ROHDE & SCHWARZ

```
6 STEP=   0 LEN= 49
```

```
0  M/S=.90 L=2.13I
1  389    95998
```

FSK ANALYZER GA 082

```
0  PERIOD = 28  -ASY
0  ARQ-56        N09
   0  IDLE 1.1      N01
   1  E AVEC AUTORITE.
   0  ASY-ASCI      N10
   18  1199      75.00 178
```

IEC 625 Bus
IEEE 488

- Measurement of shift
- Measurement of baud rate (crystal-accurate)
- Continuous code analysis

```
17  398    50088
0  BAUDOT        -N07
```

CHARACTERISTICS

- 4-digit readout of shift (resolution 1 Hz)
- Tuning indication for demodulator (bar indicator)
- 8-digit readout of baud rate accurate to max. 10^{-5} baud
- Indication of synchronous difference (i. e. signal quality) between measured and actual baud rate (bar indicator)
- 3-digit readout of measuring time in minutes
- 16-digit display of code analysis (alphanumeric display)
- Display of 48 code bits in seven different modes (bar indicator)
- 3-digit readout of centre frequency
- Interfaces to IEC 625-1 (IEEE 488) and CCITT V.24/V.28 (RS 232 C)
- Self-test facility
- Microprocessor-controlled function keys for simple manual operation
- Extension for user-specific analysis programs possible

The major part of **radiocommunications traffic in the VLF-HF range** is in the form of frequency-shift-keyed F1B or F7B emissions. In addition to the standard methods (CCITT, CCIR) there are user-specific systems and specific codes for military and diplomatic networks, which operate with different transmission speeds and shifts.

The **identification of a radioteletype signal** by conventional means is time-consuming and requires elaborate equipment. Due to the use of modern scrambling methods, evaluation of the information content is practically no longer possible. The signal source can however be identified by accurate measurement of all parameters of the emissions (and localized by direction finding): repeatedly occurring equipment-specific deviations in the parameter data of individual emissions make it possible to recognize transmitters and thereby to detect whole radio networks.

Characteristics of the GA 082

Supported by a microprocessor, the **FSK Analyzer GA 082** automatically analyzes with high accuracy all parameters of teletype signals of F1B (F1) and F7B (F6) emissions and simultaneously displays the measurement results together with all essential information. Radioteletype signal identification is thus greatly facilitated and speeded up. The GA 082 can be used both as a stand-alone unit for **manual control** and as a **system unit** for computer-aided radiomonitoring by postal, military and intelligence authorities.

Measurement tasks   The analyzer performs the following four main tasks with the aid of a powerful microprocessor:

- measurement of shift,
- measurement of baud rate,
- continuous analysis of transmission code (using standard programs or specific user programs), and
- test output for standard-code signals.

Microprocessor, program memory   The 16-bit microprocessor system 8086 of the GA 082 controls the analysis sequence and simplifies manual control via the function keys. A 24-kbyte program memory contains framing programs for the analyses as well as the standard programs. For user-specific programs a memory capacity (EPROM) of about 8 kbyte is available. Alternatively, a lockable storage unit (option) with the same capacity can be plugged into the rear panel.

Displays   The measurement results and essential additional information such as operating mode, demodulator tuning and measuring time are simultaneously indicated on the four displays of the GA 082:

Either the **shift** in Hz or the **centre frequency** in kHz and the **baud rate** in baud with the number of digits being automatically adapted are indicated on the lower left display on the front panel (photo see page 4).

The **bit pattern display** (48 bits) on the upper right display is – depending on the operating mode – either static or dynamic and with a possible shift to the left or right, single-bit display or code line superimposition being selectable (illustration below and on top of next page).
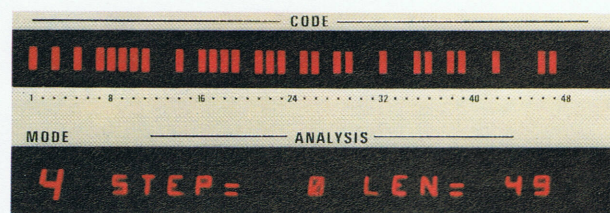
Static single-bit display of code in mode 4 (top), no shift (STEP = 0; with negative steps, STEP–... is indicated); line length is adjusted to 49 bits for output

