National Semiconductor

November 2000

LM35
Precision Centigrade Temperature Sensors

General Description

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a −55° to +150°C temperature range, while the LM35C is rated for a −40° to +110°C range (−10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package.

Features

- Calibrated directly in ° Celsius (Centigrade)
- Linear + 10.0 mV/°C scale factor
- 0.5°C accuracy guaranteeable (at +25°C)
- Rated for full −55° to +150°C range
- Suitable for remote applications
- Low cost due to wafer-level trimming
- Operates from 4 to 30 volts
- Less than 60 µA current drain
- Low self-heating, 0.08°C in still air
- Nonlinearity only ±¼°C typical
- Low impedance output, 0.1 Ω for 1 mA load

Typical Applications

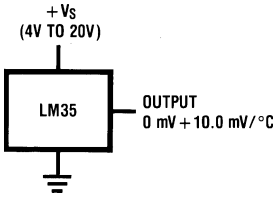
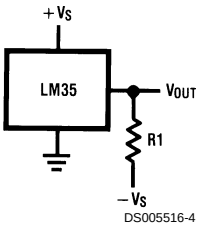


FIGURE 1. Basic Centigrade Temperature Sensor (+2°C to +150°C)



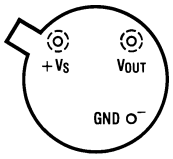
Choose $R_1 = -V_S/50\ \mu A$

V_{OUT} = +1,500 mV at +150°C
= +250 mV at +25°C
= −550 mV at −55°C

FIGURE 2. Full-Range Centigrade Temperature Sensor

Connection Diagrams

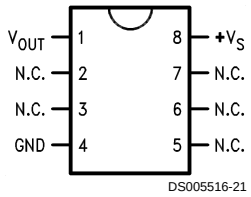
TO-46
Metal Can Package*



*Case is connected to negative pin (GND)

Order Number LM35H, LM35AH, LM35CH, LM35CAH or LM35DH
See NS Package Number H03H

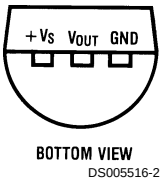
SO-8
Small Outline Molded Package



N.C. = No Connection

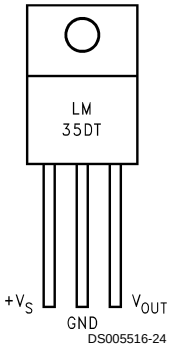
Top View
Order Number LM35DM
See NS Package Number M08A

TO-92
Plastic Package



Order Number LM35CZ, LM35CAZ or LM35DZ
See NS Package Number Z03A

TO-220
Plastic Package*



*Tab is connected to the negative pin (GND).

Note: The LM35DT pinout is different than the discontinued LM35DP.

Order Number LM35DT
See NS Package Number TA03F

Absolute Maximum Ratings (Note 10)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Supply Voltage	+35V to −0.2V
Output Voltage	+6V to −1.0V
Output Current	10 mA
Storage Temp.;	
TO-46 Package,	−60˚C to +180˚C
TO-92 Package,	−60˚C to +150˚C
SO-8 Package,	−65˚C to +150˚C
TO-220 Package,	−65˚C to +150˚C
Lead Temp.:	
TO-46 Package, (Soldering, 10 seconds)	300˚C
TO-92 and TO-220 Package, (Soldering, 10 seconds)	260˚C
SO Package (Note 12)	
Vapor Phase (60 seconds)	215˚C
Infrared (15 seconds)	220˚C
ESD Susceptibility (Note 11)	2500V
Specified Operating Temperature Range: T_{MIN} to T_{MAX} (Note 2)	
LM35, LM35A	−55˚C to +150˚C
LM35C, LM35CA	−40˚C to +110˚C
LM35D	0˚C to +100˚C

Electrical Characteristics

(Notes 1, 6)

Parameter	Conditions	LM35A			LM35CA			Units (Max.)
		Typical	Tested Limit (Note 4)	Design Limit (Note 5)	Typical	Tested Limit (Note 4)	Design Limit (Note 5)	
Accuracy	T_A=+25˚C	±0.2	±0.5		±0.2	±0.5		˚C
(Note 7)	T_A=−10˚C	±0.3			±0.3		±1.0	˚C
	T_A=T_{MAX}	±0.4	±1.0		±0.4	±1.0		˚C
	T_A=T_{MIN}	±0.4	±1.0		±0.4		±1.5	˚C
Nonlinearity (Note 8)	T_{MIN}≤T_A≤T_{MAX}	**±0.18**		**±0.35**	**±0.15**		**±0.3**	˚C
Sensor Gain (Average Slope)	T_{MIN}≤T_A≤T_{MAX}	**+10.0**	**+9.9, +10.1**		**+10.0**		**+9.9, +10.1**	mV/˚C
Load Regulation (Note 3) 0≤I_L≤1 mA	T_A=+25˚C	±0.4	±1.0		±0.4	±1.0		mV/mA
	T_{MIN}≤T_A≤T_{MAX}	**±0.5**		**±3.0**	**±0.5**		**±3.0**	mV/mA
Line Regulation (Note 3)	T_A=+25˚C	±0.01	±0.05		±0.01	±0.05		mV/V
	4V≤V_S≤30V	**±0.02**		**±0.1**	**±0.02**		**±0.1**	mV/V
Quiescent Current (Note 9)	V_S=+5V, +25˚C	56	67		56	67		µA
	V_S=+5V	**105**		**131**	**91**		**114**	µA
	V_S=+30V, +25˚C	56.2	68		56.2	68		µA
	V_S=+30V	**105.5**		**133**	**91.5**		**116**	µA
Change of Quiescent Current (Note 3)	4V≤V_S≤30V, +25˚C	0.2	1.0		0.2	1.0		µA
	4V≤V_S≤30V	**0.5**		**2.0**	**0.5**		**2.0**	µA
Temperature Coefficient of Quiescent Current		**+0.39**		**+0.5**	**+0.39**		**+0.5**	µA/˚C
Minimum Temperature for Rated Accuracy	In circuit of *Figure 1*, I_L=0	+1.5		+2.0	+1.5		+2.0	˚C
Long Term Stability	T_J=T_{MAX}, for 1000 hours	±0.08			±0.08			˚C

Electrical Characteristics

(Notes 1, 6)

Parameter	Conditions	LM35			LM35C, LM35D			Units (Max.)
		Typical	Tested Limit (Note 4)	Design Limit (Note 5)	Typical	Tested Limit (Note 4)	Design Limit (Note 5)	
Accuracy,	T_A=+25˚C	±0.4	±1.0		±0.4	±1.0		˚C
LM35, LM35C	T_A=−10˚C	±0.5			±0.5		±1.5	˚C
(Note 7)	T_A=T_{MAX}	±0.8	±1.5		±0.8		±1.5	˚C
	T_A=T_{MIN}	±0.8		±1.5	±0.8		±2.0	˚C
Accuracy, LM35D	T_A=+25˚C				±0.6	±1.5		˚C
(Note 7)	T_A=T_{MAX}				±0.9		±2.0	˚C
	T_A=T_{MIN}				±0.9		±2.0	˚C
Nonlinearity	T_{MIN}≤T_A≤T_{MAX}	**±0.3**		**±0.5**	**±0.2**		**±0.5**	˚C
(Note 8)								
Sensor Gain	T_{MIN}≤T_A≤T_{MAX}	**+10.0**	**+9.8, +10.2**		**+10.0**		**+9.8, +10.2**	mV/˚C
(Average Slope)								
Load Regulation	T_A=+25˚C	±0.4	±2.0		±0.4	±2.0		mV/mA
(Note 3) 0≤I_L≤1 mA	T_{MIN}≤T_A≤T_{MAX}	**±0.5**		**±5.0**	**±0.5**		**±5.0**	mV/mA
Line Regulation	T_A=+25˚C	±0.01	±0.1		±0.01	±0.1		mV/V
(Note 3)	4V≤V_S≤30V	**±0.02**		**±0.2**	**±0.02**		**±0.2**	mV/V
Quiescent Current	V_S=+5V, +25˚C	56	80		56	80		µA
(Note 9)	V_S=+5V	**105**		**158**	**91**		**138**	µA
	V_S=+30V, +25˚C	56.2	82		56.2	82		µA
	V_S=+30V	**105.5**		**161**	**91.5**		**141**	µA
Change of	4V≤V_S≤30V, +25˚C	0.2	2.0		0.2	2.0		µA
Quiescent Current	4V≤V_S≤30V	**0.5**		**3.0**	**0.5**		**3.0**	µA
(Note 3)								
Temperature Coefficient of Quiescent Current		**+0.39**		**+0.7**	**+0.39**		**+0.7**	µA/˚C
Minimum Temperature for Rated Accuracy	In circuit of *Figure 1*, I_L=0	+1.5		+2.0	+1.5		+2.0	˚C
Long Term Stability	T_J=T_{MAX}, for 1000 hours	±0.08			±0.08			˚C

Note 1: Unless otherwise noted, these specifications apply: −55˚C≤T_J≤+150˚C for the LM35 and LM35A; −40˚C≤T_J≤+110˚C for the LM35C and LM35CA; and 0˚C≤T_J≤+100˚C for the LM35D. V_S=+5Vdc and I_{LOAD}=50 µA, in the circuit of *Figure 2*. These specifications also apply from +2˚C to T_{MAX} in the circuit of *Figure 1*. Specifications in **boldface** apply over the full rated temperature range.

Note 2: Thermal resistance of the TO-46 package is 400˚C/W, junction to ambient, and 24˚C/W junction to case. Thermal resistance of the TO-92 package is 180˚C/W junction to ambient. Thermal resistance of the small outline molded package is 220˚C/W junction to ambient. Thermal resistance of the TO-220 package is 90˚C/W junction to ambient. For additional thermal resistance information see table in the Applications section.

Note 3: Regulation is measured at constant junction temperature, using pulse testing with a low duty cycle. Changes in output due to heating effects can be computed by multiplying the internal dissipation by the thermal resistance.

Note 4: Tested Limits are guaranteed and 100% tested in production.

Note 5: Design Limits are guaranteed (but not 100% production tested) over the indicated temperature and supply voltage ranges. These limits are not used to calculate outgoing quality levels.

Note 6: Specifications in **boldface** apply over the full rated temperature range.

Note 7: Accuracy is defined as the error between the output voltage and 10mv/˚C times the device's case temperature, at specified conditions of voltage, current, and temperature (expressed in ˚C).

Note 8: Nonlinearity is defined as the deviation of the output-voltage-versus-temperature curve from the best-fit straight line, over the device's rated temperature range.

Note 9: Quiescent current is defined in the circuit of *Figure 1*.

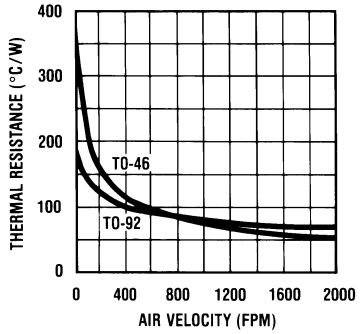
Note 10: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications do not apply when operating the device beyond its rated operating conditions. See Note 1.

Note 11: Human body model, 100 pF discharged through a 1.5 kΩ resistor.

Note 12: See AN-450 "Surface Mounting Methods and Their Effect on Product Reliability" or the section titled "Surface Mount" found in a current National Semiconductor Linear Data Book for other methods of soldering surface mount devices.

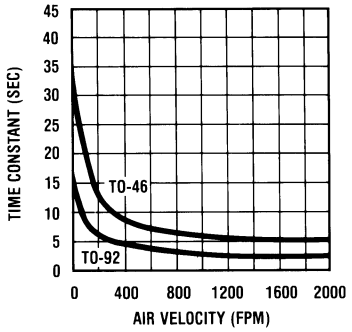
Typical Performance Characteristics

Thermal Resistance Junction to Air



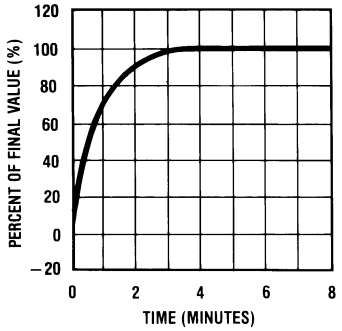
DS005516-25

Thermal Time Constant



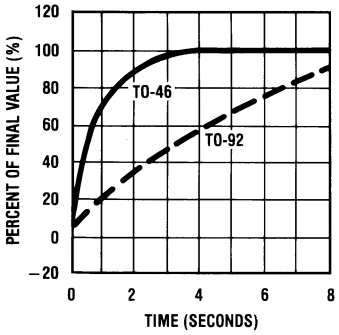
DS005516-26

Thermal Response in Still Air



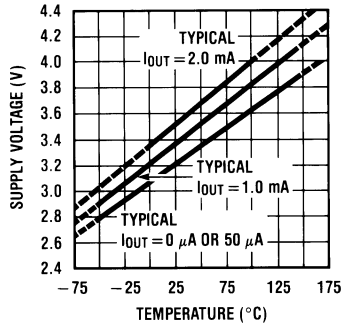
DS005516-27

Thermal Response in Stirred Oil Bath



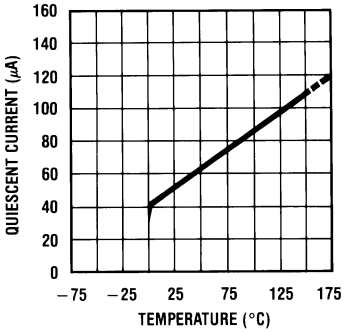
DS005516-28

Minimum Supply Voltage vs. Temperature



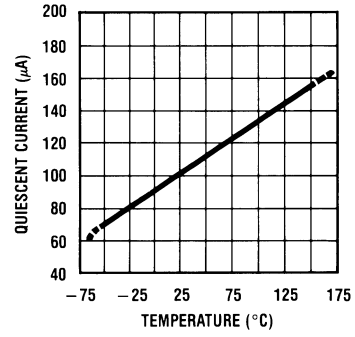
DS005516-29

Quiescent Current vs. Temperature (In Circuit of *Figure 1*.)



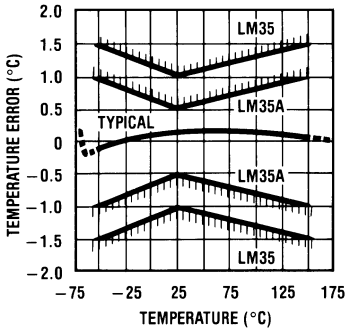
DS005516-30

Quiescent Current vs. Temperature (In Circuit of *Figure 2*.)



