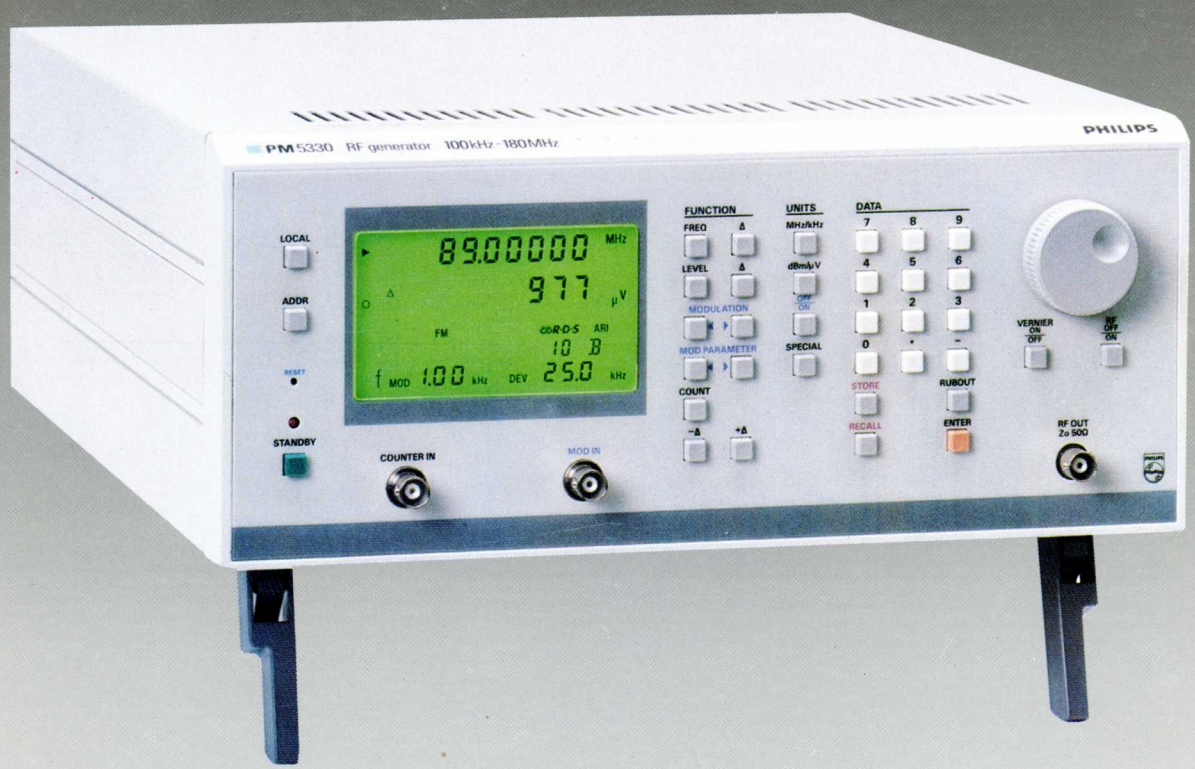
PM 5330
RF GENERATOR 100 kHz – 180 MHz
Programming manual



921101

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PM 5330 RF generator 100 kHz – 180 MHz

Programming card
9499 520 12711
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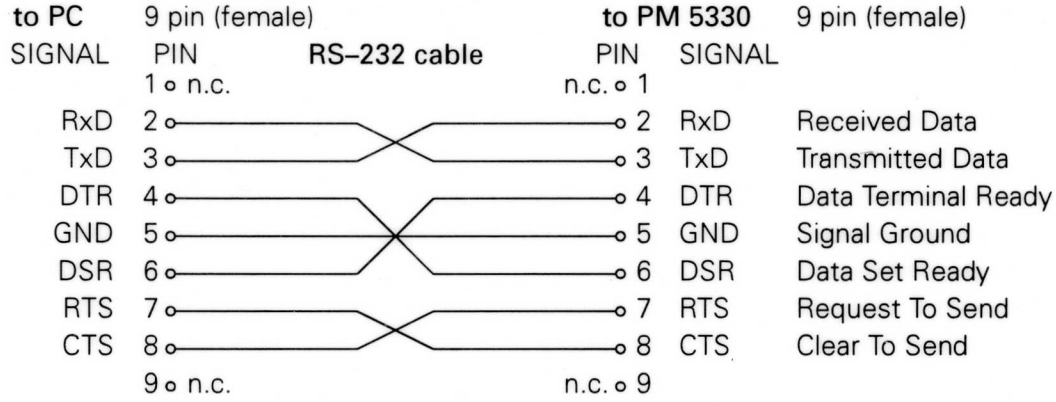
IEEE INTERFACE

AH1	acceptor handshake
SH1	source handshake
L4	listener function
T6	talker function
RL1	local/remote with local lockout
SR1	service request (SRQ)
DC1	device clear
DT1	device trigger
PPO	no parallel poll
CO	no controller function
E2	three–state drivers

Addresses: 1 to 30

RS–232 INTERFACE



Baud rate: 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200
Data bits: 7 or 8
Stop bits: 1 (2 for 110 baud only)
Parity: odd, even or no
Xon/Xoff handshake: on or off
Hardware connection: 3 or 7 wires
Hardware handshake: DSR/DTR or CTS/RTS

Special Interface Functions

IEEE		RS–232
GTL	go to local	ESC 1
GTR	go to remote control	ESC 2
DCL	device clear	ESC 4
LLO	local lockout	ESC 5
★STB?	asks for status byte	ESC 7
DTR	device trigger	ESC 8

Common Commands and Queries in Accordance with IEEE–488.2

★CLS	Clear Status Command	★RST	Reset Command
★ESE(?)	Event Status Register Enable	★SAV	Save Command
★ESR?	Standard Event Status Register Query	★SRE(?)	Service Request Enable
★IDN?	Identification Query	★STB?	Read Status Byte
★LRN?	Learn Mode	★TRG	Trigger Command
★OPC(?)	Operation Complete Command	★TST?	Selftest Query
★RCL	Recall Command	★WAI	Wait–to–Continue