CODE

MODE — ANALYSIS —

6 STEP= 0 LEN= 49
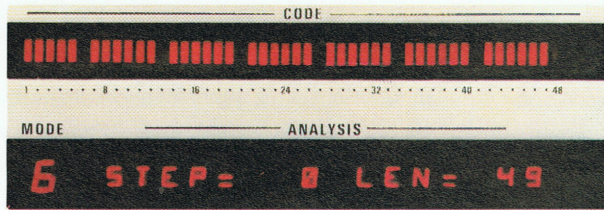
Dynamic code-line superimposition in mode 6 (start bits of Baudot code can be clearly recognized); otherwise same as illustration on preceding page

```
0111111001001101100010100001000110101001 01
0100001001010100010010100111010000100011001
0010111010000100011110100010101001010101001
0100001000110101101110001111000100101011111
0011011011001011010101100010001001001 0011111
0100001001010100110011001001001010001010 1001
0001001001100100110110100001001010101010 01
00001110100001000110100100110011001001 11 01
0001011011110101000010011001000001101010 001
0001101000100111001000110100010101101100 01
0010101000110100001001000100101110010001100
0101010000100101000101001001010101010001 000
0000101000100101111110111111010000100011001
0000110110011001100110010111010111010100001
0010011000001101000010001101000010010101 1101
011000100110110110111011011100011110001001
```

Printed out lines of dynamic code line superimposition; start and stop bits can be clearly recognized

The **analysis result** is indicated together with the mode number (see specifications) on the alphanumeric display in the lower right part of the front panel. If there is a decode program, texts appear in running mode. For examples of possible displays see page 6.

Demodulation   For connection to the IF or AF output of a monitoring receiver, the FSK Analyzer GA 082 is fitted with a demodulator which is automatically adjusted for F1B or F7B signals. Connectors for external demodulators (VF telegraph transmission systems) and for operation from the line current of a teletype line are also provided. In these cases measurement of the line shift is not possible and the associated displays remain unlit.

Analysis methods   The software of the GA 082 contains programs for the analysis of the following four standard codes (for details see page 6):

CCITT code No. 2 (Baudot)
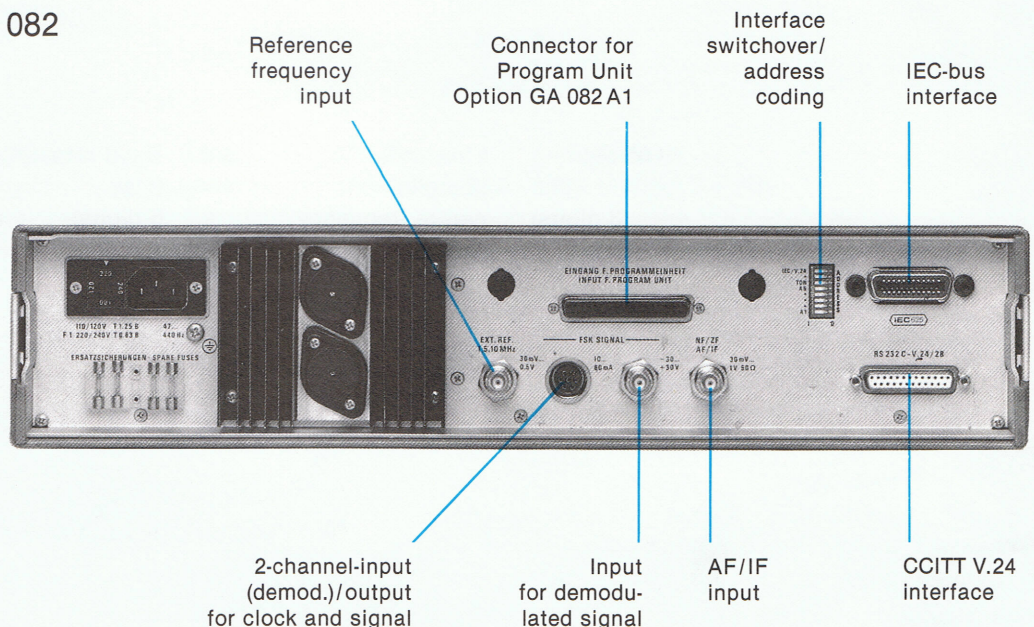CCITT code No. 3 (ARQ 28 und ARQ 56)
CCITT code No. 5 (ASCII)

In addition, it is possible to have the firmware extended by Rohde & Schwarz for about 15 to 25 **special codes.** The number of programs that can be stored depends on the code structure.