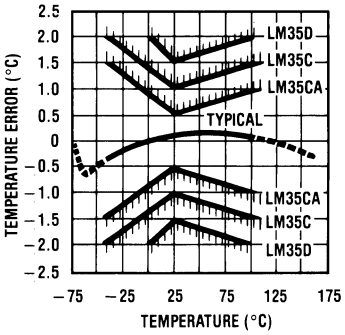
DS005516-31

Accuracy vs. Temperature (Guaranteed)



DS005516-32

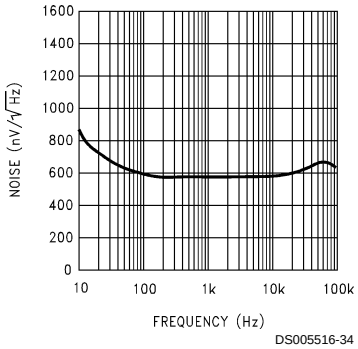
Accuracy vs. Temperature (Guaranteed)



DS005516-33

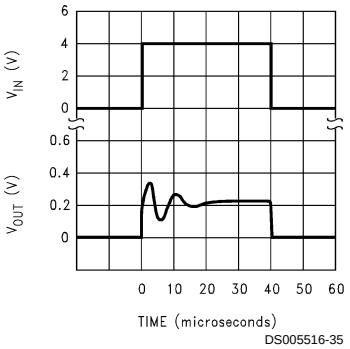
Typical Performance Characteristics (Continued)

Noise Voltage



DS005516-34

Start-Up Response



DS005516-35

Applications

The LM35 can be applied easily in the same way as other integrated-circuit temperature sensors. It can be glued or cemented to a surface and its temperature will be within about 0.01˚C of the surface temperature.

This presumes that the ambient air temperature is almost the same as the surface temperature; if the air temperature were much higher or lower than the surface temperature, the actual temperature of the LM35 die would be at an intermediate temperature between the surface temperature and the air temperature. This is expecially true for the TO-92 plastic package, where the copper leads are the principal thermal path to carry heat into the device, so its temperature might be closer to the air temperature than to the surface temperature.

To minimize this problem, be sure that the wiring to the LM35, as it leaves the device, is held at the same temperature as the surface of interest. The easiest way to do this is to cover up these wires with a bead of epoxy which will insure that the leads and wires are all at the same temperature as the surface, and that the LM35 die's temperature will not be affected by the air temperature.

The TO-46 metal package can also be soldered to a metal surface or pipe without damage. Of course, in that case the V− terminal of the circuit will be grounded to that metal. Alternatively, the LM35 can be mounted inside a sealed-end metal tube, and can then be dipped into a bath or screwed into a threaded hole in a tank. As with any IC, the LM35 and accompanying wiring and circuits must be kept insulated and dry, to avoid leakage and corrosion. This is especially true if the circuit may operate at cold temperatures where condensation can occur. Printed-circuit coatings and varnishes such as Humiseal and epoxy paints or dips are often used to insure that moisture cannot corrode the LM35 or its connections.

These devices are sometimes soldered to a small light-weight heat fin, to decrease the thermal time constant and speed up the response in slowly-moving air. On the other hand, a small thermal mass may be added to the sensor, to give the steadiest reading despite small deviations in the air temperature.

Temperature Rise of LM35 Due To Self-heating (Thermal Resistance, θ_{JA})

	TO-46, no heat sink	TO-46*, small heat fin	TO-92, no heat sink	TO-92**, small heat fin	SO-8 no heat sink	SO-8** small heat fin	TO-220 no heat sink
Still air	400˚C/W	100˚C/W	180˚C/W	140˚C/W	220˚C/W	110˚C/W	90˚C/W
Moving air	100˚C/W	40˚C/W	90˚C/W	70˚C/W	105˚C/W	90˚C/W	26˚C/W
Still oil	100˚C/W	40˚C/W	90˚C/W	70˚C/W			
Stirred oil	50˚C/W	30˚C/W	45˚C/W	40˚C/W			
(Clamped to metal, Infinite heat sink)	(24˚C/W)				(55˚C/W)		

*Wakefield type 201, or 1" disc of 0.020" sheet brass, soldered to case, or similar.
**TO-92 and SO-8 packages glued and leads soldered to 1" square of 1/16" printed circuit board with 2 oz. foil or similar.

Typical Applications

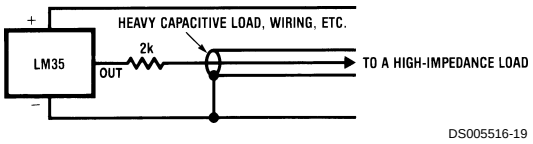


FIGURE 3. LM35 with Decoupling from Capacitive Load

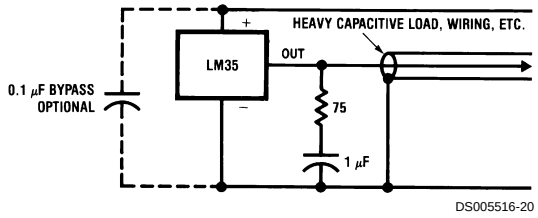


FIGURE 4. LM35 with R-C Damper

CAPACITIVE LOADS

Like most micropower circuits, the LM35 has a limited ability to drive heavy capacitive loads. The LM35 by itself is able to drive 50 pf without special precautions. If heavier loads are anticipated, it is easy to isolate or decouple the load with a resistor; see *Figure 3*. Or you can improve the tolerance of capacitance with a series R-C damper from output to ground; see *Figure 4*.

When the LM35 is applied with a 200Ω load resistor as shown in *Figure 5*, *Figure 6* or *Figure 8* it is relatively immune to wiring capacitance because the capacitance forms a bypass from ground to input, not on the output. However, as with any linear circuit connected to wires in a hostile environment, its performance can be affected adversely by intense electromagnetic sources such as relays, radio transmitters, motors with arcing brushes, SCR transients, etc, as its wiring can act as a receiving antenna and its internal junctions can act as rectifiers. For best results in such cases, a bypass capacitor from V_{IN} to ground and a series R-C damper such as 75Ω in series with 0.2 or 1 μF from output to ground are often useful. These are shown in *Figure 13*, *Figure 14*, and *Figure 16*.

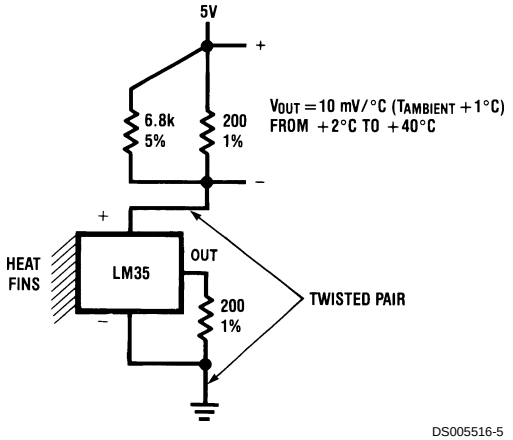


FIGURE 5. Two-Wire Remote Temperature Sensor (Grounded Sensor)

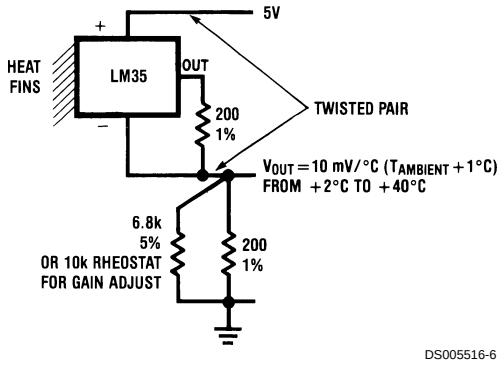


FIGURE 6. Two-Wire Remote Temperature Sensor (Output Referred to Ground)

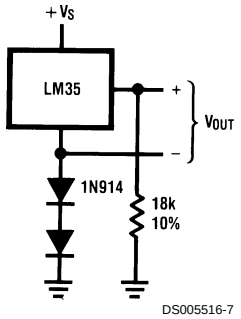


FIGURE 7. Temperature Sensor, Single Supply, −55˚ to +150˚C

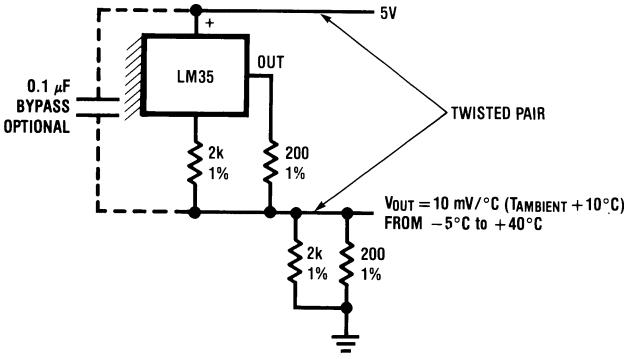


FIGURE 8. Two-Wire Remote Temperature Sensor (Output Referred to Ground)

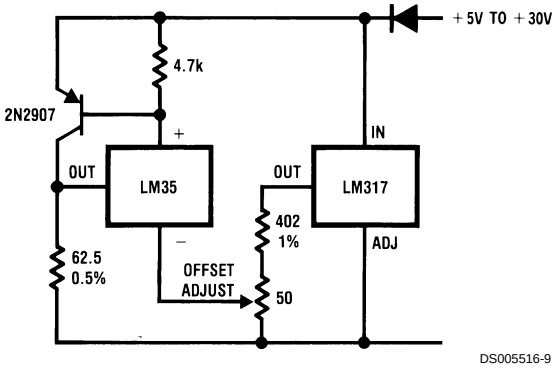


FIGURE 9. 4-To-20 mA Current Source (0˚C to +100˚C)

Typical Applications (Continued)

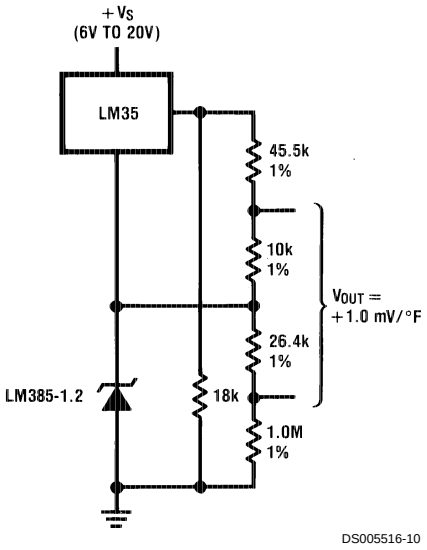


FIGURE 10. Fahrenheit Thermometer

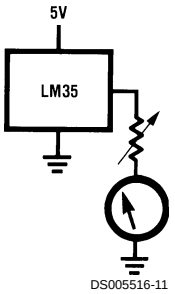


FIGURE 11. Centigrade Thermometer (Analog Meter)

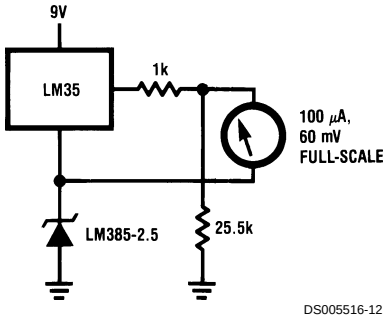


FIGURE 12. Fahrenheit ThermometerExpanded Scale Thermometer
(50˚ to 80˚ Fahrenheit, for Example Shown)

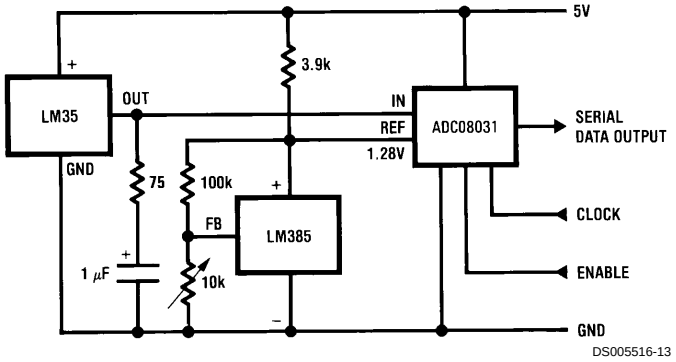


FIGURE 13. Temperature To Digital Converter (Serial Output) (+128˚C Full Scale)

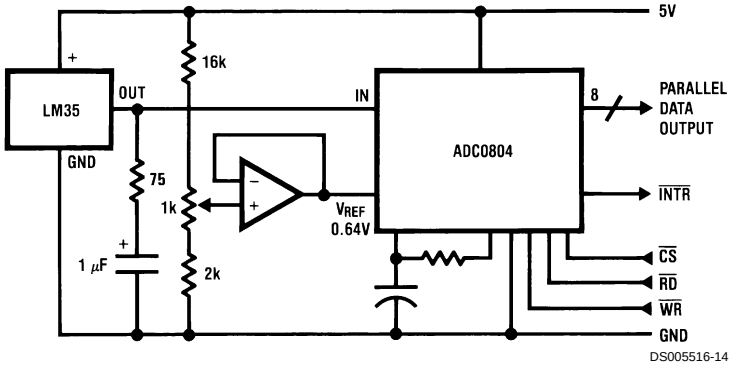
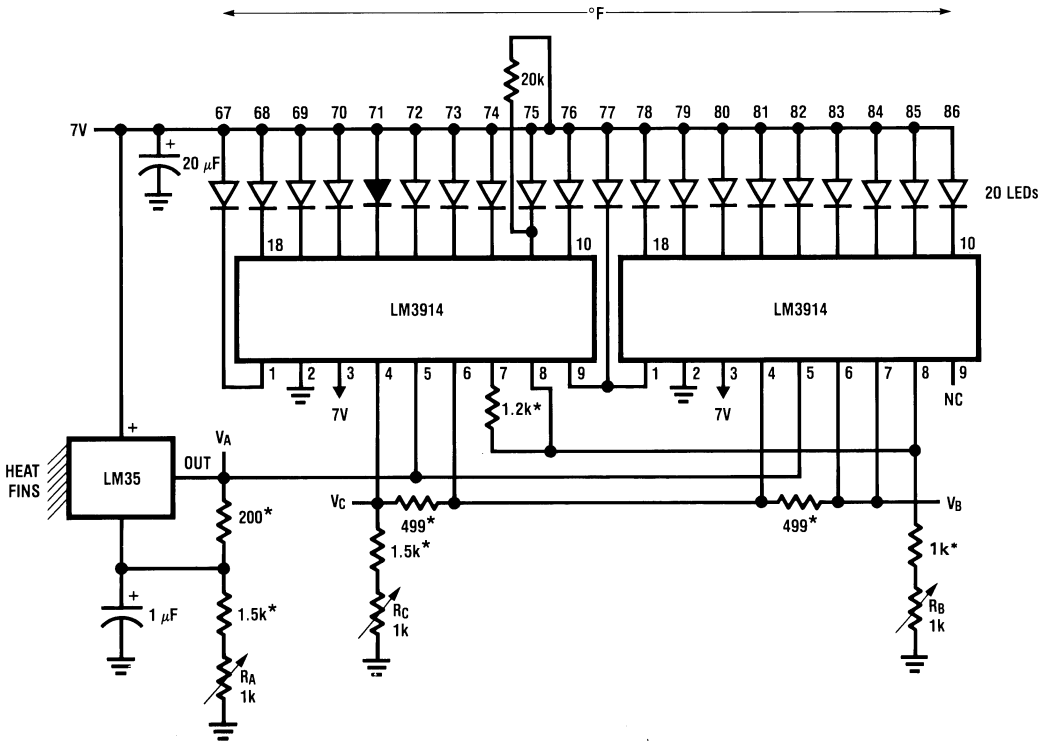