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Device Specific Commands

Header	Function
AMDEPTH(?)	AM depth (m)
AREACODE(?)	ARI Areacode
ARI(?)	ARI
BINPROG(?)	binary programming
CALCOARSE	calibrate coarse attenuator
CALFINE	calibrate fine attenuator
CALREADY	calibration successful done
CALSWEEP	calibrate sweep oscillator
COUNT(?)	counter function
DISPMODE(?)	display on or off
ERROR?	error query
FMDEVIATION(?)	FM deviation
FREQUENCY(?)	RF frequency
FREQINCR(?)	frequency increment
IMPEDANCE(?)	impedance (counter)
LEVEL(?)	output level
LEVELINCR(?)	level increment
MODULATION(?)	modulation mode
MODLN(?)	
MODDEV	set position
MODDEP	rotary knob
MODFREQ(?)	modulation frequency
MODSOURCE(?)	modulation frequency source
MODSRC(?)	
MOD_ADD(?)	combined modulations

Header	Function
OUTPSTATUS?	output query
PILOT(?)	pilot on or off
PREEMPHASIS(?)	pre–emphasis
RDS_DATA(?) ★	transfer RDS–data
RDS_DEVIATION(?)	set RDS–deviation
RDS_PHASE(?)	set RDS–phase
RDS_RECORD(?)	recall RDS–record
RDS_SEQ(?) ★	transfer RDS–sequence
RF(?)	RF output on or off
SETCOARSE	set coarse attenuator
SETFINE	set fine attenuator
SETSWEEP	switch sweep oscillator on
STEREO	stereo modulation
SWEEP I **SWP**	sweep
SWPFREQ(?)	sweep frequency
SWPWIDTH(?)	sweep width
TRANNOUNCE(?)	ARI traffic announcement
TRM	response terminator setting
VERNIER(?)	rotary knob

★ only when Message–Writer is used

? only as query possible

(?) additional as query possible

Suffix

Suffix	used for
dB	level increment
dB I **dBm**W **dBmV** I **dBu**V	level
DEG	RDS–phase
Hz I **k**Hz I **M**Hz	RF frequency, frequency increment, modulation frequency, sweep frequency, sweep–width
s I **m**s I **u**s	pre–emphasis
V I **m**V I **u**V	output amplitude (level)

PM 5330
RF GENERATOR 100 kHz – 180 MHz

Programming manual

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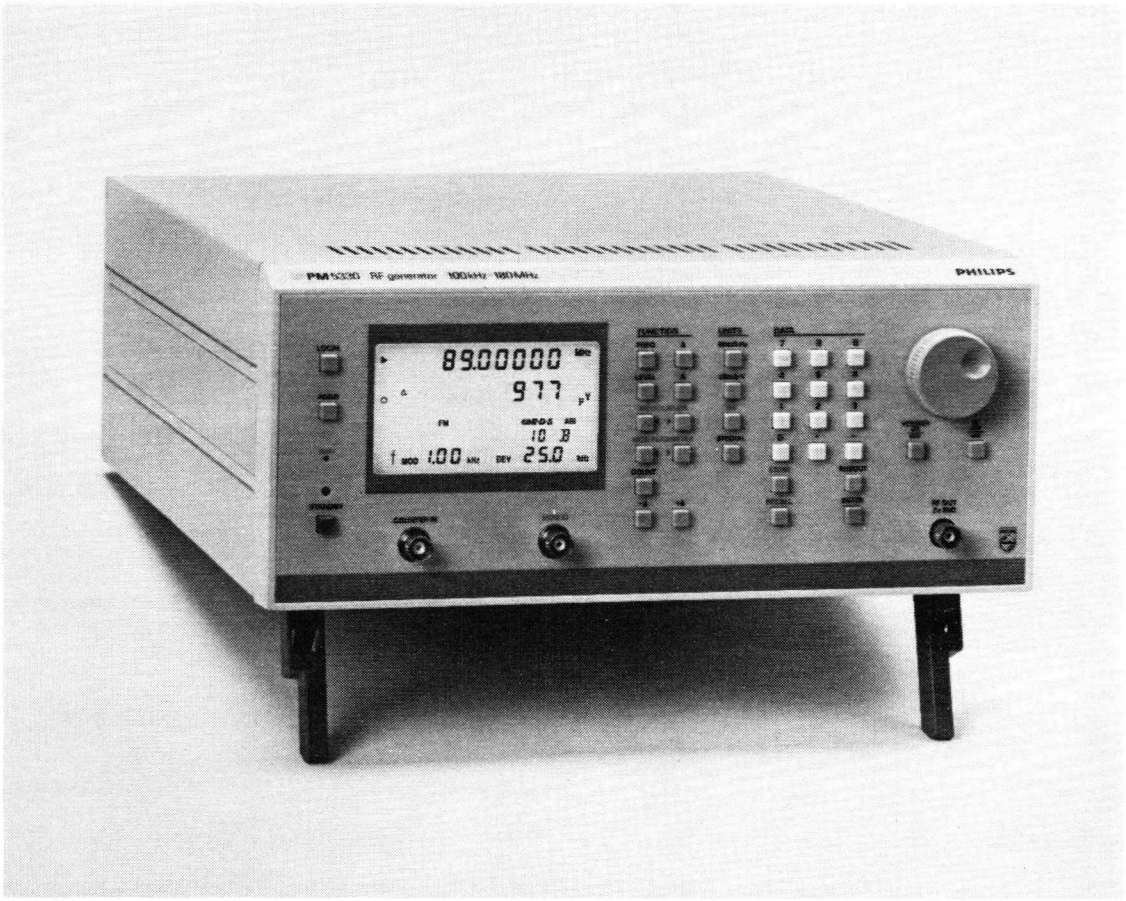
921101



PHILIPS

PHILIPS

Please note

In correspondence concerning this instrument, please quote the type number and serial number as given on the type plate.

Bitte beachten

Bei Schriftwechsel über dieses Gerät wird gebeten, die Typennummer und die Gerätenummer anzugeben. Diese befinden sich auf dem Typenschild an der Rückseite des Gerätes.

Noter s.v.p.

Dans votre correspondance et dans vos réclamations se rapportant à cet appareil, veuillez toujours indiquer le numéro de type et le numéro de série qui sont marqués sur la plaquette de caractéristiques.

Important

As the instrument is an electrical apparatus, it may be operated only by trained personnel. Maintenance and repairs may also be carried out only by qualified personnel.

Wichtig

Da das Gerät ein elektrisches Betriebsmittel ist, darf die Bedienung nur durch eingewiesenes Personal erfolgen. Wartung und Reparatur dürfen nur von geschultem, fach- und sachkundigem Personal durchgeführt werden.