Inputs/Outputs   Various interfaces are available (photo below) for feeding in test signals, for the system use of the GA 082 and for improving the measuring accuracy:

- Input for demodulated signal, single current
- Floating input for two demodulated channels, single or double current
- IF/AF input (IF internally programmable)
- IEC 625-1 (IEEE 488) interface
- V.24/V.28 (RS 232 C) interface
- Reference frequency input (1/5/10 MHz)

Self-test facility   For checking proper functioning, the GA 082 has facilities enabling memory tests, display tests and testing with a defined 75-baud signal.

Rear view of GA 082

Reference frequency input

Connector for Program Unit Option GA 082 A1

Interface switchover/ address coding

IEC-bus interface

2-channel-input (demod.)/output for clock and signal

Input for demodulated signal

AF/IF input

CCITT V.24 interface

FSK ANALYZER GA 082

Demodulator
tuning
(momentary frequency)

Synchronous difference
measured/actual
baud rate

Bit pattern display (48
in seven m

ROHDE & SCHWARZ · TELEGRAFIEANALYSATOR · FSK ANA

DEMOD. SYNC.

MADE IN GERMANY

ZEIT · TIME   SHIFT / FREQ.   RATE   MODE

18 1199   *75.00 178*   *0   AS*

min   Hz/kHz   BAUD

SHIFT/FREQ.   RATE   MODE

Measuring
time
(3 digits)

Line shift
(4 digits)/
centre frequency
(3 digits)

Baud rate
(max.
8 digits)

Mode
number

Code nur
switch
control
cons

Bit pattern shift
and step indication

Input of code
numbers or
auxiliary functions

Switchover
to centre
frequency

Internal
demodulation

YZER · GA 082

CODE

624.0512. 02   FNr. 334 457/001

· 16 ·   · 24 ·   · 32 ·   · 40 ·   · 48

ANALYSIS

Y-ASCI   N18

STEP

LÄNGE · LENGTH

START 0	CONST 1	FREQ. SHIFT 2	DEMOD 3
SELECT	PRINT 4	CHAN 1/2 5	TEST 6
FIX X	A 7	B 8	C 9

NETZ · POWER

Analysis result (16 digits,
alphanumeric),
text in running mode/
operating status

Line
length
for
output

Output of
measured data

Switchover
to channel 2 (F7B)

5

ANALYSIS

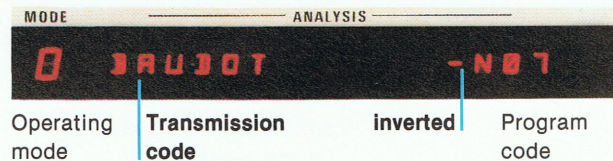## Analysis programs (basic programs for standard codes)

Framing program

The framing program organizes the execution of the analysis of the incoming bit stream both for standard and for user-specific transmission code programs.

Mode 0 Search run of analysis programs in fixed sequence; the designation contained in the program descriptor is indicated when the code is recognized.

Mode 2 Manual selection of a program (via SELECT key + program code number or by stepped switching with STEP key).

Mode 1 Running display of a text belonging to the code recognized in mode 0 or 2 (provided that a decode program is stored).

MODE	ANALYSIS
0	**BAUDOT -N07**

Operating mode | **Transmission code** | **inverted** | Program code

MODE	ANALYSIS
1	**E AVEC AUTORITE.**

Operating mode | **Running display** of a text

Programs for standard-code analyses

Idling programs They recognize idling cycles which might be misinterpreted.

N00 STOP-MOD
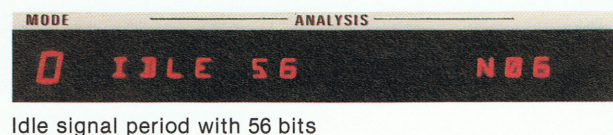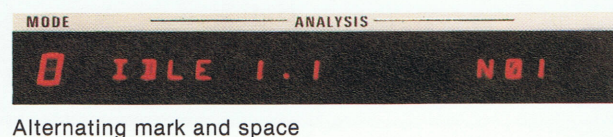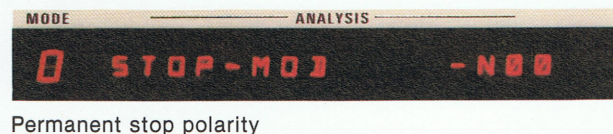Permanent start or stop polarity.

