider (SIM card). Details of whether e-mails or faxes are possible can be found on the web site of your telephone provider. Our examples are based on the “Swisscom” service:

5.1 Send E-mail

If you wish to receive the SMS as a e-mail, select the telephone number 555 as the *SMS number*. The e-mail address of the recipient is then entered at the start of the SMS text. This is followed by a space and then the actual text.

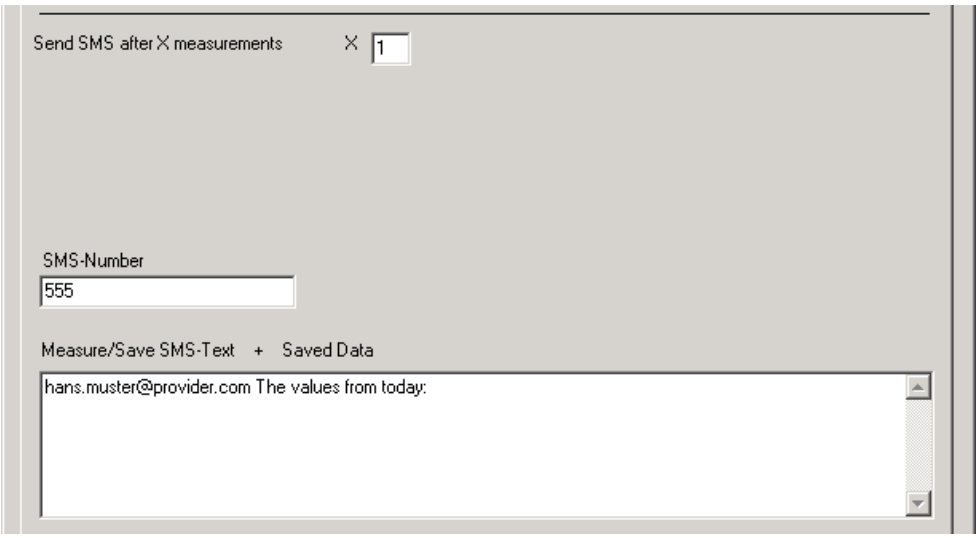


Fig. 19: “SMS text“

5.2 Send Fax

The fax number is entered as the SMS number, and "*FAX#" is entered at the start of the text. This is followed by a space and then the actual text.

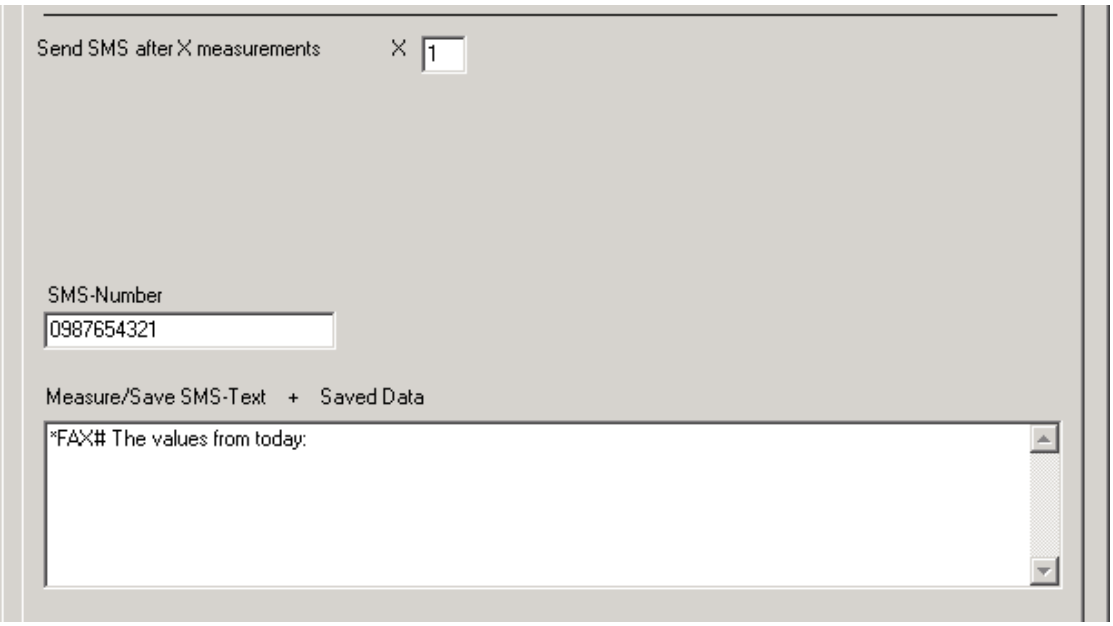


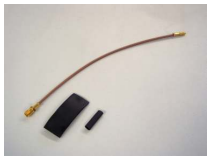
Fig. 20: "Fax text"

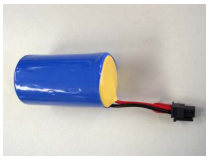
Further information is available on the Swisscom web site at:

http://www.swisscom-mobile.ch/sp/GDAAAAAA-de.html

Different providers have different procedures!!

6. ACCESSORIES

Description	Delivery Package	Image	Product No.
Adapter cable SMA → MMCX with shrink sleeves	Optional		320020.0006
Stub antenna with SMA connection	Optional		320020.0003
Flat antenna with cover	Optional		320020.0004
O-ring ∅17x1.5	Optional		508610.0024
Adapter with rubber seal for connection of a Series 30	Optional		320020.0007
Adapter with rubber seal for connection of a Series 30 **with hole** for air pressure equalisation	Optional		320020.0008
Modem adapter for data connection	Optional		320020.0005

GSM-1 CD CD includes: Configuration program: GSM-1 Setup, Modem-Reader, Modem-Adjust, Operating manual The software can also be downloaded free from the Internet! → www.keller-druck.com (at “Products” – “Miscellaneous/Software” “GSM-1”)	Optional		239005.0002
K-103A interface converter For communication between the PC and GSM-1. Connection to a serial port (RS 232 – RS 485 converter)	Optional		309010.0002
K-104A interface converter For communication between the PC and GSM-1. Connection to a USB-port (USB – RS 485 converter)	Optional		309010.0009
Plug cable for connection of a data logger (DCX-22)	Included		320020.0009
Battery 3.6V with plug Capacity: 16.5 Ah	Included		557005.0012