Important

Comme l'instrument est un équipement électrique, le service doit être assuré par du personnel qualifié. De même, l'entretien et les réparations sont à confier aux personnes suffisamment qualifiées.

Printed in Germany

FLUKE®

INSIDE THIS MANUAL

This PROGRAMMING MANUAL contains information how to control the instrument by a Personal Computer or Controller via IEEE-488 or RS-232.

This manual is organized into the following chapters:

IEEE-488 interface	**Chapter 1** describes the function of the IEEE-488 interface and how to set the instrument address.
RS-232 interface	**Chapter 2** describes the RS-232 interface and the steps necessary for configuration.
Remote Control Commands	**Chapter 3** contains information about the Message Syntax and describes all commands necessary for operation via IEEE-488 as well as via RS-232.
Programming Examples	**Chapter 4** shows programming examples for IEEE-488 and RS-232.
Error Messages	**Chapter 5** lists error messages with reference to chapters where the item is described.
Commands in Alphabetical Order	**Chapter 6** shows all commands and queries in a short form. It serves to look for correct syntax.

This Programming Manual implicates that you are aquainted with the functions of the instrument, measurement setups, parameters and limits. For detailed information about:

Characteristics, Specifications,
Safety Precautions, Operating Instructions see **OPERATING MANUAL PM 5330**

CONTENTS

1 IEEE–488 INTERFACE

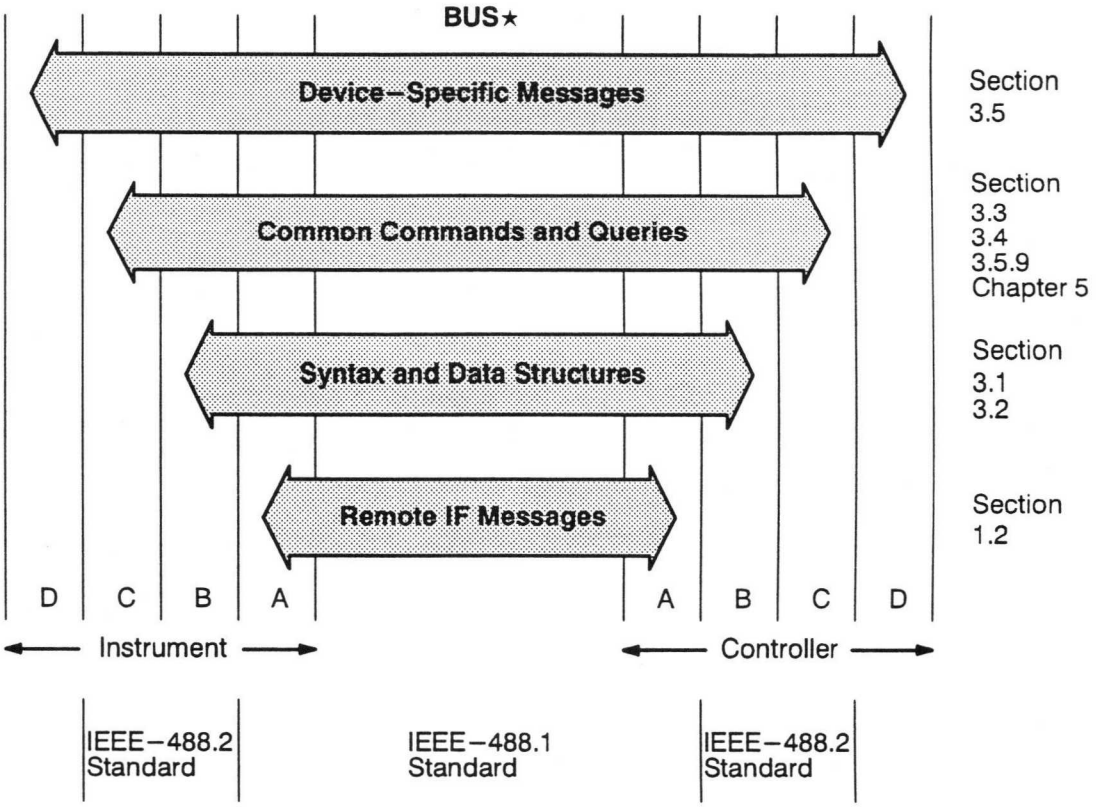
1.1 INTRODUCTION, INSTRUMENT ADDRESS

All instrument functions of the RF generator with the exception of the step function, the vernier and some functions activated by the SPECIAL key can be controlled via the IEEE/IEC–488 interface.

This implicates that you are acquainted with the operation of the instrument, modulation facilities, parameters and limits. A detailed description with examples is included in Section 3.5 of the Operating Manual.

In the following sections the functions of the IEEE–488 bus interface, the implemented commands and queries according to IEEE–488.2, and the device–specific messages are described.

For more details about IEEE–488.1 see Philips publication 'GENERAL PURPOSE INTERFACE BUS', order number 4822 872 80148.



A = Interface functions
B = Message communication functions
C = Common system functions
D = Device functions

★ this figure is in accordance with "IEEE Standard Codes, Formats, Protocols, and Common Commands" (ANSI/IEEE Std 488.2–1987).

Remote control of the generator requires the instrument address to be known. On delivery from the factory the address is set to 21. With the key ADDR the set address can be displayed, and if necessary, a new one from 0 - 30 can to be input by the numeric keyboard.

When switching on the instrument is in 'local' mode (input via keyboard). When addressed as listener by a controller the text REMOTE appears in the display field. The rotary knob and all keys except LOCAL are locked and the instrument can now be operated in remote control. Return to local operation is done by the addressed command GTL (go to local) or by the LOCAL key. In order to avoid unintended return the LOCAL key can be disabled by the universal command LLO (local lockout).

1.2 INTERFACE FUNCTIONS

The following interface functions are implemented:

AH1:	acceptor handshake	SR1:	service request SRQ
SH1:	source handshake	DC1:	device clear function
L4:	listener function	DT0:	no device trigger function
T6:	talker function	PP0:	no parallel poll
RL1:	remote/local with local lockout	C0:	no control function
		E2:	three-state driver

Hardware, connections and handshake procedure are in accordance with IEEE-488.1.