N01 IDLE 1:1
Idle signal; 1 mark and 1 space are sent alternately.

N02 IDLE 1:6
Idle signal; 1 mark and 6 spaces are sent alternately.

N04 IDLE 14

N05 IDLE 28

N06 IDLE 56
Idle signals; periods of 14, 28 and 56 bits are repeated (the format of the idling cycle is irrelevant).

MODE	ANALYSIS
0	**STOP-MOD -N00**

Permanent stop polarity

MODE	ANALYSIS
0	**IDLE 1.1 N01**

Alternating mark and space

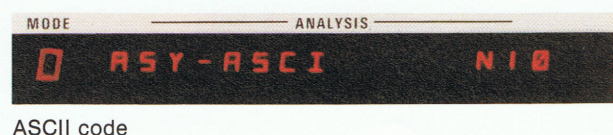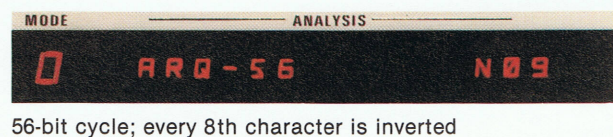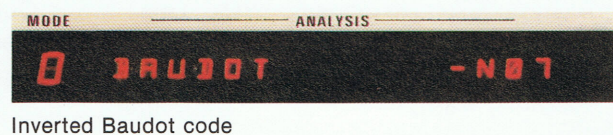| MODE	ANALYSIS
0	**IDLE 56 N06**

Idle signal period with 56 bits

Programs for CCITT codes No. 2, 3 and 5

N07 BAUDOT
Asynchronous signal (CCITT No. 2); 7.5 bits (1 start bit, 5 data bits, 1.5 stop bits).

N08 ARQ-28
Synchronous signal (CCITT No. 3); 7 bits (3 marks and 4 spaces); every 4th character is inverted.

N09 ARQ-56
Same as N08, however every 8th character is inverted.

N10 ASY-ASCI
Asynchronous signal (CCITT No. 5); 10 bits (1 start bit, 7 data bits, 1 parity bit with even parity, 1 stop bit).

MODE	ANALYSIS
0	**BAUDOT -N07**

Inverted Baudot code

MODE	ANALYSIS
0	**ARQ-56 N09**

56-bit cycle; every 8th character is inverted

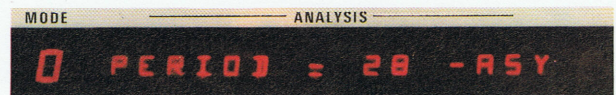| MODE	ANALYSIS
0	**ASY-ASCI N10**

ASCII code

Statistic programs

N78 Periodicity check (if no code is recognized)
Periods between 2 and 64 bits are checked for periodically occurring bits or bit groups.
Indication for

periodic idling cycle	IDLE
periodic mark bits	MARK
periodic space bits	SPAC
periodic change in mark/space	ASY
periodic change in space/mark	–ASY

```
MODE ───── ANALYSIS ─────
0  PERIOD = 28  -ASY
```

Period of 28 bits with periodic change in space/mark

N79 Statistics program (always furnishes an analysis result)
It calculates the mark/space ratio (M/S) and the average number of bits (L) between the polarity changes.

```
MODE ───── ANALYSIS ─────
0  M/S=.98  L=2.1BIT
```
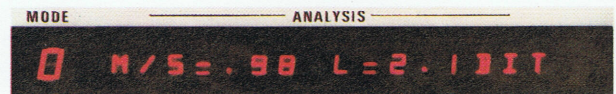
Mark/space ratio 0.98, polarity change after 2.1 bits on average

Documentation via printer

In mode 1 a printer produces a hardcopy of the running text.

In the other operating modes the measurement and analysis results as well as bit patterns are recorded (see also illustration on page 3).