FIGURE 14. Temperature To Digital Converter (Parallel TRI-STATE™ Outputs for Standard Data Bus to µP Interface) (128˚C Full Scale)

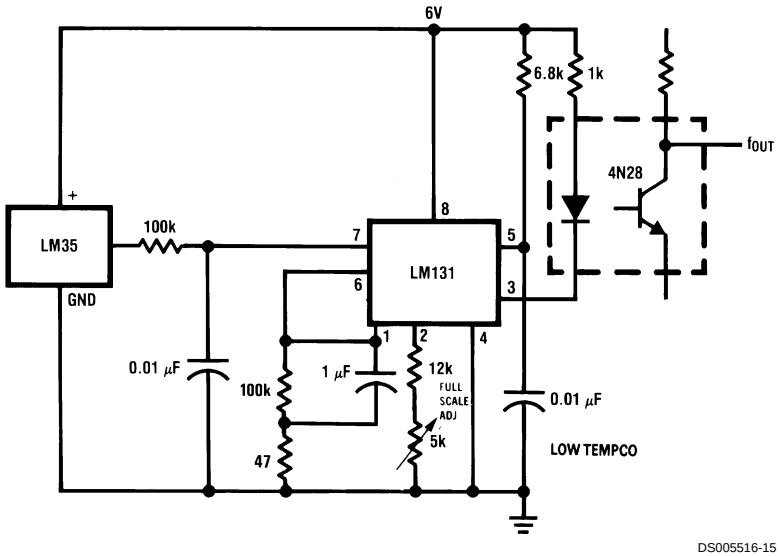
Typical Applications (Continued)



DS005516-16

*=1% or 2% film resistor
Trim R_B for V_B=3.075V
Trim R_C for V_C=1.955V
Trim R_A for V_A=0.075V + 100mV/°C x $T_{ambient}$
Example, V_A=2.275V at 22°C

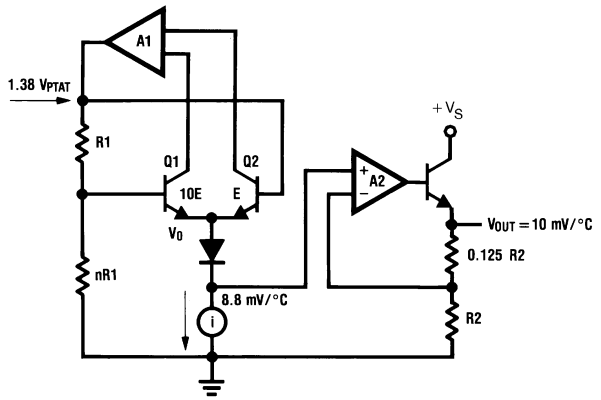
FIGURE 15. Bar-Graph Temperature Display (Dot Mode)



DS005516-15

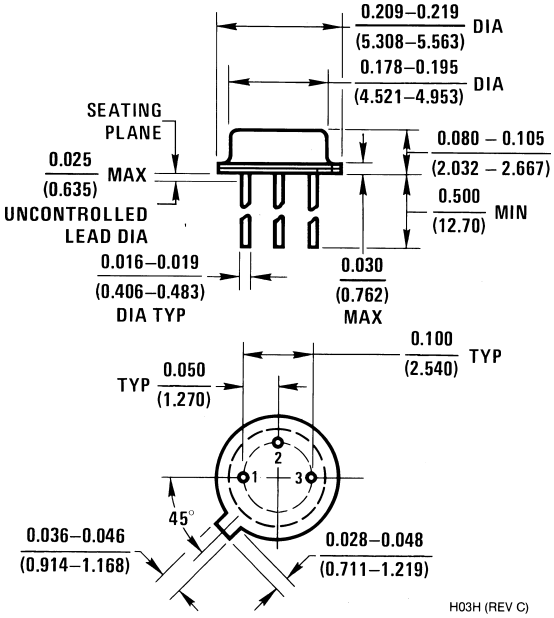
FIGURE 16. LM35 With Voltage-To-Frequency Converter And Isolated Output (2°C to +150°C; 20 Hz to 1500 Hz)

Block Diagram

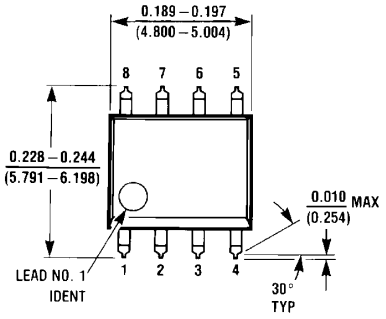


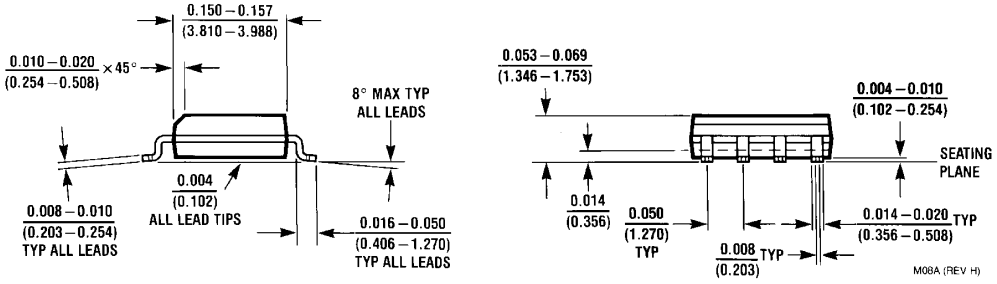
DS005516-23

Physical Dimensions inches (millimeters) unless otherwise noted



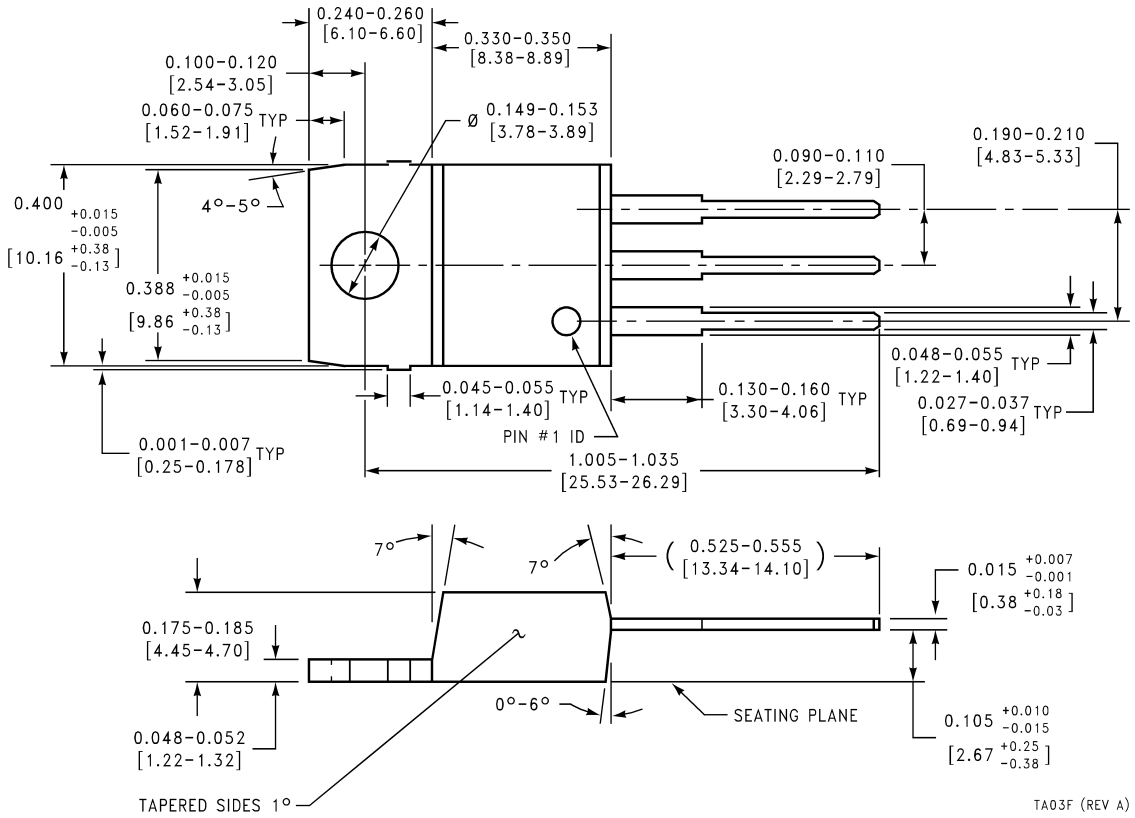
TO-46 Metal Can Package (H)
Order Number LM35H, LM35AH, LM35CH, LM35CAH, or LM35DH
NS Package Number H03H





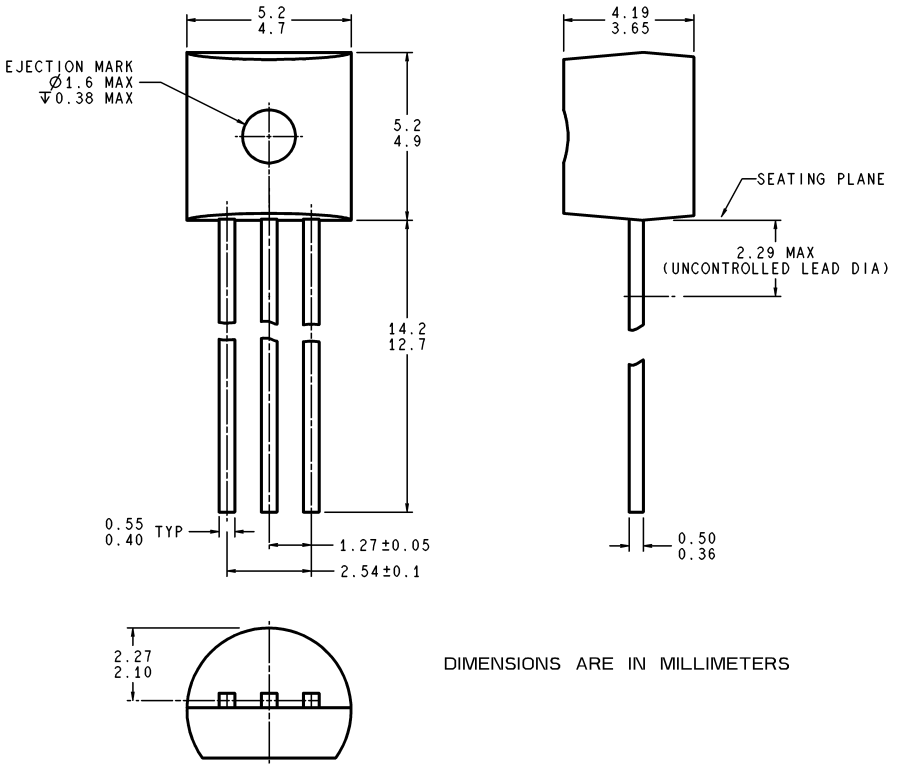
SO-8 Molded Small Outline Package (M)
Order Number LM35DM
NS Package Number M08A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



Power Package TO-220 (T)
Order Number LM35DT
NS Package Number TA03F

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



TO-92 Plastic Package (Z)
Order Number LM35CZ, LM35CAZ or LM35DZ
NS Package Number Z03A

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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```
=  assembler =
$mod51
org 00h

 main:  mov sbuf,#00h
        lcall init
        mov p2,#00h
init_hp:lcall ate_1
        setb p2.0
        lcall at_cnmi
        setb p2.1
main1:
 cek0:  lcall inchar
        cjne a,#'1',cek0
         setb p2.2
        clr p2.2
         lcall at_cmgr
        lcall delay500m
        lcall at_cmgr
        clr p2.1
  cok:   lcall inchar
        cjne a,#'0',cok
        mov r1,#20h
        clr p2.0
 lagi1:  lcall inchar
        mov @r1,a
        inc r1
        cjne a,#0dh,lagi1
   yu:  lcall inchar
        cjne a,#'K',yu
```

```
        setb p2.0
        lcall at_cmgd
        mov p2,#0ffh
ya:     lcall inchar
        cjne a,#'K',ya
        mov p2,#00h
        lcall delay100m

        mov r1,#55h
        mov a,@r1
        mov p2,a
        lcall delay500m
        cjne a,#41h,bb
        mov a,#0ah
        ajmp dd
bb:     cjne a,#42h,cc
        mov a,#0bh
        ajmp dd
cc:     cjne a,#43h,dd
        mov a,#0ch
dd:     anl a,#0fh
        mov p2,a
        lcall delay500m
        rl a
        rl a
        rl a
        rl a
        mov p2,a
        lcall delay500m
        mov b,a
```

```
        mov r0,#56h
        mov a,@r0
        mov p2,a
        lcall delay500m
        anl a,#0fh
        mov p2,a
        lcall delay500m
        add a,b
        mov p2,a
        lcall delay500m
        mov r1,#30h
        mov @r1,a
        anl a,#80h
        cjne a,#80h,no_C
        mov r1,#70h
         mov @r1,#01h
         mov r1,#30h
        mov a,@r1
        subb a,#80h
        mov p2,a
        lcall delay500m
        mov r1,#30h
        mov @r1,a
        mov p2,#0ffh
        lcall delay100m
        mov p2,#00h
        lcall delay100m
        mov p2,#0ffh
        lcall delay100m
no_C: mov r1,#57h
```

```
        mov a,@r1
        mov p2,a
        lcall delay500m
        anl a,#0fh
        mov p2,a
        lcall delay500m
        rl a
        rl a
        rl a
        rl a
        mov p2,a
        lcall delay500m
        mov b,a
        mov r0,#58h
        mov a,@r0
        mov p2,a
        lcall delay500m
        cjne a,#41h,bb1
        mov a,#0ah
        ajmp dd1
bb1:    cjne a,#42h,cc1
        mov a,#0bh
        ajmp dd1
cc1:    cjne a,#43h,dd1
        mov a,#0ch
dd1:    anl a,#00fh
        mov p2,a
        lcall delay500m
        add a,b
        mov p2,a
```

```
        lcall delay500m
        mov r1,#32h
        mov @r1,a
        rl a
        mov p2,a
        lcall delay500m
        mov r1,#32h
        mov @r1,a
        mov r1,#70h
        mov a,@r1
        cjne a,#01h,no_C1
        mov r1,#32h
        mov a,@r1
        add a,#01h
        mov p2,a
        lcall delay500m
        mov r1,#31h
        mov @r1,a
        ajmp tampil
no_C1: mov r1,#32h
        mov a,@r1
        mov r1,#31h
        mov @r1,a

tampil: mov r1,#30h
        mov a,@r1
        anl a,#0fh
        rl a
        rl a
        rl a
```