Table: RS-232 configuration by IEEE-488 bus address setting:

ADDR.	Oper. mode	Baud-rate	Data bits	Parity	Stop bits	H.W. Handsh.	X-on/ X-off
1	Comm.	1200	7	Even	1	No	On
2	Comm.	1200	7	Odd	1	No	On
3	Comm.	1200	8	Even	1	No	On
4	Comm.	1200	8	Odd	1	No	On
5	Comm.	1200	8	None	1	No	On
6	Comm.	2400	7	Even	1	No	On
7	Comm.	2400	7	Odd	1	No	On
8	Comm.	2400	8	Even	1	No	On
9	Comm.	2400	8	Odd	1	No	On
10	Comm.	2400	8	None	1	No	On
11	Comm.	4800	7	Even	1	No	On
12	Comm.	4800	7	Odd	1	No	On
13	Comm.	4800	8	Even	1	No	On
14	Comm.	4800	8	Odd	1	No	On
15	Comm.	4800	8	None	1	No	On
16	Comm.	9600	7	Even	1	No	On
17	Comm.	9600	7	Odd	1	No	On
18	Comm.	9600	8	Even	1	No	On
19	Comm.	9600	8	Odd	1	No	On
20	Comm.	9600	8	None	1	No	On
21	Comm.	19200	7	Even	1	No	On
22	Comm.	19200	7	Odd	1	No	On
23	Comm.	19200	8	Even	1	No	On
24	Comm.	19200	8	Odd	1	No	On
25	Comm.	19200	8	None	1	No	On
26	Comm.	9600	8	Even	1	Yes	Off
27	Comm.	9600	8	Odd	1	Yes	Off
28	Comm.	9600	8	None	1	Yes	Off
29	Comm.	110	7	Even	2	No	On
30	Comm.	9600	8	None	1	No	On

2 RS-232 INTERFACE

2.1 INTRODUCTION, INSTRUMENT CONFIGURATION

All instrument functions can be controlled via the RS-232 interface.

This implicates that you are acquainted with the functions of the instrument, measurement setups, parameters, and limits. A detailed description with examples is in the Operating Manual.

In the following chapter the functions of the RS-232 bus interface are described.

For commands, queries, syntax, and terminators see Chapter 3.

Remote control of the instrument requires an interface communication configuration in accordance with the used PC.

Setting the RS-232 interface is possible by one of 29 fixed parameter sets and can be made via the IEEE-488 address function.

Example for a RS-232 configuration:

baud rate	9600
data bits	8
parity	even
stop bit	1
software handshake X-on/X-off	on

Select IEEE-488 address 20 according to the table, Page 1 - 3.

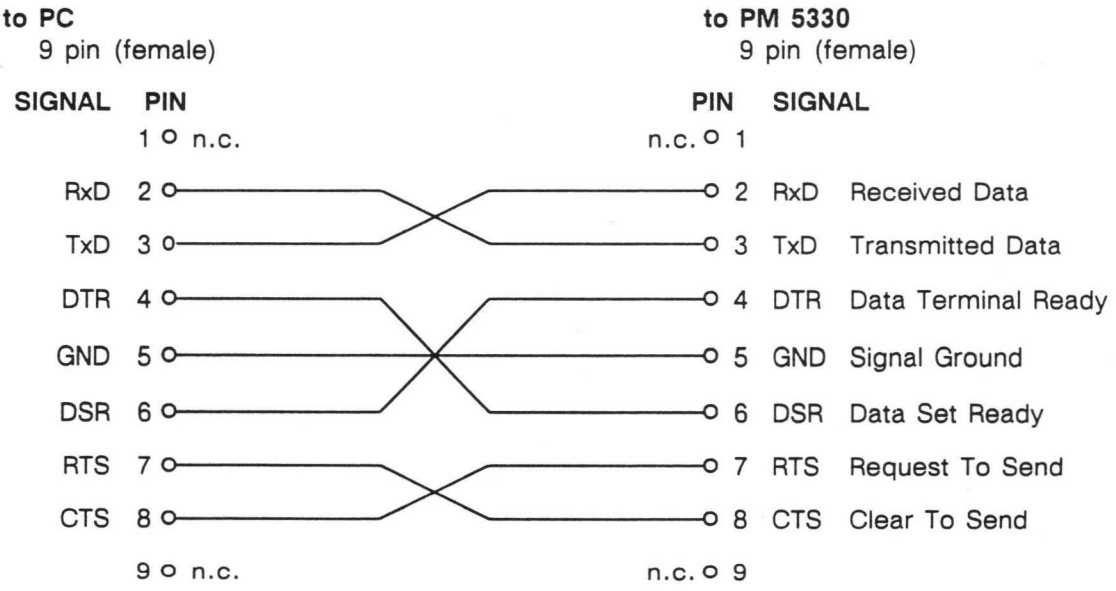
Setting	Key operation	Display shows
address 20	ADDR 2 0	ADDRESS ENTER 20
execution	ENTER	

When turning on the instrument is in 'local' mode (input via keyboard). When set to listener by PC with the command **ESC 2** the text REMOTE appears in the display field. All keys except LOCAL are locked and the instrument can now be operated in remote control. Return to local operation is done by the command **ESC 1** or by the LOCAL key. In order to avoid unintended return the LOCAL key can be disabled by the command **ESC 5**.