F1B reception; printout of the front panel information from an automatic code analysis (mode 0)

```
FREQ SHFT Q S MIN  BAUD     ANALYSE
2.24  402 0 0       50,0    B
2.24  402 0 0       49,99   BAUDOT     N07
2.24  401 0 0       49,979  BAUDOT     N07
2.24  401 0 0    1  49,975  BAUDOT     N07
2.24  401 0 0    1  49,973  BAUDOT     N07
2.24  402 0 0    1  49,972  BAUDOT     N07
2.24  401 0 0    2  49,971  BAUDOT     N07
2.24  402 0 0    2  49,970  BAUDOT     N07
```

F1B reception; text printout (mode 1) of an identified code (Baudot)

```
          IMMENSE CHALLENGES HAVE TO BE SURMOUNTED AND
CONSIDERABLE WORK HAS TO BE DONE IN THE NEAR FUTURE IN ORDER
TO OVERCOME THE EXISTING PROBLEMS IN THE AGRICULTURAL SECTOR.
AS WAS STRESSED IN THE RECENT NATIONAL SEMINAR. THE DUTIES
OF DEVELOPMENT-ORIENTED GOVERNMENT AND MASS ORGANIZATIONS
WERE OUTLINED AT THE OPENING SESSION OF THE SEMINAR, AND
THE ORGANIZATIONS CONCERNED WERE CALLED UPON TO CO-ORDINATE
```

F7B reception; printout of displayed information from the automatic identification of diplex operation with automatic analysis (mode 0)

```
FREQ SHFT Q S MIN  BAUD      ANALYSE
2.24  288 1 0       200,1    F6
2.24  292 4 0       200,19   ASY-ASCI   -N10
2.24  294 5 0       200,196  ASY-ASCI   -N10
2.24  295 5 0       200,198  ASY-ASCI   -N10
2.24  297 5 0       200,199  ASY-ASCI   -N10
2.24  298 5 0       200,199  ASY-ASCI   -N10
2.24  298 4 0       200,1989 ASY-ASCI   -N10
2.24  299 5 0       200,1992 ASY-ASCI   -N10
```

F7B reception; text printout (mode 1) of one of the channels (ASCII coding)

```
   Oslo (dpa) - Die norw=ische Marine sucht nahe des
NATO-Flottenstützpunktes Andou (nIdnorwegen) ein fremdes U-Boot.
Wie am Donnerstag beichtet wurde, feuerten Schiffe in der Nacht nach
vorausgegangenen Sonar-Kontakten erfolglos sechs Raketenab. An der
U-Boot-Jagd beteiligen sich sechs Schiffe und ein Fugzeug.
```

Printout of bit patterns in hexadecimal notation

```
6125192F2C64E2B1CE4C2D19251251947120581855A099E7BB11A44FBF1CC4AB01B84
E74A31B254231B0612558A45A01B67C642AC843F58453A01B251251C841B39A84126
A2223F19251251A44FBF5EC42B11E24AA19C24C225C666A29B612659063A11C4662
1BD1F84F3E990AC6E2A99853225E
```

SPECIFICATIONS

Specifications

Analysing tasks

Analysed teletype signals
(automatic switchover) .... | F1B (previously F1),
teletype telegraphy without
modulating audio frequency;
F7B (previously F6),
four-frequency diplex telegraphy

Measurement of line shift

Measurement range .... 30 to 2000 Hz
Error limits .... ±1 % of reading
Readout .... 4 digits in Hz and individual
LED bars as indicator

Measurement of baud rate

Measurement range via FSK signal
inputs (demodulated signal) .... 2 to 9600 baud
   via IF/AF input .... 2 to 200 baud
Resolution for <1000 baud .... 10 µbaud
      ≧1000 baud .... 100 µbaud
      2450 to 9600 baud ... 1 baud
Error limits .... ±1 digit of last place
           ± crystal accuracy
Crystal accuracy .... $±1 \times 10^{-6}$
Indication .... 8-digit readout; decimal point after
third or fourth digit; number of
digits indicated is automatically
adapted to measuring accuracy
Difference indication
(measured/actual baud rate) .... 16 LED bars of 0.5 bit each

Code analysis

(see also "operating modes"; detailed information on page 6)
Standard analysis programs .... for CCITT code No. 2 (Baudot)
                  CCITT code No. 3
                  (ARQ 28 and ARQ 56)
                  CCITT code No. 5 (ASCII)
Memory for special programs ...... for any codes
  Memory capacity .... 8 kbyte (EPROM), sufficient for
15 to 25 codes
  or with Program Unit GA 082 A1
  (option) .... lockable plug-in unit
(memory capacity as above)
Measurement range for analysis
of transmission code .... 2 to 2400 baud
Indication of measuring time ...... 3 digits in minutes
Start of measurement .... automatic; restart in case of baud
rate deviation