```
        rl a
        mov b,a
        lcall delay1s
        mov r1,#31h
        mov a,@r1
        anl a,#0fh
        add a,b
        mov r0,#32h
        mov @r0,a
        lcall delay1s
; a set point
; b lm 35
    lg: mov a,r5
        mov b,p0
        cjne a,b,satu
        sjmp lg
 satu:  jc kecil
        sjmp  besar
besar:  ajmp pemanas
kecil:  ajmp valve
pemanas:
        setb p2.7
        cjne a,b,lg
        sjmp sukses
valve:
        setb p2.6
        cjne a,b,valve
        sjmp sukses

sukses: lcall at_cmgs
```

```
        mov dptr,#jml_Ok
        lcall outstr
        mov a,#0dh
        lcall outchr
        setb p2.3
        lcall siku
        clr p2.3
        mov dptr,#Ok
        lcall outstr
        lcall ctrl_Z
        clr p2.2
   ye:  lcall inchar
        cjne a,#'K',ye
        lcall delay1s
        ljmp main1


;======= kirim ate1 =======
 ate_1: mov dptr,#ate1
        lcall outstr
        mov a,#0dh
        lcall outchr
        ret

;======= kirim at+cmps =======
at_cnmi:mov dptr,#cnmi
        lcall outstr
        mov a,#0dh
        lcall outchr
        ret
```

```
;======= kirim at+cmgr =======
at_cmgr:mov dptr,#cmgr
        lcall outstr
        mov a,#0dh
        lcall outchr
        ret

;======= kirim at+cmgd =======
at_cmgd:mov dptr,#cmgd
        lcall outstr
        mov a,#0dh
        lcall outchr
      ret

;====== kirim at+cmgs= ======
at_cmgs:mov dptr,#cmgs
        lcall outstr
        ret

;====== cek tanda > ======
siku:
  cek3:  lcall inchar
        cjne a,#'>',cek3
        ret

;======        kirim ctrl Z ======
ctrl_Z:
  cek2:  cjne a,#0,cek2
        lcall delay100m
        mov a,#26
```

```
          lcall outchr
          ret

;======= Inisialisasi UC ========
    init:  mov tmod,#20h
           mov pcon,#80h
           mov TH1,#0fdh
           setb TR1
           mov scon,#52h
           ret

outstr:  clr a
          movc a,@a+dptr
           jz exit
          lcall outchr
           inc dptr
           lcall delay50m
        jmp outstr
  exit:  ret

inchar: clr a
          jnb ri,inchar
          clr ri
          mov a,sbuf
           ret

outchr:  jnb ti,outchr
           mov sbuf,a
           clr ti
           ret
```

```
;=========DELAY_50mS=========
    delay50m:  mov r5,#50
       d50m2:  mov r6,#04h
       d50m3:  mov r7,#0ffh
               djnz r7,$
               djnz r6,d50m3
               djnz r5,d50m2
               ret

;=========DELAY_100mS=========
  delay100m:  mov r5,#100
      d100m2:  mov r6,#04h
      d100m3:  mov r7,#0ffh
               djnz r7,$
               djnz r6,d100m3
               djnz r5,d100m2
               ret

;=========DELAY_500mS=========
  delay500m:  lcall delay100m
               lcall delay100m
               lcall delay100m
               lcall delay100m
               lcall delay100m
               ret

;==========DELAY_1S==========
       delay1s:  lcall delay500m
               lcall delay500m
               ret
```

```
;=======Inisialisasi HP=======
  ate1: db 'ate1',0
  cnmi: db 'at+cnmi=1,1,0,1,1',0
  cmgr: db 'at+cmgr=1',0
  cmgd: db 'at+cmgd=1',0
  cmgs: db 'at+cmgs=',0

;=========JUMLAH_PDU==========
 jml_Ok: db '1','5',0
 jml_Err: db '1','8',0

;=========PDU_LAPORAN=========
  Ok:   db '0691261801000011000A81808102196800000B02CF35',0
  Err:  db '0691261801000011000A81808102196800000B0545B9FC2D07',0

selesai:
          nop
       end
```

```
= Borland Delphi =
unit U_sms2;

interface

uses
  Windows, Messages, SysUtils, Variants, Classes, Graphics, Controls, Forms,
  Dialogs, StdCtrls, Mask, sCustomComboEdit, sCurrEdit, sButtonControl,
  sCustomButton, ComCtrls, sPageControl, jpeg, ExtCtrls, AfPortControls,
  AfDataDispatcher, AfComPort, sTooledit;

type
  TForm1 = class(TForm)
    Image1: TImage;
    sBitBtn1: TsBitBtn;
    sCalcEdit1: TsCalcEdit;
    AfComPort1: TAfComPort;
    AfDataDispatcher1: TAfDataDispatcher;
    sDateEdit1: TsDateEdit;
    AfPortRadioGroup1: TAfPortRadioGroup;
    Timer1: TTimer;
    Label1: TLabel;
    sBitBtn2: TsBitBtn;
    Memo1: TMemo;
    GroupBox1: TGroupBox;
    Edit1: TEdit;
    Label2: TLabel;
    Button1: TButton;
    Label3: TLabel;
    sBitBtn3: TsBitBtn;
    Image2: TImage;
    procedure sBitBtn1Click(Sender: TObject);
    procedure Button1Click(Sender: TObject);

    procedure Timer1Timer(Sender: TObject);
    procedure AfDataDispatcher1DataReceived(Sender: TObject);
    procedure sBitBtn2Click(Sender: TObject);
    procedure sBitBtn3Click(Sender: TObject);
  private
    { Private declarations }
  public
    { Public declarations }
  end;

var
```

```
  Form1: TForm1;

implementation

{$R *.dfm}
var
suhu :  string;
s1,s2,s3,s4,data : string ;
u :  integer ;
  procedure TForm1.sBitBtn1Click(Sender: TObject);


begin
u := 13 ;
s2 :=  '0691261801000011000B818021123098F90000A702'+suhu ;
s1 := 'at+cmgs=16' ;
form1.AfDataDispatcher1.WriteString(s1);
form1.AfDataDispatcher1.WriteData(u,1);
form1.Timer1.Enabled := true;

end;

procedure TForm1.Button1Click(Sender: TObject);
begin
suhu := edit1.text ;
end;


procedure TForm1.Timer1Timer(Sender: TObject);
begin
form1.AfDataDispatcher1.WriteString(s2);
u := 26 ;
form1.AfDataDispatcher1.WriteData(u,1);
form1.Timer1.Enabled := false;
form1.Label1.Caption := 'PESAN TERKIRIM' ;
end;

var
 u1 : integer =0 ;
procedure TForm1.AfDataDispatcher1DataReceived(Sender: TObject);
var
sms : string;
sms1 : integer;
begin
sms := form1.AfDataDispatcher1.ReadString ;
```

```
inc(u1);
if ( (0 < u1) or (u1<= 2)) then
begin
memo1.Lines.Add(sms);
end;
if(u1>5) then
begin
s2 := 'at+cmgd=1';
form1.AfDataDispatcher1.WriteString(s2);
u := 13;
form1.AfDataDispatcher1.WriteData(u,1);
label1.Caption := 'Sukses' ;
end;

end;


procedure TForm1.sBitBtn2Click(Sender: TObject);
begin
s1 := 'at+cnmi=1,1,0,1,1';
u := 13 ;
form1.AfDataDispatcher1.WriteString(s1);
form1.AfDataDispatcher1.WriteData(u,1);
end;

procedure TForm1.sBitBtn3Click(Sender: TObject);
 var
s6 : string;
x : integer;
begin
s6 := 'at+calm=1' ;
 form1.AfDataDispatcher1.WriteString(s6);
x := 13 ;
form1.AfDataDispatcher1.WriteData(x,1);

end;