2.2 INTERFACE FUNCTIONS AND WIRING

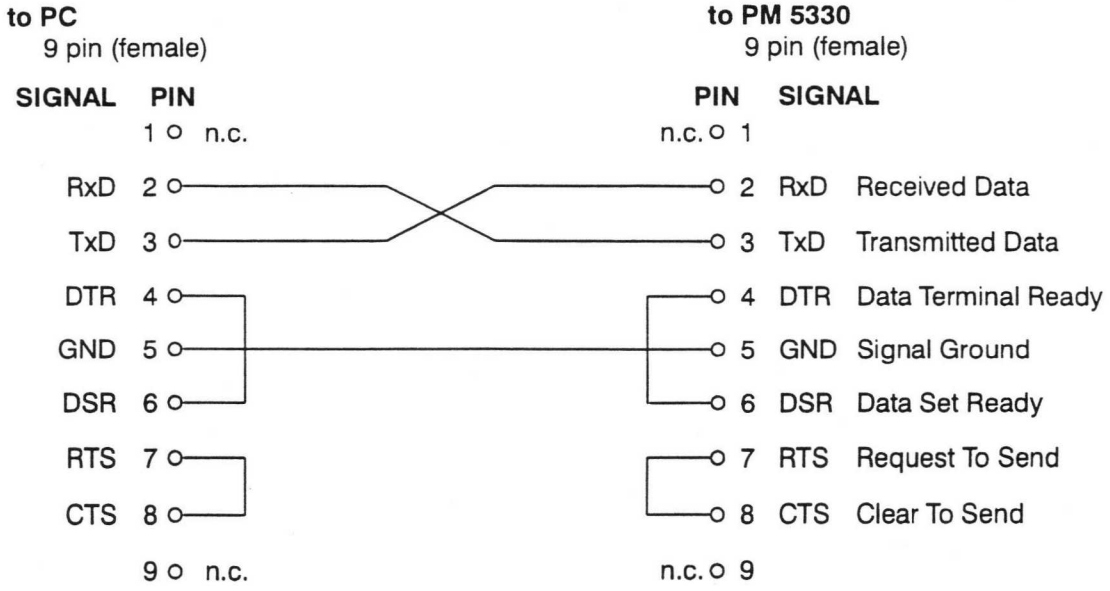
Operating modes:	Communication mode
Command set:	compatible with IEEE-488.2
Baud rates:	110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200
Data bits:	7 or 8
Stop bits:	1 (2 for 110 baud only)
Parity:	ODD EVEN NO (with 8 data bits)
Xon/Xoff Handshake:	ON or OFF
Hardware connection:	3 wires, no hardware handshake 7 wires, with hardware handshake
Hardware handshake:	DSR/DTR and CTS/RTS
Connector:	9-pin D-connector (male)

Because the PC as well the PM 5330 are DTE (Data Terminal Equipement) following pin configuration for the RS-232 connection cable should be used. In general it is recommended to use a well screened cable to meet specifications of Radio Interference Suppression.



This cable can be purchased from your local Philips/Fluke Organisation, order number PM 9536/041.

If you use a 3 wire connection set the PM 5330 to software handshake.



2.3 SPECIAL INTERFACE FUNCTIONS

For communication with the RS-232 interface following commands (similar to the addressed and unaddressed interface commands for IEEE-488) are used:

RS-232	Function	similar to IEEE-488
ESC 1	go to local	**GTL**
ESC 2	go to remote control	**GTR**
ESC 4	device clear	**DCL**
ESC 5	local lock out	**LLO**
ESC 7	asks for status byte	★ **STB?** ★1

To send this commands press the ESC key and after that the required numeric key.

★1 the instrument sends an ASCII string

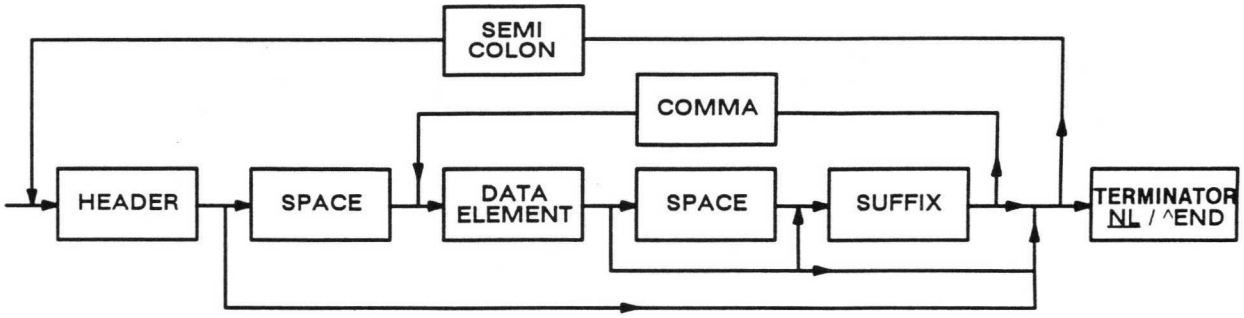
3 REMOTE CONTROL COMMANDS

In this section the commands are described related to the instrument functions and front panel keys, which are shown in chapter 3 OPERATING INSTRUCTIONS of the Operating Manual.

3.1 PROGRAM MESSAGE SYNTAX

Several commands can be combined in a message and sent to the generator, whereby the semicolon ";" must be used as separator between the commands.

Header and data element must be separated by a space; the end of a message must be terminated by NL (new line), ^END or both for the IEEE-488 interface and by NL for the RS-232 interface.



3.2 MESSAGE TERMINATOR

The generator accepts ^END or NL (ASCII 10 dec.) or both as terminator for a program message via IEEE-488 interface.
The generator also sets ^END and NL as terminator for a response message. To get compatibility to earlier controllers you can program terminators depart from IEEE-488.2. For this the command TRM followed by the decimal value of the required ASCII character is used.

Example: **TRM 13,10** sets CR NL as terminator for a response message

By this the instrument is not in accordance with IEEE-488.2 anymore.

The command TRM without decimal value, *RST or the interface functions SDC/DCL sets the initial terminator again; so it is also after power on.

Programming via RS-232 interface uses only NL as terminator.

3.3 SERVICE REQUEST (SRQ) AND STATUS REGISTERS

Service Request will be generated if one or more bits of the 'Status Byte Register' are set to 1 and if the corresponding bits are enabled by the 'Service Request Enable Register'. The controller asks the contents of the 'Status Byte Register' in 'Serial Poll Mode'.

PM 5330 'Status Byte Register':