Measurement of centre frequency

Measurement range .... 1 to 7.99 kHz
Error limits .... ±1 % of reading
Indication .... 3 digits in kHz

Operating modes

Analysis of transmission methods (code analysis)

Display .... 16-digit alphanumeric display
Mode 0 .... search run through all stored
analysis programs (user programs
and standard programs)
Mode 1 .... running display of text if code is
identified and decode program is
available
Mode 2 .... selection of a certain analysis
program

Bit pattern display (code display)

Display .... 48 LED bars
  Mode of display.............. illuminated LED corresponds to
mark bit (high)
    inverted.................... illuminated LED corresponds to
space bit (low)
Single-bit display
  Mode 3....................... running bit patterns
  Mode 4....................... stationary bit patterns, can be
shifted left and right
  Mode 5....................... same as mode 4, inverted
Code line superimposition
  Mode 6....................... current superimposition of
16 periods of continuously varying
bit sequence; can be shifted left
and right
    Period length .... 2 to 255 bits selectable per line
  Mode 7....................... same as mode 6, inverted
  Mode 8....................... stationary superimposition
of 16 periods of stored bit
sequence (max. 8192 bits); can be
shifted left and right
    Period length .... 2 to 255 bits selectable per line
  Mode 9....................... same as mode 8, inverted

Inputs and outputs

FSK signal input (grounded) .... for demodulated signals to V.28
(RS 232 C) as well as TTL levels
and single current 10 to 60 mA
Input voltage range, mark .... + 2.4 to + 30 V
                space .... – 30 to + 0.8 V
Input impedance .... 2 kΩ
Connector .... BNC female

FSK signal input (floating via
optocoupler) .... for two channels
with demodulated signals (F7B)
Switchover .... with CHAN 1/2 key
Input current range............... 10 to 60 mA; positive or negative
single or double current
Input impedance .... 100 Ω
Connector .... 7-way female (Tuchel)

IF/AF input
Frequency range AF .... 1.2 to 8 kHz
              IF .... 30 to 1400 kHz (programmable)
Input voltage range............... 50 mV to 1 V
Input impedance .... 50 Ω
Connector .... BNC female
Demodulator adjustment for F1B
or F7B signals .... automatic
  Evaluation of channels .... can be selected with
CHAN 1/2 key
Indication of momentary frequency
or of demodulator tuning .... 32 LED bars

Switchover between FSK signal
inputs and IF/AF input .... by means of DEMOD key (either of
the FSK signal inputs can be
selected)

Standard-frequency input .... 1/5/10 MHz (programmable)
Input voltage ...... 0.3 to 1 V$_{rms}$
Input impedance .... approx. 1 kΩ
Connector .... BNC female

Output for regenerated signal
and bit clock .... for recording or display of
demodulated signal
Levels .... TTL
Operating range .... 2 to 600 baud
Bit clock duration .... approx. 100 µs
Output impedance .... 500 Ω
Connector .... 7-way female (Tuchel) connector
of floating input

Interfaces

CCITT interface .... to CCITT V.24/V.28
and EIA RS 232 C
  Signals .... DTR, TXD, DSR, RXD, RTS, CTS
Baud rate......................... 75 to 2400 baud (switch-selected)
Connector .... 25-way male (Cannon)

IEC-bus interface .... to IEC 625-1 and IEEE 488
  Functions SH1, AH1, T5, L3, SR1, PP1
Connector .... 24-way male (Amphenol)

General data

Operating temperature range ...... 0 to + 40 °C
Storage temperature range .... – 40 to + 70 °C
Interference class .... K, to VDE 0875 and MIL-Std. 461B
Power supply .... 100/120/220/240 V ± 10 %,
47 to 440 Hz (50 VA)
Overall dimensions (W × H × D)
  Bench model .... 470 mm × 118 mm × 349 mm
  19″ rackmount .... 483 mm × 88 mm × 392 mm
Weight of bench model .... 5 kg

Ordering information

Order designation .... ▶ FSK Analyzer GA 082
Bench model 624.0512.02
19″ rackmount.................... 624.0512.03

Accessories supplied .... manual

Recommended extras
Program Unit GA 082 A1 (lockable
plug-in unit)..................... 628.6715.05 (without program)
Printer .... RX 80 (Epson) with V.24 (RS 232 C)
interface/20 mA