end.
```

Manual Reference

AT Command Set

(GSM 07.07, GSM 07.05,
Siemens specific commands)

for the SIEMENS Mobile Phones

S35i,C35i, M35i

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Revisions Overview

Date	Version	Name	Description of revision
15-03-2000	1.0	Kel	created

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7	AT+CGMM	Issue model ID code
7	AT+CGMR	Output the GSM telephone version
8	AT+CGSN	Output the serial number (IMEI)
8	AT+GSN	Output the serial number (IMEI)
8	AT+CHUP	Terminate call
8	AT+CEER	Query the reason for disconnection of last call
9	AT+CREG	Network registration
9	AT+COPS	Commands concerning selection of network operator
10	AT+CLCK	Switch locks on and off
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14	AT+CPBS	Select a telephone book
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17	AT+VTS	Send a DTMF tone
18	AT+VTD	Set duration of a DTMF tone
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23	AT+CPUC	Price per unit and currency table
24	AT+CALM	Alert sound mode
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24	AT+CLVL	Loudspeaker volume level
24	AT+CMUT	Mute control
25	AT+CVIB	Vibrator mode

1.2. AT Command Set

Remote control operation of the GSM mobile telephone runs via a serial interface (data cable of infrared connection), where AT+C commands according to ETSI GSM 07.07 and GSM 07.05 specification as well as several manufacturer specific AT commands are available. These commands are described in more detail later on.

The modem guideline V.25ter applies to the sequence of the interface commands. According to this guideline, commands should begin with the character string **”AT”** and end with **”<CR>” (= 0x0D).** The input of a command is acknowledged by the display of ”OK” or ”ERROR”. **A command currently in process is interrupted by each additional character entered**. This means that you should not enter the next command until you have received the acknowledgment; otherwise the current command is interrupted.

The commands supported are listed in the following tables:

1.2.1. Hayes-Standard Commands

The Hayes-standard commands correspond to the commands of AT Hayes-compatible modems.

Command	Function
A/	Repeat last command
AT...	Prefix for all other commands
ATA	Accept call
ATD<str>;	Dial the dialing string <str> with the voice utility Valid dial modifiers: ”T” (tone dialing), ”P” (pulse dialing) is ignored. The character ”;” is important, for this tells the phone that the call should be set up with the voice utility. Otherwise an attempt is made to set up a data call, which the phone immediately acknowledges with ”ERROR”. The dial command responds with OK to the user right after starting a voide call. Other behavior like *# sequences in the dial command and also data calls remain unchanged.
ATD><n>;	Dial the telephone number from the current telephone book location number <n> The telephone book is selected with the command at+cpbs (or at^spbs).
ATD><mem><n>;	Dial the telephone number from the telephone book <mem> location number <n>
ATDL	Dial last telephone number
ATE0	Deactivate command echo
ATE1	Activate command echo
ATH[0]	Separate connection
ATQ0	Display acknowledgments
ATQ1	Suppress acknowledgments
ATV0	Output acknowledgments as numbers
ATV1	Output acknowledgments as text
AT&F[0]	Reset to factory profile
ATZ	Set to default configuration
AT+GCAP	Output the capabilities list

1.2.2. Acknowledgments for Normal Data Communication

Response	Numeric	Meaning
OK	0	Command executed, no errors
RING	2	Ring detected
NO CARRIER	3	Link not established or disconnected
ERROR	4	Invalid command or command line too long
NO DIALTONE	6	No dial tone, dialing impossible, wrong mode
BUSY	7	Remote station busy

1.3. AT Commands and Responses According to GSM 07.07 and GSM 07.05

According to GSM, it is possible to execute an AT command in various forms.

Test command	AT+CXXX**=?**	The telephone responds by sending the list of parameters and value ranges; these can be set using the affiliated Write command or by means of internal processes.
Read command	AT+CXXX**?**	This command tells you the current value setting of the parameter(s).
Write command	AT+CXXX**=<...>**	This command is used to set parameters that can be set.
Execute command	AT+CXXX	The Execute command reads non-settable parameters which are influenced by internal processes in the telephone.

1.3.1. AT Cellular Commands According to GSM 07.07

AT+CGMI	Issue manufacturer ID code
Test command AT+CGMI=?	Response OK
Execute command AT+CGMI	Response <manufacturer> Parameter <manufacturer> Name of manufacturer (SIEMENS) **Important:** There is a leading output prefix +CGMI in models before the S25.

AT+CGMM	Issue model ID code
Test command AT+CGMM=?	Response OK
Execute command AT+CGMM	Response <model> Parameter <model> Name of telephone (MOBILE) **Important:** There is a leading output prefix +CGMM in models before the S25.

AT+CGMR	Output the GSM telephone version
Test command AT+CGMR=?	Response OK
Execute command AT+CGMR	Response <revision> Parameter <revision> Version of the telephone software **Important:** There is a leading output prefix +CGMR in models before the S25.

AT+CGSN	Output the serial number (IMEI)
Test command AT+CGSN=?	Response OK
Execute command AT+CGSN	Response <sn> Parameter <sn> IMEI of the telephone **Important:** There is a leading output prefix +CGMI in models before the S25.

AT+GSN	Output the serial number (IMEI)
Test command AT+GSN=?	Response OK
Execute command AT+GSN	Response +GSN: <sn> Parameter <sn> IMEI of the telephone **Important:** The output prefix +GSN may be missing in future versions.

AT+CHUP	Terminate call
Test command AT+CHUP=?	Response OK
Execute command AT+CHUP	Response OK/ERROR
	Description: All active calls and all calls on hold are terminated.

AT+CEER	Query the reason for disconnection of last call
Test command AT+CEER=?	Response OK
Execute command AT+CEER	Response +CEER: <report> Parameter <report> Disconnection reason reported as number

AT+CREG	Network registration
Test command AT+CREG=?	Response +CREG: (list of supported <n>s) OK/ERROR/+CME ERROR
	Parameter <n> 0 Suppresses the unexpected network-status messages 1 Displays the unexpected network-status messagesOK/ERROR/+CME ERROR
Read command AT+CREG?	Response +CREG: <n>,<stat>[,<lac>,<ci>] OK/ERROR/+CME ERROR
	Parameter <n> See Test command <stat> 0 Not checked in, not seeking 1 Checked in 2 Not checked in, but seeking a network 3 Check-in denied by network 4 Unknown 5 Registered, roaming <lac> Hexadecimal 2-byte string type of location area code <ci> Hexadecimal 2-byte string type of cell ID
Write command AT+CREG=<n>	Parameter <n> See Test command Response OK/ERROR/+CME ERROR
	Unexpected message +CREG: <stat>

AT+COPS	Commands concerning selection of network operator
Test command AT+COPS=?	Response +COPS: [list of supported (<stat>,long alphanumeric <oper>,,numeric <oper>)s][,,(list of supported <mode>s),(list of supported <format>s)] OK/ERROR/+CME ERROR Parameter <stat> 0 Unknown 1 Useful network operator 2 Used network operator 3 Prohibited network operator <oper> Operator in the format according to <mode> <mode> 0 Automatic mode 1 Manual selection of network operator 3 Setting of format 4 Automatic, manual selected <format> 0 Long alphanumeric 2 Numeric <oper>
Read command AT+COPS?	Response +COPS: <mode>[,<format>,<oper] OK/ERROR/+CME ERROR Parameter <mode> See Test command <format> See Test command <oper> Network operator
Write command AT+COPS=<mode>[,<format>[,<oper>]]	Parameter <mode> See Test command <format> See Test command If <mode> = 1, <format> can only = 2 <oper> In numeric form only Response

	OK/ERROR/+CME ERROR

AT+CLCK	Switch locking on and off **Revision to GSM 07.07 according to CR TDOC ETSI/SMG4 187/96**
Test command AT+CLCK=?	Response +CLCK: (list of supported <fac>s) OK/ERROR/+CME ERROR Parameter <fac> ”CS” Keyboard lock ”PS” Phone locked to SIM (device code) ”SC” SIM card (PIN) ”FD” FDN lock "AO" BAOC (bar all outgoing calls) "OI" BOIC (bar outgoing international calls) "OX" BOIC-exHC (bar outgoing international calls except to home country) "AI" BAIC (bar all incoming calls) "IR" BIC-Roam (bar incoming calls when roaming outside the home country) "AB" All Barring services "AG" All outgoing barring services "AC" All incoming barring services
Write command AT+CLCK=<fac>, <mode>[, <passwd> [,<class>]]	Parameter <fac> See Test command <mode> 0 Cancels lock 1 Activates lock 2 Queries lock status <passwd> Password <class> 1 Voice 2 Data 4 Fax 7 All classes (default value) Response If <mode>=2 and command is successful +CLCK: <status>[,<class1>[<CR><LF> +CLCK: <status>, class2....]] Parameter <status> 0 Off 1 On OK/ERROR/+CME ERROR

AT+CPWD	Change password to a lock
Test command AT+CPWD=?	Response +CPWD: list of supported (<fac>, <pwdlength>)s OK/ERROR/+CME ERROR Parameter <fac> “P2” PIN2 otherwise See Test command for AT+CLCK command, without ”FD” <pwdlength> Password length
Write command AT+CPWD= <fac>, <oldpwd>, <newpwd>	Parameter <fac> See Test command for AT+CLCK command <oldpwd>, <newpwd> Old and new password Response OK/ERROR/+CME ERROR

AT+CLIP	Display telephone number of calling party
Test command AT+CLIP=?	Response +CLIP: (list of supported <n>s) OK/ERROR/+CME ERROR Parameter <n> 0 Suppresses the unexpected messages 1 Displays the unexpected messages
Read command AT+CLIP?	Response +CLIP: <n>, <m> OK/ERROR/+CME ERROR Parameter <n> See Test command <m> 0 CLIP not booked 1 CLIP booked 2 Unknown
Write command AT+CLIP=[<n>]	Parameter <n> See Read command Response OK/ERROR/+CME ERROR
	Unexpected message +CLIP: <num>,<type> Telephone number of caller

AT+CCFC	Call forwarding
Test command AT+CCFC=?	Response +CCFC: (list of supported <reas>s) OK/ERROR/+CME ERROR Parameter <reas> 0 Always 1 If busy 2 If no answer 3 If not available 4 All reasons (0-3) 5 All conditional reasons (1-3)
Write command AT+CCFC=<reas>, <mode>[, <num>[,<type>[,<class>[,,,<time>]]]]	Parameter <reas> See Test command <mode> 0 Deactivate 1 Activate 2 Query 3 Install 4 Delete <num> Telephone number <type> Type of telephone number <class> 1 Voice 2 Data 4 Fax 7 All classes <time> 1-30 Time, rounded to a multiple of five seconds Response If <mode>=2 and command is successful +CCFC: <status>, <class1>[, <num>, <type>[,,, <time>]][<CR><LF>+CCFC: ....] OK/ERROR/+CME ERROR Parameter <status> 0 Not active 1 Active

AT+CHLD	Call hold and multiparty		
Test command AT+CHLD=?	Response +CHLD: (list of supported <n>s) OK/ERROR/+CME ERROR		
Write command AT+CHLD= [<n>]	Parameter <n>	0	Terminates all held calls or sets UDUB (**U**ser **D**etermined **U**ser **B**usy) for a waiting call
		1	Terminates all active calls (if there are any) and accepts the other call (waiting call or held call)
		1X	Terminates call number X (X= 1-7)
		2	Puts all active calls on hold (if there are any) and accepts the other call (waiting call or held call) as active
		2X	Puts all active calls except call X (X= 1-7) on hold
		3	Connects the call put on hold to the active call
	For terminating		Terminating all calls except waiting calls is done with ”AT+CHUP”
	Note:		Command scope depends on the SIM clearing and/or on the network support
	Response OK/ERROR/+CME ERROR		

AT+CPAS	Query the telephone status		
Test command AT+CPAS=?	Response +CPAS: (list of supported <pas>s) OK/ERROR/+CME ERROR		
	Parameter <pas>	0	Ready
		3	Incoming call (phone is ringing)
		4	Call is active
Execute command AT+CPAS	Response +CPAS: <pas> OK/ERROR/+CME ERROR		
	Parameter <pas>		See Test command
	OK/ERROR/+CME ERROR		

AT+CPIN	Enter PIN and query lock
Test command AT+CPIN=?	Response OK
Read command AT+CPIN?	Response +CPIN: <code> OK/ERROR/+CME ERROR Parameter <code> READY — No further input necessary SIM PIN — SIM PIN input necessary SIM PUK — SIM PUK input necessary PH-SIM PIN — Device-code (theft protection) input necessary PH-SIM PUK — Device-code PUK (theft protection) input necessary SIM PIN2 — PIN2, e.g. for editing the FDN book; only possible if previous command was acknowledged with +CME ERROR:17 SIM PUK2 — Only possible if previous command was acknowledged with error +CME ERROR:18 The required error message can (must) be provoked by an attempted Write command.
Write command AT+CPIN=<pin> [,<new pin>]	Parameter <pin> — Password for appropriate lock; if the lock is a PUK, then a <new pin> is necessary. <new pin> — New password for the lock Response OK/ERROR/+CME ERROR

AT+CBC	Battery charge
Test command AT+CBC=?	Response +CBC: (list of supported <bcs>s),(list of supported <bcl>s) OK/ERROR/+CME ERROR Parameter <bcs> 0 ME is supplied from battery 1 ME has battery but is not supplied from there 2 ME has no battery connected 3 Error <bcl> 0 Battery is flat, but no more actions possible 1-100 charge in per cent
Execute command AT+CBC	Response +CBC: <bcs>,<bcl>

AT+CSQ	Output signal quality
Test command AT+CSQ=?	Response +CSQ: (list of supported <rssi>s), list of supported <ber>) OK/ERROR/+CME ERROR Parameter <rssi> Reception level: 0 -113 dBm or less 1 -111 dBm 2-30 -109 to -53 dBm 31 -51 dBm or more 99 Unknown <ber> Bit error rate: 0-7 Like RXQUAL values from Table GSM 05.08 in Section 8.2.4 99 Unknown
Execute command AT+CSQ	Response +CSQ: <rssi>, <ber> OK/ERROR/+CME ERROR Parameter <rssi> See Test command <ber> See Test command

AT+CPBS	Select a telephone book
Test command AT+CPBS=?	Response +CPBS: (list of supported <sto>s) OK/ERROR/+CME ERROR Parameter <sto> ”FD” SIM fix-dialing phonebook ”SM” SIM phonebook ”ME” ME phonebook ”DC” ME Dialled Calls List ”ON” SIM (or ME) own numbers (MSISDNs) list ”LD” SIM last-dialling phonebook "MC" ME missed (unanswered received) calls list "RC" ME received calls list ***For description of telephone-book features, see** *Appendix A* **Note:** ”DC” and ”LD” are never both available.
Read command AT+CPBS?	Response +CPBS: <sto> OK/ERROR/+CME ERROR Parameter <sto> See Test command
Write command AT+CPBS=<sto>	Parameter <sto> See Test command Response OK/ERROR/+CME ERROR

AT+CPBR	Read a telephone-book entry
Test command AT+CPBR=?	Response +CPBR: (list of supported <index>s), <nlength>, <tlength> OK/ERROR/+CME ERROR Parameter <index> Location number <nlength> Max. length of telephone number <tlength> Max. length of text corresponding to the number
Write command AT+CPBR= <index1> [,<index2>]	Response +CPBR: <index1>, <nummer>, <typ>, <text>[<CR><LF> +CPBR: ..... +CPBR: <index2>, <nummer>, <typ>, <text>] OK/ERROR/+CME ERROR Parameter <index1> Location number where the read of the entry starts <index2> Location number where the read of the entry ends <nummer> Telephone number <typ> Type of number <text> Text corresponding to the telephone number **NOTE:** In the <text> field, there may appear special characters like **`"` (0x22), `@` (0x00), `ò` (0x08), `Ö` (0x5c).** (See also **+CPBW** and *Appendix A*: **Special hints for using** +CPBR/+CPBW **command)** In models before the S25, empty phonebook records are reported as follows: **+CPBR: <index1>,empty** In S25ff, those empty entries don't produce any output.

AT+CPBW	Write a telephone-book entry
Test command AT+CPBW=?	Response +CPBW: (list of supported <index>s), <nlength>,(list of supported <type>s), <tlength> OK/ERROR/+CME ERROR Parameter <index> Location number <nlength> Max. length of telephone number <tlength> Max. length of text corresponding to the number
Write command AT+CPBW= [<index>] [,<nummer> [,<typ>[,<text>]]]	Parameter <index> Location number at which the entry is written <nummer> Telephone number <typ> Type of number <text> Text corresponding to the telephone number Response OK/ERROR/+CME ERROR Note: The following characters in `<text>` must be entered via the escape sequence (see also *Appendix A*: **Special hints for using** +CPBR/+CPBW **command**) **GSM Char** / Hex char. / ASCII / **GSM Esc Seq** / Seq.(hex) / Note **Ö** / 5C / \ / **Ö5C** / 5C 35 43 / Backslash **"** / 22 / “ / **Ö22** / 5C 32 32 / String delim **ò** / 08 / BSP / **Ö08** / 5C 30 38 / Backspace @ / 00 / NULL / **Ö00** / 5C 30 30 / GSM Null y cause problems on application level when using the function strlen() and should thus be represented by an escape sequence

AT+CMEE	Expanded error messages according to GSM 07.07
Test command AT+CMEE=?	Response +CMEE: (list of supported <n>s) Parameter <n> 0 Suppresses the expanded error format 1 Expanded error messages as number 2 Expanded error messages as text
Read command AT+CMEE?	Response +CMEE: <n> Parameter <n> See Read command
Write command AT+CMEE=<n>	Parameter <n> See Read command Response OK/ERROR/+CME ERROR