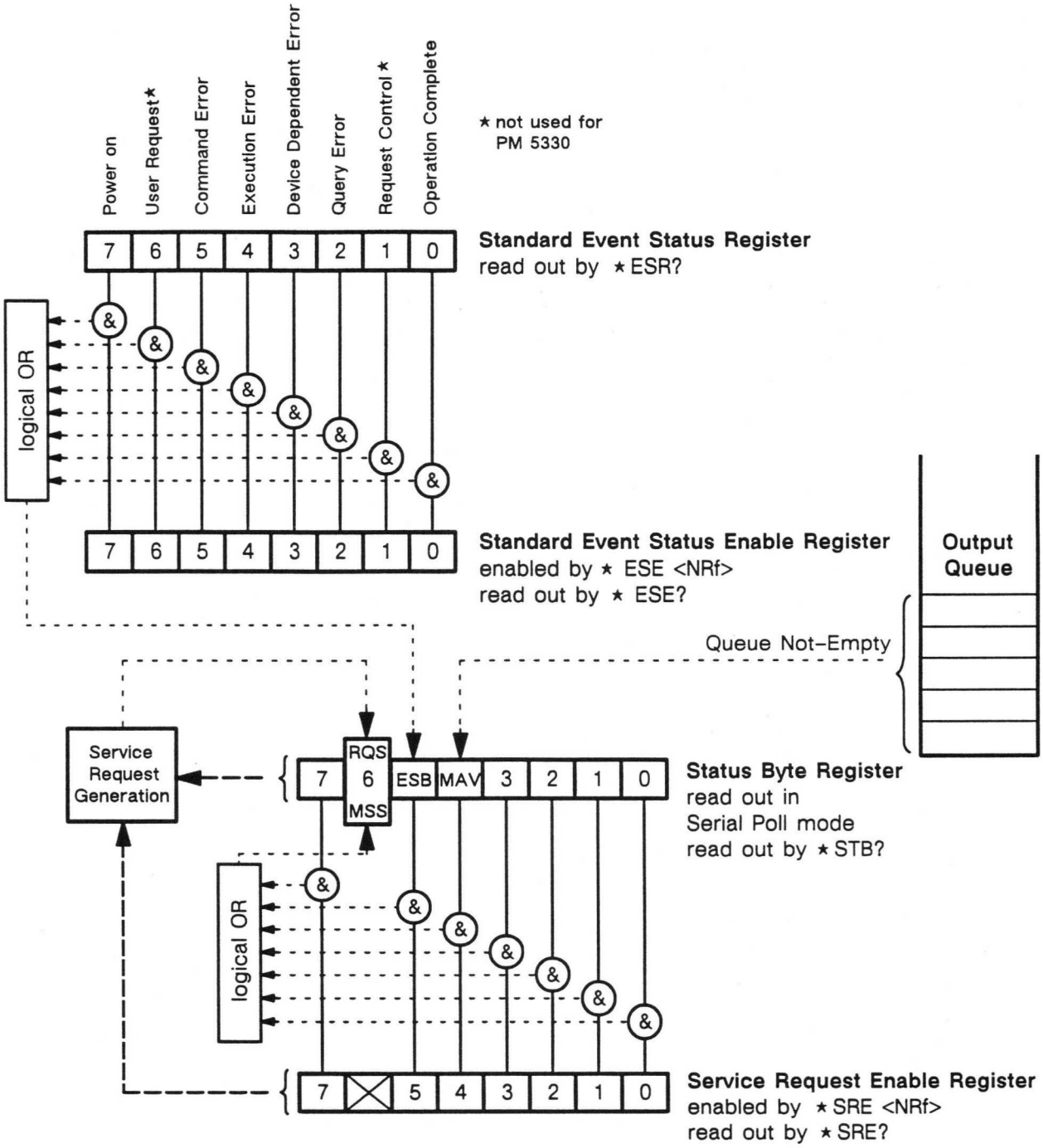
Bit	Function	Decimal value
0	reverse power protection tripped ★	1
1	not used	2
2	not used	4
3	not used	8
4	message available (MAV)	16
5	bit of the 'Standard Event Status Register' high	32
6	request for service (RQS)	64
7	not used	128

★ power protection reset by RF ON, bit reset by ★CLS

To get information via Service Request, that bits of the 'Standard Event Status Register' are set, those bits must have been enabled by ★ESE **and** bit 5 of the 'Status Byte Register' must have been enabled by ★SRE.

Direct read-out without Service Request is possible by the queries ★ESR? for the 'Standard Event Status Register' and by ★STB? for the 'Status Byte Register'.

PM 5330 'Standard Event Status Register'



<NRf> represents a decimal value which binary pattern sets the corresponding bits of the 'Enable Register' to 1. By this the assigned bits of the 'Standard Event Status Register' resp. the bits of the 'Status Byte Register' are enabled.

All bits of the 'Standard Event Status Enable Register' and of the 'Service Request Enable Register' are set to 0 when switching on the instrument. The same applies after the command STBY (standby). Therefore in a user program it is necessary that the required bits are set to 1 after power-on, if Service Request is required.

3.4 COMMON COMMANDS (IEEE-488.2)

System data:

⋆IDN? Identification Query

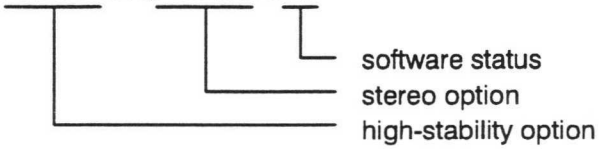
After receipt of this query the instrument generates the following response message:

PHILIPS,PM5330,0,Vx.x x.x = software status

⋆OPT? Option Identification Query

the message which can be read in shows the implemented options, for example:

PM9554:0:0,PM9555:0:x.x



Internal operations:

⋆RST Reset Command

This command performs a device reset which sets the instrument to a defined status:

frequency 100 MHz		frequency increment	1 MHz
level –27 dBm		level increment	1 dB
internal amplitude modulation		sweep frequency	10 Hz
modulation frequency 1 kHz		sweep width	50 kHz
modulation depth 30 %		FM deviation	25 kHz
RF output off (RF OFF)			

2nd modulation: OFF

Stereo: pilot ON, pre-emphasis OFF
ARI: system Germany, area code A, announcement (DK) OFF
RDS: OFF, RDS phase 90°, RDS deviation 1.25 kHz
Counter: OFF, impedance 50 Ω

The reset doesn't affect the internal memories of the generator or the enable or status registers of the interface.

***TST? Selftest Query**

The instrument automatically checks the RAM, ROM and the EEPROM, which contains the calibration data. The contents of the registers will not be destroyed, instrument settings remain unchanged.

A zero in the response string indicates that the self-test has completed without errors detected.

190 means checksum error during RAM-test
191 means checksum error during ROM-test
193 means checksum error during EEPROM-Test (calibration)

Synchronization:
***OPC Operation Complete Command**

For PM 5330 this command is suggestive for sweep mode. Selecting sweep via IEEE-488 bus, followed by the command *OPC, sets bit 0 (operation complete) of the 'Standard Event Status Register' to 1 when the oscillator is settled to centre frequency. This bit activates bit 5 of the 'Status Byte Register' (event status bit) which generates Service Request. This allows the controller to realize that settling is finished. Service Request however will be generated when the respective bits are enabled, see Section 3.3.

***OPC? Operation Complete Query**

Sending the query *OPC? to the generator during sweep settling causes the instrument to wait until settling is finished and to set a 1 into the output queue. The register can be read out by the controller without Service Request to continue in its user program.

Data in the output queue generally activate bit 4 of the 'Status Byte Register' (MAV, message available), this may generate Service Request. In order to avoid this, bit 4 must not be enabled. Bit 0 (operation complete) of the 'Standard Event Status Register' is not affected by *OPC?.

***WAI Wait-to-Continue Command**

This command sent to the instrument in a common string with further commands causes the generator to execute the command behind *WAI only when the previous command is completed.

Example: FREQUENCY 50 MHZ;SWEEP ON;***WAI**;LEVEL 7 DBM

In this example the output level will not be set to 7 dBm, before the sweep oscillator is settled to the centre frequency.

Status and event:
***CLS Clear Status Command**

Sets the bits of the 'Standard Event Status Register' and of the 'Status Byte Register' to zero. Sending *CLS as a single command or as the first command of a string additionally clears the contents of the Output Queue.

***ESE Standard Event Status Enable Command**

*ESE, followed by a decimal value, sets the bits of the 'Standard Event Status Enable Register' which correspond to that decimal value to 1. This enables the assigned bits of the 'Standard Event Status Register', see Section 3.3.

***ESE? Standard Event Status Enable Query**

This query asks for the contents of the 'Standard Event Status Enable Register'. The response is a decimal value.

Example: "255" = all bits are set to 1, that means all events of the 'Standard Event Status Register' are enabled.

***ESR? Standard Event Status Register Query**

Asks for the contents of the 'Standard Event Status Register'. The response is a decimal value. This query clears the register.

***SRE Service Request Enable Command**

*SRE, followed by a decimal value, sets the bits of the 'Service Request Enable Register' which correspond to that decimal value to 1, except bit 6. This enables the assigned bits of the 'Status Byte Register', see Section 3.3.

***SRE? Service Request Enable Query**

Asks for the contents of the 'Service Request Enable Register'. The response is a decimal value.

***STB? Read Status Byte Query**

Asks for the contents of the 'Status Byte Register'. The response is a decimal value.

Stored settings:

***SAV Save Command**

This command followed by a decimal value 00 to 74 stores the current instrument setting into the corresponding memory place. The contents of the memory is not affected by the command *RST or when switching off the instrument.

***RCL Recall Command**

This command followed by a decimal value from 00 to 74 for the memory place calls up and executes the instruments settings stored in that memory place.

3.5 DEVICE SPECIFIC MESSAGES

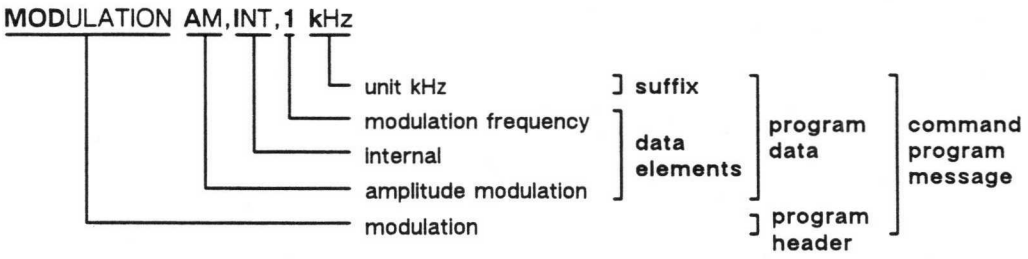
Following survey shows which remote control commands are necessary to select operation modes and parameters and to input values.

"|" separates expressions which can be used by choice.

"[ ]" means that this expression or unit need not necessarily be input. If the unit for the suffix is missing the first one mentioned in the brackets will automatically be set.

"NRf" (flexible numeric representation) value within the allowed range as integer, real or exponential value (NRf 1, 2 or 3 according to IEEE 488.2), whereby the number of digits is limited to 16 and to 2 for the exponent. Inputs for frequency and level with a resolution below the allowed limits are rounded.

"," serves as separator between several data elements in the program data, for example:



Most header and data can be used in short form, marked with bold letters in the table.

Example: **MOD A,I,1 k**

Some headers can be sent as command headers to program the generator and additionally as query with a question mark. By this the instrument generates an answer with its actual value.

Example:	**FREQ 10e6**	sets the frequency to 10 MHz
	FREQ?	answer: FREQ 10.000E+6

In the following sections the question mark of these headers is set into brackets, for example, Frequency Setting: FREQUENCY(?).

Most headers can be used in short form, marked with bold letters.

Example: **FREQ**UENCY(**?**) is short form **FREQ**(**?**)

3.5.1 Frequency Setting

Header: **FREQ**UENCY(**?**)
Data element: NRf
Suffix: [**H**z | **k**Hz | **M**Hz]

Remark: Range 100 kHz – 179.99900 MHz, resolution 10 Hz;
200 kHz – 179.90000 MHz for FM and stereo

for sweep centre frequency:
100 kHz + ½ sweep width (min. 200 kHz)
180 MHz – ½ sweep width (max. 179.9 MHz)

Example: **FREQUENCY 89.9 MHZ** or **FREQ 89.9E6**

sets frequency to 89.9 MHz

3.5.2 Level Setting

During level input the units dBmW, dBf, dBmV, dBµV, mV, µV and V are accepted. Inputs of units mV or µV are internally rounded to the next 0.1 dBm value.
The level output data (after query LEVEL?) are always sent in the dBm unit. If no unit was stated before the instrument selects dBm as basic setting.
The 50/75 Ω level format can only be selected manually and is not controllable via remote control.