	Description: **The following CME errors are possible:** 0 PHONE FAILURE 1 NO CONNECTION TO PHONE 2 PH-TA LINK RESERVED 3 OPERATION NOT ALLOWED 4 OPERATION NOT SUPPORT 5 PH-SIM PIN REQUIRED 10 SIM NOT INSERTED 11 SIM PIN REQUIRED 12 SIM PUK REQUIRED 13 SIM FAILURE 14 SIM BUSY 15 SIM WRONG 16 INCORRECT PASSWORD 17 SIM PIN2 REQUIRED 18 SIM PUK2 REQUIRED 20 MEMORY FULL 21 INVALID INDEX 22 NOT FOUND 23 MEMORY FAILURE 24 TEXT TOO LONG 25 INV CHAR IN TEXT 26 DIAL STRING TOO LONG 27 INV CHAR IN DIAL 30 NO NETWORK SERVICE 31 NETWORK TIMEOUT 100 UNKNOWN 512 CALL BARRED BY BLACKLIST 513 PHONE LINK RESERVED 514 INVALID DIAL STRING 515 PHONE BUSY 550 PH-SIM PUK REQUIRED 551 NTF-SIM PIN REQUIRED 552 NTF-SIM PUK REQUIRED 553 PH-NET PIN REQUIRED 554 PH-NET PUK REQUIRED 555 PH-SP PIN REQUIRED 556 PH-SP PUK REQUIRED 557 PH-CP PIN REQUIRED 558 PH-CP PUK REQUIRED 559 FEATURE PIN REQUIRED

	560 FEATURE PUK REQUIRED The following CMS errors have been defined for SMS: 300 ME failure 301 SMS service of ME reserved 302 operation not allowed 303 operation not supported 304 invalid PDU parameter 305 invalid TEXT mode 310 SIM not inserted 311 SIM PIN necessary 312 PH-SIM PIN necessary 313 SIM failure 314 SIM busy 315 SIM wrong 320 memory failure 321 invalid memory failure 322 memory full 330 SMSC address unknown 331 no network service 332 network timeout 340 NO +CNMA ACK EXPECTED 500 unknown error

AT+VTS	Send a DTMF tone
Test command AT+VTS=?	Response (list of supported <dtmf>s), (list of supported <duration>s) OK/ERROR/+CME ERROR Parameter <dtmf> 0-9,#,*,A-D, exactly one character <duration> Duration of tone in (duration/10) seconds
Write command AT+VTS=<dtmf>[,<duration>] or AT+VTS=<dtmf-string>	Parameter <dtmf> **One** character from the list, see Test command<duration> See Test command <dtmf-string> max. 29 characters in quotation marks (”...”), then a duration cannot be specified Response OK/ERROR/+CME ERROR **Important**: There is a leading output prefix +VTS in models before the S25.

AT+VTD	Set duration of a DTMF tone
Test command AT+VTD=?	Response +VTD: (list of supported <duration>s) OK/ERROR/+CME ERROR Parameter <duration> 1-255 Duration of tone in (duration/10) seconds
Read command AT+VTD?	Response +VTD: <duration> OK/ERROR/+CME ERROR
Write command AT+VTD= <duration>	Parameter <duration> See Test command Response OK/ERROR **Important**: There is a leading output prefix +VTD in models before the S25.

AT+WS46	Select wireless network
Test command AT+WS46=?	Response (list of supported <n>s) OK
Read command AT+WS46?	Response <n> OK/ERROR/+CME ERROR Parameter <n> Integer; WDS side stack 12 GSM digital cellular
Write command AT+WS46=[<n>]	Response OK/ERROR/+CME ERROR **Important:** There is a leading output prefix +WS46 in models before the S25.

AT+CSCS	Select TE character set
Test command AT+CSCS=?	Response +CSCS: (list of supported <chset>s) OK
Read command AT+CSCS?	Response +CSCS: <chset> OK/ERROR/+CME ERROR Parameter <chset> String; determines which TE character set is used
Write command AT+CSCS= [<chset>]	Response OK/ERROR/+CME ERROR

AT+CAOC	Advice of charge
Test command AT+CAOC=?	Response +CAOC: (list of supported <mode>s) Parameter <mode> 0 query CCM value
Read command AT+CAOC?	Response +CAOC: <mode> Parameter <mode> 0 See Test command
Write command AT+CAOC=<mode>	Response OK Parameter <mode> 0 See Test command
Execute command AT+CAOC	Response +CAOC: <ccm> OK/ERROR/+CME ERROR Parameter <ccm> Updated hexadecimal call meter, measured in home units; coding analogous to ACMmax on the SIM

AT+CSSN	Supplementary service notifications **Revision according to GSM 07.07 Version 5.0.0**
Test command AT+CSSN=?	Response +CSSN: (list of supported <n>s), (list of supported <m>s) Parameter <n> 0 Suppresses the +CSSI messages 1 Activates the +CSSI messages <m> 0 Suppresses the +CSSU messages 1 Activates the +CSSU messages For supported +CSSI/+CSSU messages, see also 1.3.4. **Summary of All UnexpectedMessages**
Read command AT+CSSN?	Response +CSSN: <n>,<m> Parameter <n> See Test command <m> See Test command
Write command AT+CSSN=<n>[,<m>]	Parameter <n> See Read command <m> See Read command
	Unexpected message +CSSI: <code1> +CSSU: <code2> Parameter <code1> Intermediate result code 3 Waiting call is pending <code2> Unsolicited result code 5 Held call was terminated

AT+CRSM	Restricted SIM access
Test command AT+CRSM=?	Response OK
Write command +CRSM=<command> [,<fileid> [,<P1>,<P2>,<P3> [,<data>]]]	Response +CRSM: <sw1>,<sw2>[,<response>] OK/ERROR/+CME ERROR Parameter <command>: 176 READ BINARY 178 READ RECORD 192 GET RESPONSE 214 UPDATE BINARY 220 UPDATE RECORD 242 STATUS <fileid>: Integer, identifier of the data file on the SIM, mandatory for every command except STATUS (see GSM 11.11) <P1>, <P2>, <P3>: Integer, transferal parameter from ME to SIM, mandatory for every command except GET RESPONSE,STATUS (see GSM 11.11) <data>: Hexadecimal string; information that is to be written to the SIM <sw1>, <sw2>: Integer; information from the SIM as to how/whether the command was executed <response>: Hexadecimal string; given when a command was successfully processed **Note**: The write access to CK boxes receives only limited support and differs from device to device.

AT+CIMI	Output of IMSI
Test command AT+CIMI=?	Response OK
Execute command AT+CIMI	Response <imsi> Parameter <imsi> International Mobile Subscriber Identity (IMSI)

AT+CACM	Accumulated call meter
Test command AT+CACM=?	Response OK
Read command AT+CACM?	Response +CACM: <acm> OK/ERROR/+CME ERROR Parameter <acm> Accumulated call meter in hexadecimal format, measured in home units; coding analogous to ACMmax on the SIM
Write command AT+CACM=[<passwd>]	Response OK/ERROR/+CME ERROR Parameter <passwd> String type; usually PIN2

AT+CAMM	Accumulated call meter maximum
Test command AT+CAMM=?	Response OK
Read command AT+CAMM?	Response +CAMM: <acmmax> OK/ERROR/+CME ERROR Parameter <acmmax> Accumulated call meter maximum in hexadecimal format, measured in home units; coding analogous to ACMmax on the SIM
Write command AT+CAMM=[<acmmax>[,<passwd>]]	Response OK/ERROR/+CME ERROR Parameter <acmmax> (see Read command) <passwd> String type; usually PIN2

AT+CLCC	List Current Calls
Test command AT+CLCC=?	Response OK
Execute command AT+CLCC	Response [+CLCC: <id1>,<dir>,<stat>,<mode>,<mpty>, <number>,<type>] [<CR><LF>+CLCC: <id2>,<dir>,<stat>,<mode>,<mpty>, <number>,<type> [...]]] OK/ERROR/+CME ERROR Parameter <idx>: integer type; call identification number as described in GSM 02.30 [19] subclause 4.5.5.1; this number can be used in +CHLD command operations <dir>: 0 mobile originated (MO) call 1 mobile terminated (MT) call <stat> (state of the call): 0 active 1 held 2 dialing (MO call) 3 alerting (MO call) 4 incoming (MT call) 5 waiting (MT call) <mode> (bearer/teleservice): 0 voice 1 data 2 fax 3 voice followed by data, voice mode 4 alternating voice/data, voice mode 5 alternating voice/fax, voice mode 6 voice followed by data, data mode 7 alternating voice/data, data mode 8 alternating voice/fax, fax mode 9 unknown <mpty>: 0 call is not one of multiparty (conference) call parties 1 call is one of multiparty (conference) call parties <number>: string type phone number in format specified by <type> <type>: type of address octet in integer format

AT+CCLK	Clock
Test command AT+CCLK=?	Response OK
Read command AT^SCLK?	Response +CCLK: <time> OK/ERROR/+CME ERROR Parameter: <time>: string type value; format is "yy/MM/dd,hh:mm:ss", where characters indicate year (two last digits), month, day, hour, minutes; E.g. 6th of May 1994, 22:10:00 hours equals to „94/05/06,22:10:00"
Write command AT+CCLK=<time>	Response OK/ERROR/+CME ERROR Parameter: <time> see Test commnd

AT+COPN	Read operator names
Test command AT+COPN=?	Response OK
Execute command AT+COPN	Response +COPN:numeric <oper>,long alphanumeric <oper><CR><LF> +COPN:..... OK/ERROR/+CME ERROR Parameter <oper> Network operator in numeric and alphanumeric notation see AT^SPLM

AT+CPUC	Price per unit and currency table
Test command AT+CPUC=?	Response OK
Read command AT+CPUC?	Response +CPUC: <currency>,<ppu> OK/ERROR/+CME ERROR Parameter <currency> three-character currency code (e.g. “FRA”, “DEM”) <ppu> price per unit; dot is used as a decimal separator (e.g. “1.33”)
Write command AT+CPUC= <currency>,<ppu>[, <passwd>]	Response OK/ERROR/+CME ERROR Parameter <passwd> String type; usually PIN2

AT+CALM	Alert sound mode
Test command AT+CALM=?	Response +CALM: (list of supported <mode>s) OK
Read command AT+CALM?	Response +CALM: <mode> OK/ERROR/+CME ERROR
Write command AT+CALM=<mode>	Response OK/ERROR/+CME ERROR Parameter <mode>: 0 normal mode 1 silent mode (all sounds are prevented) 2 beep (only a short beep indicates an incomming call)

AT+CRSL	Ringer sound level
Test command AT+CRSL=?	Response +CRSL: (list of supported <level>s) OK
Read command AT+CRSL?	Response +CRSL: <level> OK/ERROR/+CME ERROR
Write command AT+CRSL=<level>	Response OK/ERROR/+CME ERROR Parameter <level>: Ringer Sound Level

AT+CLVL	Loudspeaker volume level
Test command AT+CLVL=?	Response +CLVL: (list of supported <level>s) OK
Read command AT+CLVL?	Response +CLVL: <level> OK/ERROR/+CME ERROR
Write command AT+CLVL=<level>	Response OK/ERROR/+CME ERROR Parameter <level>: Loudspeaker Volume Level

AT+CMUT	Mute control
Test command AT+CMUT=?	Response +CMUT: (list of supported <n>s) OK
Read command AT+CMUT?	Response +CMUT: <n> OK/ERROR/+CME ERROR
Write command AT+CMUT=<n>	Response OK/ERROR/+CME ERROR Parameter <n>: 0 mute off 1 mute on

AT+CVIB	Vibrator mode
Test command AT+CVIB=?	Response +CVIB: (list of supported <mode>s) OK
Execute command AT+CVIB	Response +CVIB: <mode> OK/ERROR/+CME ERROR
Write command AT+CVIB=<mode>	Response OK/ERROR/+CME ERROR Parameter <mode>: Vibrator mode 0 disable 1 enable 16 vibrate then ring (not available in every model)

1.3.2. AT Commands According to GSM 07.05 for SMS

The GSM 07.05 commands are used for operating the SMS functions of the GSM mobile phone. The GSM module MOBILE supports the SMS PDU mode.

AT+CSMS	Selection of message service **Revision according to GSM 07.05 Version 5.0.0**
Test command AT+CSMS=?	Response +CSMS: (list of supported <service>s) Parameter <service> 0 GSM 3.40 and 3.41 1 GSM 3.40 and 3.41 and compatibility of the AT command syntax for phase 2+ **NOTE:** Deactivating the phase 2+ compatibility is only possible if the direct output of short messages +CNMI=1,2 or +CNMI=1,3 is not activated. If necessary, the latter should be deactivated first.
Read command AT+CSMS?	Response +CSMS: <service>,<mt>,<mo>,<bm> Parameter <service> 0 GSM 3.40 and 3.41 <mt> Mobile terminated messages 1 Type supported <mo> Mobile originated messages 1 Type supported <bm> Broadcast type messages 0 Type not supported
Write command AT+CSMS=<service>	Parameter <service> 0 GSM 3.40 and 3.41 Response +CSMS: <mt>,<mo>,<bm> OK/ERROR/+CMS ERROR

AT+CPMS	Selection of SMS memory **Revision according to GSM 07.05 Version 4.7.0**
Test command AT+CPMS=?	Response +CPMS: (list of supported <mem1>s),(list of supported <mem2>s) ,(list of supported <mem3>s) Parameter <mem1> Memory from which messages are read and deleted "SM" SIM-messages memory <mem2> Memory to which messages are written and sent "SM" SIM-messages memory <mem3> Memory in which received messages are stored, if forwarding to the PC is not set ("+CNMI") "SM" SIM-messages memory
Read command AT+CPMS?	Response +CPMS: <mem1>,<used1>,<total1>,<mem2>,<used2>,<total2> ,<mem3>,<used3>,<total3> Parameter <memx> Memory from which messages are read and deleted <usedx> Number of messages currently in <memx> <totalx> Number of storable messages in <memx>
Write command AT+CPMS=<mem1>[,<mem2>[,<mem3>]]	Parameter <mem1> See Test command <mem2> See Test command <mem3> See Test command Response +CPMS: <used1>,<total1>,<used2>,<total3>,<used3>,<total3> OK/ERROR/+CMS ERROR

AT+CMGF	SMS format
Test command AT+CMGF=?	Response +CMGF: (list of supported <mode>s) Parameter <mode>: 0 PDU mode
Read command AT+CMGF?	Response +CMGF: <mode> Parameter <mode>: 0 PDU mode
Write command AT+CMGF=[<mode>]	Parameter <mode>: 0 PDU mode Response OK/ERROR

AT+CSCA	Address of the SMS service center
Test command AT+CSCA=?	Response OK
Read command AT+CSCA?	Response +CSCA: <sca>,<tosca> Parameter <sca> Service-center address in string format <tosca> Service-center address format
Write command AT+CSCA= <sca>[,<tosca>]	Parameter <sca> Service-center address in string format <tosca> Service-center address format Response OK/ERROR

AT+CNMI	Display new incoming SMS **Revision according to GSM 07.05 Version 4.7.0**
Test command AT+CNMI=?	Response +CNMI: (list of supported <mode>s),(list of supported <mt>s),(list of supported <bm>s),(list of supported <ds>s),(list of supported <bfr>s) Parameter <mode> 0 Buffers unexpected messages (but is equivalent to rejecting; see <bfr>) 1 Discard indication and reject new received message unsolicited result codes when TA-TE link is reserved. Otherwise forward them directly to the TE. (only with S25ff) 2 Buffers unexpected messages if serial interface is occupied, otherwise they are output (only models before S25) <mt> 0 Suppresses unexpected messages for incoming short messages 1 Unexpected messages of a received short message (SMS-DELIVER) that is stored on a chip card are output in the form +CMTI: <mem>,<index> 2 Unexpected messages of a received short message (SMS-DELIVER) (except class 2 and the message "Waiting Indication Group: store message") are output in the form +CMT: [<alpha>],<length><CR><LF><pdu> (<alpha> is not supported) Class 2 and the message "Waiting Indication Group: store message" are output as <mt>=1 3 Unexpected messages of a received short message (SMS-DELIVER) class 3 are output as <mt>=2. Messages with other data coding schemes are output as <mt>=1. **NOTE:** <mt>=2 and <mt>=3 are not possible unless the Phase 2+ compatibility has been activated by means of +CSMS=1 <bm> 0 Suppresses unexpected messages for incoming cell broadcast messages 2 Outputs unexpected messages for cell broadcast messages in the form +CBM: <length><CR><LF><pdu> <ds> 0 Suppresses unexpected messages for incoming SMS status reports 2 Outputs unexpected messages for SMS status reports in the form +CDS: <length><CR><LF><pdu>

	<bfr> 1 Buffered unexpected messages are rejected when switching from <mode> 0 to <mode> 2. <mem> See +CPMS <index> Index of the record on the chip card <alpha> alphanumeric representation of the sender address <length> Length of <pdu> <pdu> See +CMGL
Read command AT+CNMI?	Response +CNMI: <mode>,<mt>,<bm>,<ds>,<bfr> Parameter <mode> See Test command <mt> See Test command <bm> See Test command <ds> See Test command <bfr> See Test command
Write command AT+CNMI=[<mode>[,<mt>[,<bm>[,<ds>[,<bfr>]]]]]	Parameter <mode> See Test command <mt> See Test command <bm> See Test command <ds> See Test command <bfr> See Test command Response OK/ERROR/+CMS ERROR
	Unexpected message +CMTI: <mem>,<index> Indication that new message has arrived +CMT: ,<length><CR><LF><pdu> Direct output of the short message +CDS: <length><CR><LF><pdu> Direct output of the status report +CBM: <length><CR><LF><pdu> Direct output of the cell broadcast message

AT+CNMA	Acknowledgment of a short message directly output (without storing on the chip card) **Revision according to GSM 07.05 Version 5.0.0** ***(NOTE**: This command is not possible unless the Phase 2+ compatibility has been activated by means of +CSMS=1*)
Test command AT+CNMA=?	Response +CNMA: (list of supported <n>s) Parameter <n> 0 Mode of functioning analogous to GSM 07.05 text mode
Write command AT+CNMA[=<n>]	Parameter <n> See Test command Response OK/ERROR/+CMS ERROR: <err>

AT+CMGL	List SMS **Revision according to GSM 07.05 Version 4.7.0**
Test command AT+CMGL=?	Response +CMGL: (list of supported <stat>s) Parameter <stat> 0 ”REC UNREAD”: received unread messages (default) 1 ”REC READ”: received read messages 2 ”STO UNSENT”: stored unsent messages 3 ”STO SENT”: stored sent messages 4 ”ALL”: all messages
Write command AT+CMGL [=<stat>]	Parameter <stat> See Test command Response If PDU mode (+CMGF=0) and command are successful: +CMGL:<index>,<stat>,[<alpha>],<length> <CR><LF><pdu>[<CR><LF> +CMGL: <index>,<stat>,[alpha],<length> <CR><LF><pdu><CR><LF> [...]]
	Parameter <pdu> The PDU begins with the service-center address (according to GSM04.11), followed by the TPDU according to GSM03.40 in hexadecimal format otherwise: +CMS ERROR: <err>

AT+CMGR	Read in an SMS **Revision according to GSM 07.05 Version 4.7.0**
Test command AT+CMGR=?	Response OK
Write command AT+CMGR= <index>	Parameter <index> Index of message in selected memory <mem1> Response **If PDU mode (+CMGF=0) and command are successful:** +CMGR: <stat>,[<alpha>],<length><CR><LF><pdu> Parameter <pdu> Siehe “AT+CMGL” otherwise: +CMS ERROR: <err>

AT+CMGS	Send an SMS
Test command AT+CMGS=?	Response OK
Write command **If PDU mode (+CMGF=0)** +CMGS=<length><CR>***PDU is given*** <ctrl-Z/ESC>	Parameter <length> Length of PDU <pdu> See ”AT+CMGL” <mr> Message reference Response **If sending is successful:** +CMGS: <mr> **If sending is not successful:** +CMS ERROR: <err>

AT+CMSS	Send an SMS from the SMS memory
Test command AT+CMSS=?	Response OK
Write command +CMSS=<index>[,<da>[,<toda>]]	Parameter <index> Index of message in selected memory <mem1> <da> Destination address in string format <toda> Format of destination address <mr> Message reference Response **If sending is successful:** +CMSS: <mr> **If sending is not successful:** +CMS ERROR: <err>

AT+CMGW	Write an SMS to the SMS memory
Test command AT+CMGW=?	Response OK
Write command **If PDU mode (+CMGF=0)** AT+CMGW=<length>[,<stat>]<CR>***PDU is given*** <ctrl-Z/ESC>	Parameter <length> Length of PDU <stat> See command +CMGL <pdu> See "AT+CMGL" <index> Index of message in selected memory <mem1> Response +CMGW: <index> +CMS ERROR: <err>

AT+CMGD	Delete an SMS in the SMS memory
Test command At+CMGD=?	Response OK
Write command AT+CMGD=<index>	Parameter <index> Index of message in the selected memory <mem1> Response OK/ERROR/+CMS ERROR

AT+CSCB	Select cell broadcast messages
Test command AT+CSCB=?	Response +CSCB: (list of supported <mode>s) Parameter <mode> 0 Accepts messages that are defined in <mids> and <dcss> 1 Does not accept messages that are defined in <mids> and <dcss>
Read command AT+CSCB? Write command AT+CSCB=[<mode>[,<mids>[,<dcss>]]]	Response +CSCB: <mode>,<mids>,<dcss> Parameter <mode> See Test command <mids> String type; combinations of CBM message IDs <dcss> String type; combinations of CBM data coding schemes

AT+CMGC	Send an SMS command
Test command AT+CMGC=?	Response OK
Write command **If PDU mode (+CMGF=0)** +CMGC=<length><CR>***PDU is given*** <ctrl-Z/ESC>	Parameter <length> Length of PDU <pdu> See "AT+CMGL" <mr> Message reference Response **If sending is successful:** +CMGC: <mr> **If sending is not successful:** +CMS ERROR: <err>

1.3.3. User-Defined Commands for Controlling the GSM Mobile Phone

Since user-defined commands cannot be implemented according to official syntax, the character string ”+C” is replaced by ”^S” (”^” = 0x5E). For the future: if a user-defined command is accepted in the same syntax in GSM recommendations, the command can be addressed using both command strings.

AT^SPBS	Select a telephone book (including Siemens-specific books)
Test command AT^SPBS=?	Response ^SPBS: (list of supported <sto>s) OK/ERROR/+CME ERROR Parameter <sto> ”FD” SIM fix-dialing telephone book ”SM” SIM telephone book ”ME” Telephone book in device ”DC” ME Dialled Calls List ”ON” Own telephone numbers ”LD” SIM last dialing number "MC" ME Missed Calls List "RC" ME Received Calls List ”MD” Last number redial memory in telephone device ”OW” Own numbers ”BD” Barred dialing numbers ”SD” Service dialing numbers ”MS” Missed dialing numbers (unanswered calls) ”CD” Callback dialing numbers (answered calls) ”BL” Blacklist dialing numbers (barred numbers from remote) ”MB” Mailbox dialing numbers (network-operator mailbox) ”CS” Common sortable telephone book (sorted combination of ”SM”, ”ME”, ”FD”; access only via ^SPBC, ^SPBG) ”RD” Red book (all entries in ”CS” whose name portions have an exclamation point (‘!’) as the final character) *For a description of the telephone-book features, see Appendix A
Read command AT^SPBS?	Response ^SPBS: <sto> OK/ERROR/+CME ERROR Parameter <sto> See Test command
Write command AT^SPBS= <sto>	Parameter <sto> See Test command Response OK/ERROR/+CME ERROR

AT^SDLD	Delete the ”last number redial” memory
Test command AT^SDLD=?	Response OK
Execute command AT^SDLD	Response OK/ERROR/+CME ERROR

AT^SPBC	Seek the first entry in the sorted telephone book which begins with the selected (or next available) letter
Test command AT^SPBC=?	Response ^SPBC: (list of sorted telephone books supported <mem>s) See AT+CPBS/AT^SPBS OK/ERROR/+CME ERROR
Write command AT^SPBC=<char>	Parameter <char> First letter of sought entry "A" to "Z" (with any other character, the index of the first entry that begins with a special character is sent back) <index> Index in the sorted telephone book (access via AT^SPBG) Response ^SPBC: <index> OK/ERROR/+CME ERROR

AT^SPBG	Read entry from the sorted telephone book via the sorted index
Test command AT^SPBG=?	Response ^SPBG: (list of supported <index>s), <nlength>, <tlength> OK/ERROR/+CME ERROR Parameter <index> Location number <nlength> Max. length of telephone number <tlength> Max. length of the text corresponding to the number
Write command AT^SPBG=<index1> [, <index2>]	Response ^SPBG: <index1>, <nummer>, <typ>, <text>[<CR><CL> ^SPBG: ..... ^SPBG: <index2>, <nummer>, <typ>, <text>] OK/ERROR/+CME ERROR Parameter <index1> Location number where the read of the entry starts <index2> Location number where the read of the entry ends <nummer> Telephone number <typ> Type of number <text> Text corresponding to the telephone number

AT^SLCK	Switch locks (including user-defined locks) on and off
Test command AT^SLCK=?	Response ^SLCK: (list of supported <fac>s) OK/ERROR/+CME ERROR Parameter <fac> "PS" Phone locked to SIM (device code) "SC" SIM card (PIN) "FD" FDN lock "AO" BAOC (bar all outgoing calls) "OI" BOIC (bar outgoing international calls) "OX" BOIC-exHC (bar outgoing international calls except to home country) "AI" BAIC (bar all incoming calls) "IR" BIC-Roam (bar incoming calls when roaming outside the home country) "AB" All barring services "AG" All outgoing barring services "AC" All incoming barring services "PN" Network personalization (GSM 02.22) "PC" Corporate personalization (GSM 02.22) "PU" Network subset personalization (GSM 02.22) "PP" Service provider personalization (GSM 02.22) "PF" Phone locked to very first inserted SIM
Write command AT^SLCK = <fac>, <mode> [,<passwd> [,<class>]]	Parameter <fac> See Test command <mode> 0 Cancels lock 1 Activates lock 2 Queries lock status <passwd> Password <class> 1 Voice 2 Data 4 Fax 7 All classes (default value) Response **If <mode>=2 and command is successful** ^SLCK: <status>[,<class1>[<CR><LF> ^SLCK: <status>, class2....]] Parameter <status> 0 Off 1 On OK/ERROR/+CME ERROR

AT^SPWD	Change password to a lock (including user-defined locks)
Test command AT^SPWD=?	Response ^SPWD: list of supported (<fac>, <pwdlength>)s OK/ERROR/+CME ERROR Parameter <fac> ”P2” PIN2 otherwise See Test command for the command AT^SLCK, without ”FD” <pwdlength> Length of password
Write command AT^SPWD = <fac>,<oldpwd>, <newpwd>	Parameter <fac> See Test command for the command AT^SLCK <oldpwd>, <newpwd> Old and new password Response OK/ERROR/+CME ERROR

AT^SACM	Output ACM (accumulated call meter) and ACMmax
Test command AT^SACM=?	Response ^SACM: (list of supported <n>s)
Execute command AT^SACM	Response ^SACM: <n>,<acm>,<acm_max> OK/ERROR/+CME ERROR Paramter <n> See Test command <acm> Accumulated call meter <acm_max> Maximum accumulated call meter
Write command AT^SACM=<n>	Parameter <n> 0 Suppresses the unexpected message 1 Outputs the unexpected message

AT^SPLM	Read the PLMN list
Test command AT^SPLM=?	Response OK
Execute command AT^SPLM	Response ^SPLM:numeric <oper>,long alphanumeric <oper><CR><LF> ^SPLM:..... OK/ERROR/+CME ERROR Parameter <oper> Network operator in numeric and alphanumeric notation

AT^SPLR	Read an entry from the preferred-operator list
Test command AT^SPLR=?	Response ^SPLR: (list of supported <index>s) OK/ERROR/+CME ERROR Parameter <index> Location numbers
Write command AT^SPLR=<index1> [, <index2>]	Response ^SPLR: <index1>, numeric <oper> ^SPLR: ..... ^SPLR: <index2>, numeric <oper> OK/ERROR/+CME ERROR Parameter <index1> Location number where the read of the entry starts <index2> Location number where the read of the entry ends <oper> Network operator in numeric form

AT^SPLW	Write an entry to the preferred-operator list
Test command AT^SPLW=?	Response ^SPLW: (list of supported <index>s) OK/ERROR/+CME ERROR Parameter <index> Location number
Write command AT^SPLW=<index>[, <oper>]	Parameter <index> Location number at which the entry is written <oper> Network operator in numeric form Response OK/ERROR/+CME ERROR

AT^SCNI	Output call number information
Test command AT^SCNI=?	Response OK
Execute command AT^SCNI	Response ^SCNI: 1[,<cs>[,<number>,<type>]]<CR><LF> ^SCNI: 2[,<cs>[,<number>,<type>]]<CR><LF> ^SCNI: 3[,<cs>[,<number>,<type>]]<CR><LF> ^SCNI: 4[,<cs>[,<number>,<type>]]<CR><LF> ^SCNI: 5[,<cs>[,<number>,<type>]]<CR><LF> ^SCNI: 6[,<cs>[,<number>,<type>]]<CR><LF> ^SCNI: 7[,<cs>[,<number>,<type>]] OK/ERROR/+CME ERROR Parameter <cs> Call status of affiliated call number (first parameter) 0 Call on hold 1 Active call 2 Waiting call <number> Telephone number <type> Type of number

AT^SNFV	Set the volume
Test command AT^SNFV=?	Response ^SNFV: (list of supported <vol>s) Parameter <vol> Value range of volume (0 to 4) (0 low, ..., 4 max. volume; approx. 3 dB/level)
Read command AT^SNFV?	Response ^SNFV: <vol> Parameter <vol> See Test command
Write command AT^SNFV=<vol>	Parameter <vol> See Test command Response OK/ERROR

AT^SNFS	Select NF hardware
Test command AT^SNFS=?	Response ^SNFS: (list of supported <dev>s) Parameter <dev> 0 Cell phone mode 1 Handsfree
Read command AT^SNFS?	Response ^SNFS: <dev> Parameter <dev> See Test command **Note:** Volume should be temporarily set to „0“ before NF hardware is changed.
Write command AT^SNFS=<dev>	Parameter <dev> See Test command Response OK/ERROR

AT^SRTC	Set the ringing tone
Test command AT^SRTC=?	Response ^SRTC: (list of supported <type>s), (list of supported <vol>s) Parameter <type> 1-X Number of ringing tone 0 Mutes the ringing tone; when MTC is set, the phone does not ring and the volume is ignored <vol> 0-Y Volume of ringing tone
Read command AT^SRTC?	Response ^SRTC: <type>, <vol>, <ringing> Parameter <type> See Test command <vol> See Test command <ringing> 0 Test-ring is switched off 1 Test-ring is switched on
Write command AT^SRTC=[<type>][, <vol>]	Parameter <type> See Test command <vol> See Test command Response OK/ERROR
Execute command AT^SRTC	Response The ringing tone sounds on the current NF device; it is selected using ”AT+CNFS” until AT^SRTC is called up again OK/ERROR/+CME ERROR **Note:** If an MTC arrives while the test-ring is active, the latter is switched off and the ”normal” ring is switched on.

AT^SCID	Output card ID
Test command AT^SCID=?	Response OK/ERROR/+CME ERROR
Execute command AT^SCID	Response ^SCID: <cid> OK/ERROR/+CME ERROR Parameter <cid> Number of SIM card

AT^SCKS	Output SIM card status
Test command AT^SCKS=?	Response ^SCKS: (list of supported <n>s) Parameter <n> 0 Suppresses the unexpected messages 1 Outputs the unexpected messages
Read command AT^SCKS?	Response ^SCKS: <n>, <m> Parameter <m> 0 No card 1 Card in card reader
Write command AT^SCKS=<n>	Parameter <n> See Test command Response OK/ERROR
	Unexpected message ^SCKS: <m> See Read command

AT^SPIC	Output PIN counter
Test command AT^SPIC=?	Response OK/ERROR/+CME ERROR
Execute command AT^SPIC	Response ^SPIC: <counter> OK/ERROR/+CME ERROR Parameter <counter> Number of tries still available to enter the <passwd. The command ”AT+CPIN?” must be used to check which password is currently needed.

AT^SMGO	SMS overflow indicator
Test command AT^SMGO=?	Response ^SMGO: (list of supported <n>s) OK/ERROR/+CME ERROR Parameter <n> 0 Disable 1 Enable
Read command AT^SMGO?	Response ^SMGO: <n>,<mode> OK/ERROR/+CME ERROR
	Parameter <n> See Test command <mode> 0 Space still available 1 SMS buffer is full (chip card) 2 Buffer is full and new message that should be sent to the telephone is present in the SC
Write command AT^SMGO=<n>	Parameter <n> See Test command Response OK/ERROR/+CME ERROR
	Unexpected message ^SMGO: <mode> See Read command

AT^SMGL	List SMS (without status change from *unread* to *read*) Revision according to GSM 07.05 Version 4.7.0
Test command AT^SMGL=?	Response ^SMGL: (list of supported <stat>s) Parameter <stat> 0 ”REC UNREAD”: received unread messages (default) 1 ”REC READ”: received read messages 2 ”STO UNSENT”: stored unsent messages 3 ”STO SENT”: stored sent messages 4 ”ALL”: all messages
Write command AT^SMGL [=<stat>]	Parameter <stat> See Test command Response **If PDU mode (+CMGF=0) and command is successful:** ^SMGL: <index>,<stat>,[<alpha>],<length> <CR><LF><pdu> [<CR><LF>^SMGL: <index>,<stat>,[alpha],<length> <CR><LF><pdu> […]]
	Parameter <pdu> The PDU begins with the service-center address (according to GSM04.11), followed by the TPDU according to GSM03.40 in hexadecimal format **otherwise:** +CMS ERROR: <err>

AT^SMGR	Read SMS record without Changing unread->read **Syntax like AT+CMGR**
Test command AT^SMGR=?	Response OK
Write command AT^SMGR= <index>	Parameter <index> Index of message in selected memory <mem1> Response **If PDU mode (+CMGF=0) and command are successful:** ^SMGR: <stat>,[<alpha>],<length><CR><LF><pdu> Parameter <pdu> Siehe “AT+CMGL” otherwise: +CMS ERROR: <err>

AT^SMSO	Switch device off
Test command AT^SMSO=?	Response OK
Execute command AT^SMSO	Response OK Device switches off

AT^SLNG	Language settings
Test command AT^SLNG=?	Response ^SLNG: (list of supported languages <lng>s) Parameter: <lng>: Integer; language coded according to GSM 03.38 or mobile-specific language (>100)
Read command AT^SLNG?	Response ^SLNG: <lng>
Write command AT^SLNG=<lng>	Response OK/ERROR/+CME ERROR

AT^SSTK	SIM Toolkit
Test command AT^SSTK=?	Response ^SSTK: <profile> Parameter: <profile> ME profile according to GSM 11.14
Write command AT^SSTK=<length>[,<mode>]<CR>***PDU is given***<ctrl-Z/ESC>	Response: OK/ERROR/CME ERROR Parameter: <length>: Length of PDU in bytes <mode>: 0: Single command 1: Sequence of commands <pdu>: SIM Toolkit commands, see GSM 11.14 **Limitation**: The maximum PDU length is 176 bytes.

AT^SBNW	Binary Write
Test command AT^SBNW=?	Response ^SBNW: ((list of supported <types>s, list of supported <subtype>s)) OK/ERROR/+CME ERROR Parameter: <type> „bmp“ bitmap Windows bitmap format without compression; 2/16/256 colours, at least 97x26 pixels <subtype> 0 shown permanently when registered in home network 1 shown temporarily, deletet by more important display contents „mid“ ring tones in standard MIDI format 0, without polyphony specification: http://www.midi.org <subtype> 0 first (and only) entry of type “mid” „vcs“ vcal format specification: http://www.imc.org/pdi

	<subtype> 0 first entry of type “vcs” 1 entry of type “vcs” … <actNumber> 0 deletes entry of the act. subtype other actual packet number <maxNumber> maximum number of packets
Write command AT^SBNW=<type>,<subtype>,[<actNumber>[,<maxNumber>]]<CR>***PDU is given***<ctrl-Z/ESC>	Response OK/ERROR/+CME ERROR Parameter: <type> see Test commnd <subtype> see Test commnd <actNumber> see Test commnd <maxNumber> see Test commnd **Note**: -It is not possible to upload data when a call is active or in progress. If a call is active the mobile responses with +CME ERROR: PHONE BUSY and the actual upload sequence is aborted and all data packets are discarded. -If uploaded data is not useable (e.g. wrong data format) the mobile responses with +CME ERROR: INV CHAR IN TEXT after the last packet is uploaded. -To get the extended +CME-ERROR-responses AT+CMEE=2 has to be sent before. Otherwise the mobile respones only with ERROR . (see GSM07.07) -If <actNumber> and <maxNumber> during the upload are omitted, the mobile aborts the whole input sequence for the current subtype. -If <actNumber> is 0 during the upload and <maxNumber> is ommitted, the mobile deletes the actual record with index <subtype> -Packets have to be uploaded in the right order! -**Limitation**:The maximum pdu size is 176 bytes (or 352 characters) *See Appendix B for examples.*

AT^SBNR	Binary Read
Test command AT^SBNR=?	Response ^SBNR: (list of supported <types>s, (list of supported <subtype>s)) OK/ERROR/+CME ERROR Parameter: <type> see AT^SBNW command <subtype> see AT^SBNW command
Write command AT^SBNR=<type>,<subtype>	Response ^SBNR: <type>,<subtype>,1,<maxNumber> <CR><LF><data><CR><LF> ^SBNR: <type>,<subtype>,2,<maxNumber> <CR><LF><data><CR><LF>[...] OK/ERROR/+CME ERROR Parameter: <type> see AT^SBNW command <subtype> see AT^SBNW command <data> data in hexadecimal form (PDU) <maxNumber> see AT^SBNW command *See Appendix B for examples.*

1.3.4. Summary of All Unexpected Messages

Message	Meaning
+CREG: <stat>	Network registration
+CLIP: <num>	Telephone number of caller
+CMTI: <mem>,<index>	Indication of a new short message
+CMT: ,<length><CR><LF><pdu>	Short message
+CSSI: <code1> +CSSU: <code2>	Supplementary service intermediate/unsolicited result code
^SMGO: <mode>	SMS overflow indicator
^SCKS: <m>	Message indicating whether card has been removed or inserted
^SACM: <m>	Message indicating if ACM has reached the maximum value ACMmax

Appendix A

Factory settings made by AT&F

```
ATE1 (only in case of RCCP mode)
ATQ0
ATV1

AT+CREG=0
AT+CLIP=0
AT+CRC=0
AT+CAOC=0
AT+CMEE=0
AT+CPBS=SM (if available)
AT+COPS=0
AT+VTS=1
AT+CSCS="GSM"
AT+CSSN=0,0
AT^SCKS=0
Reset pending locks (Phone Pin/Puk, Pin2/Puk2 ...)
which are give as answer of AT+CPIN?

AT+CSMS=0
AT+CNMI=0,0,0,0,1
AT^SMGO=0
AT+CSCB=0
```

Features of the Telephone-Book Memory

Name	Description	Category / Access	Write	Delete completely
FD	Fix-dialing number (SIM fix-dialing telephone book)	GSM 07.07 / +CPBS or ^SPBS	Allowed (PIN2 required)	
SM	Abbreviate dialing number (SIM telephone book)	GSM 07.07 / +CPBS or ^SPBS	Allowed (device code required if FDN replacement is active)	
DC (MD)	Mobile last dialing number (last number redial memory; only if ”LD” is not available)	GSM 07.07 / +CPBS or ^SPBS	Not allowed	By means of AT^SDLD
ON (OW)	Own Numbers (SIM own telephone numbers)	GSM 07.07 (Siemens) / +CPBS (historical)	Allowed	

LD	SIM last dialing number (last number redial memory on SIM)	GSM 07.07 / +CPBS or ^SPBS	Not allowed	By means of AT^SDLD
ME	Mobile-equipment telephone book (ME dialing numbers)	GSM 07.07 / +CPBS or ^SPBS	Allowed (device code required if FDN replacement is active)	
BD	Barred dialing numbers (blocked numbers)	Siemens / ^SPBS	Not allowed	
SD	Service dialing numbers (Service numbers)	Siemens / ^SPBS	Not allowed	
MC (MS)	Missed dialing numbers (unanswered calls)	GSM 07.07 (Siemens) / +CPBS, ^SPBS	Not allowed	
RC (CD)	Callback dialing numbers (answered calls)	GSM 07.07 (Siemens) / +CPBS,^SPBS	Not allowed	
BL	Blacklist dialing numbers (numbers that are blocked for a certain time in order to prevent continuous accesses from remote control)	Siemens / ^SPBS	Not allowed	
MB	Mailbox dialing numbers (network-operator mailbox)	Siemens / ^SPBS	Not allowed	
CS	Common sortable numbers (sorted combination of ”SM”, ”ME”, ”FD”)	Siemens / ^SPBS /^SPBC / ^SPBG	Not allowed	
RD	Red book numbers (”CS” entries with ‘!’ at the end of the name portion)	Siemens / ^SPBS /^SPBC / ^SPBG	Not allowed	

Writing to the FDN Phonebook / FDN Replacement

Writing to the fix-dialing number phonebook is protected by PIN2.
A Write sequence (to e.g. record 5) runs as follows:

```
AT+CMEE=2                          //Activate expanded error message
OK

AT+CPBS=?                          // Listing of available telephone books
+CPBS: (“FD”,”SM”,”LD”)
OK

AT+CPBS=”FD”                       // Selection of the FDN telephone book
OK

AT+CPBW=5,"1234",,”test”           //  A Write to record 5 is attempted...
+CME ERROR: SIM PIN2 REQUIRED      //  ... PIN2 is required for this purpose

AT+CPIN?                           //  Query of the PIN status...
+CPIN: SIM PIN2                    //  ... PIN2 is to be entered

AT+CPIN="12345678"                 //   Input of PIN2
OK

AT+CPBW=5,"1234",,”test”           // A Write to record 5 is attempted...
OK                                 // PIN2 remains active as long as you use the commands
                                      // +CPIN, +CPBS, +CPBR, +CPBW, +CACM,
                                   // +CAMM, +CPUC
                                   // ^SPIC, ^SPBS, ^SPBC, ^SPBG,:
                                      //  If you use other commands or if none of the
                                      //  above commands are executed within five
                                      //  minutes, the validity of PIN2 is voided.

AT+CPBW=6,"5678",,”new test”       //  A Write to record 6 is attempted...
OK

...
```

In addition, if there is no FDN phonebook available on the SIM, it is possible to activate a feature which activates FDN-like behavior for the ”SM” and ”ME” phonebooks (FDN replacement). (Currently this feature can only be activated via the MMI lock/device lock/excluding telephone book.)
In this case, the Write to the ”SM” and ”ME” phonebooks is ensured by the device code (PH-SIM PIN and PH-SIM PUK, respectively).
The sequence for entering the device code is analogous to the above example.

Special hints for using +CPBR/+CPBW command

String parameters ,like the <text> in +CPBW command shall be entered using quotation marks `**"**` (Ascii=Windows=GSM=0x22).e.g. "Doe Joe"
It is possible to enter string parameters without `**"**` but not recommended, because following problems may occure:
If no `"` are used:

- SPACEs (Space, Blank, Ascii=Windows=GSM=0x20) are skipped.
  E.g. at+cpbw=1,"123",,K. H. results in "K.H." ☹
  at+cpbw=1,"123",,"K. H." SPACEs are kept ☺

- No `**,**` (Ascii=Windows=GSM=0x2C) and
  `**;**` (Ascii=Windows=GSM=0x3B) in <text> is possible, because this characters are used as separator of parameters/commands.
  E.g. at+cpbw=1,"123",,Kurz,Helmut result in ERROR ☹
  at+cpbw=1,"123",,"Kurz,Helmut" ☺

But there are also some points to note when using quotation marks `"`:
There are some characters which cannot be entered in normal way:
e.g. quotation mark `"` character itself, because this is interpreted as the end of the <text>

To make this (and some other special characters) possible to be entered, the character with hex value 0x5c is used as escape character. In the ASCII character set this is equal the `\` ,like proposed in V.25ter. (Ascii=Windows=0x5C)
Unfortunately there is no `\` in GSM character set. The 0x5C equals the `Ö`

The escape sequence has the following structure:

- The sequence beginns with the escape character 0x5C (ASCII=Windows=`\', GSM=`Ö`)
- The special character follows and is entered 2 Byte representation of the GSM chacter set value .
  e.g. the 2 Byte representation of the `@` (GSM=0x**00**) is `**00**`

Following special characters shall be entered by using the escape sequence:

GSM Char	Hex char.	ASCII	**GSM Esc Seq**	Seq.(hex)	Note
Ö	5C	\	**Ö5C**	5C 35 43	Backslash
"	22	“	**Ö22**	5C 32 32	String delimiter
ò	08	BSP	**Ö08**	5C 30 38	Backspace
@	00	NULL	**Ö00**	5C 30 30	GSM NULL

Examples:

GSM string wanted in Phonebook	String in AT+CPBW Command(GSM)	String in AT+CPBW Command (Hex)
Ölhändler	"Ö5ClhÖ7Bndler"	22 5C 35 43 6C 68 7B 6E 64 6C 65 72 22
"Eddi" Kurz	"Ö22EddiÖ22 Kurz"	22 5C 32 32 45 64 64 69 5C 32 32 20 4B 75 72 7A 22
Oòo	"OÖ08o"	22 4F 5C 30 38 6F 22
@Adr.	"Ö00Adr."	22 5C 30 30 41 64 72 2E 22 [no problems with strlen()]
	"@Adr."	22 00 41 64 72 2E 22 [may cause problems with strlen() in application]

Note:
When reading phonebook records, there is NO replacement. Every character will appear in normal GSM character set notation (like the left column in the example above).

Appendix B

Example for creating/interrogation of an organizer entry

-vcs object which has to be uploaded:

BEGIN:VCALENDAR
VERSION:1.0
BEGIN:VEVENT
CATEGORIES:ANNIVERSARY
DTSTART:19991213T100000
DESCRIPTION:W. von Siemens
END:VEVENT
END:VCALENDAR

-**hexadecimal representation of this object:**
424547494E3A5643414C454E4441520D0A56455253494F4E3A312E300D0A4245
47494E3A564556454E540D0A43415445474F524945533A414E4E4956455253415
2590D0A445453544152543A313939393132313354313030303030300D0A44455343
52495054494F4E3A572E20766F6E205369656D656E730D0A454E443A56455645
4E540D0A454E443A5643414C454E4441520D0A

-**upload of an entry on record 20**

at^sbnw="vcs",20,1,3<CR>
<CR><LF> > <Space>
424547494E3A5643414C454E4441520D0A56455253494F4E3A312E300D0A4245
47494E3A564556454E540D0A43415445474F<Ctrl-Z>
<CR><LF>OK<CR><LF>

at^sbnw="vcs",20,2,3<CR>
<CR><LF> > <Space>
524945533A414E4E4956455253415259 0D0A445453544152543A3139393931323
133543130303030300D0A44455343524950<Ctrl-Z>
<CR><LF>OK<CR><LF>

at^sbnw="vcs",20,3,3<CR>
<CR><LF> > <Space>
54494F4E3A572E20766F6E205369656D656E730D0A454E443A564556454E540D
0A454E443A5643414C454E4441520D0A<Ctrl-Z>
<CR><LF>OK<CR><LF>

All characters are answered with an echo.

Echoing can be switched off with „ATE0“.
In this example the organizer entry is uploaded in 50 bytes packets (100 input characters in every pdu).
The blue painted characters characterize the responses of the mobile.

-interrogation of the current <type>,<subtype>,<actNumber>,<maxNumber>

at^sbnw?<CR>
<CR><LF>^SBNW: "vcs",20,2,3<CR><LF>
<CR><LF>OK<CR><LF>

description: The actual object which is uploaded is an VCS object.
It has to be stored on record 20.
2 of 3 packets are already uploaded.

-deleting of record 20

at^sbnw="vcs",20,0<CR>
<CR><LF>OK<CR><LF>

-download entry from record 20

at^sbnr="vcs",20<CR>
<CR><LF>^SBNR:<space>"vcs",20,1,1<CR><LF>
424547494E3A5643414C454E4441520D0A56455253494F4E3A312E300D0A4245
47494E3A564556454E540D0A43415445474F524945533A414E4E4956455253415
2590D0A445453544152543A313939393132313354313030303030300D0A44455343
52495054494F4E3A572E20766F6E205369656D656E730D0A454E443A56455645
4E540D0A454E443A5643414C454E4441520D0A<CR><LF>
<CR><LF>OK<CR><LF>

The mobile segments the record entry in 176 byte (=176*2 characters) packets.

-Download of an empty record 20

at^sbnr="vcs",20<CR>
<CR><LF>OK<CR><LF>

-Test command of AT^SBNW

at^sbnw=?<CR>
<CR><LF>^SBNW:<space>("bmp",(0)),(„mid“,(0)),(„vcs“,(1-30)) <CR><LF>
<CR><LF>OK<CR><LF>

description: The mobile supports bitmaps with suptype 0, midi obects with suptype 0 and vcs objects with the suptypes 1 up to 30.

Foto1: Perangkat Mikrokontroler AT89S52 dengan Handset GSM Siemens C-35

Foto2: Prototipe Tanki air.