Header: **LEVEL(?)**
Data element: NRf
Body: [**dBm**W] | **dBf** | **dBmV** | **dBu**V | **m**V | **u**V] (uV means µV)

Remark: Range:

−127 to + 13 dBm ★	with 50 Ω termination, resolution 0.1 dB
−20 to +120 dBµV	
−80 to + 60 dBmV	
−7 to +133 dBf	
0.1 µV to 1000 mV	

★ max. +7 dBm for amplitude modulation

Range:

−127.2 to + 12.8 dBm ★	display format 75 Ω with 75 Ω termination, resolution 0.1 dB
−18.4 to +121.6 dBµV	
−78.4 to + 61.6 dBmV	
−7.2 to +132.8 dBf	
0.12 µV to 1200 mV	

★ max. +6.8 dBm for amplitude modulation

Example: **LEVEL −67.5 DBM** or **LEVEL −67.5**

sets the level to −67.5 dBm

3.5.3 Modulation Modes

Header: **MOD**ULATION | **MODLN(?)**
Data element: **AM** | **FM** [,**EXT** | **INT**,NRf] or **ON** / **OF**F or **CLEAR**
Suffix: [**Hz** | **kHz** | **MHz**] (NRf for modulation frequency)

Remark: NRf for modulation / audio frequency: 20 Hz – 20 kHz for AM, FM
20 Hz – 15 kHz for Stereo

CLEAR switches all modulation settings OFF

Example: **MOD CLEAR** switches off all selected modulations

Modulation signal source

Header: **MODS**OURCE | **MODSRC(?)**
Data element: **INTERN** | **EXTERN**
Suffix: none

Modulation frequency

Header: **MODF**REQ(**?**)
Data element: NRf
Suffix: [**Hz** | **kHz** | **MHz**]

Remark: NRf for modulation / audio frequency: 20 Hz – 20 kHz for AM, FM
20 Hz – 15 kHz for Stereo

Example: **MODF 400 Hz**

Amplitude modulation (AM)

Example: **MODULATION AM,EXTERN** or **MOD AM,E**

sets the generator to external amplitude modulation

AM depth (m)

Header (Query): **AMD**EPTH(**?**)
Data element: NRf
Suffix: [PCT]

Remark: Suffix may be left out (AM depth always in %)

Frequency modulation (FM)

Example: **MODULATION FM,INTERN,3.3 KHZ** or **MOD FM,I,3.3E3**

sets the generator to frequency modulation,
internal modulation / audio frequency 3.3 kHz.

FM deviation

Header (Query): **FMD**EVIATION(**?**)
Data element: NRf
Suffix: [**H**z | **k**Hz | **M**Hz]

Sweep

Header: **SWE**EP | **SWP**
Data element: **ON** | **OF**F
Suffix: none

Remark: During sweep the command MOD OFF doesn't switch off the sweep oscillator, see Operating Manual, Chapter 3, Section 3.5.7.5. Switching off the oscillator is only done by the command SWP OFF.

Sweep width

Header: **SWPW**IDTH(**?**)
Data element: NRf
Suffix: [**H**z | **k**Hz | **M**Hz]

Remark: NRf for sweep width 10, 20, 50, 100, 200, 500 kHz
1, 2, 5, 10 MHz

Sweep frequency

Header: **SWPF**REQ(**?**)
Data element: NRf
Suffix: [**H**z | **k**Hz | **M**Hz]

Remark: NRf for sweep frequency: 2, 5, 10, 20, 50 Hz

Example: **FREQUENCY 5.5 MHZ;LEVEL -27 DBM;SWEEP ON;**
SWPFREQ 50 HZ;SWPWIDTH 500 KHZ or

FREQ 5.5E6;LEVEL -27;SWP ON;SWPF 50;SWPW 5E5

sets generator to:

sweep		
centre frequency	5.5	MHz
level	-27	dBm
sweep frequency	50	Hz
sweep width	500	kHz

3.5.4 Stereo

Header: **STE**REO
Data element: **L**EFT | **R**IGHT | **M**ONO | **S**UBCHANNEL | **U**NMOD | **E**XT | **OF**F
Suffix: none

Remark: The internal sound frequency (LF) is programmed by the command MODFREQ; 20 Hz – 15 kHz

Pilot

Header: **PI**LOT(**?**)
Data element: **ON** | **OF**F
Suffix: none

Pre-emphasis (only for external modulation)

Header: **PR**EEMPHASIS | **PREEMP**(**?**)
Data element: NRf
Suffix: [**s** | **m**s | **u**s] (us means µs)

Remark: NRf for pre-emphasis 0, 50 µs, 75 µs

Example: **FREQUENCY 90.3 MHZ;STEREO SUBCHANNEL;PILOT ON; MODSOURCE EXTERN;PREEMPHASIS 50 US**

FREQ 90.3E6;STE S;PI ON;PR 50E-6;MODS E

sets the generator to:

carrier frequency	90.3 MHz
stereo, subchannel	(signal S)
pilot on	
external modulation	
pre-emphasis	50 µs

3.5.5 RDS/ARI

RDS (Radio Data System)

Header: **RDS_R**ECORD(**?**)
Data element: NRf
Suffix: none

Remark: by a number 1 to 20 stored RDS data records are recalled;
0 = RDS off

Example: **RDS_R 8**

selects RDS data record no. 8

Header: **RDS_DE**VIATION(**?**)
Data element: NRf
Suffix: [Hz | kHz]

Remark: setting of the RDS deviation
range: 750 Hz – 4 kHz
step width: 50 Hz (min)

Example: **RDS_DE 1500 Hz**

sets RDS deviation to 1.5 kHz

Header: **RDS_P**HASE(**?**)
Data element: NRf
Suffix: [DEG]

Remark: setting of the RDS phase; values: 0°, 80°, 90°, 100°

Example: **RDS_P 90 DEG**

sets RDS phase to 90°

Header: **RDS_DA**TA(**?**) ⋆
Data element: Arbitrary block data
Suffix: none

Remark: defines a RDS data record

Header: **RDS_S**EQ(**?**) ⋆
Data element: Arbitrary block data
Suffix: none

Remark: defines an output sequence of RDS data record

⋆ These commands can only be operated by the **RDS-MessageWriter** via PC. By this tool the complete coded RDS data are transmitted.

ARI function (Autofahrer Rundfunk Information)

Header: **ARI**
Data element: **ON** | **OF**F | **US** | **E**UROPE
Suffix: none

Example: **ARI ON**

ARI on switches on the actual ARI system
(ARI-Germany or ARI-USA)

Query: **ARI?**

Response message: **ARI US** | **ARI EU** | **ARI OFF**

Area Identification Code

Header (Query): **ARE**ACODE(**?**)
Data element: ARI (Germany) **A** | **B** | **C** | **D** | **E** | **F** | **OFF**
ARI (USA) **A1 ... A10** | **OFF**
Suffix: none

Example: **AREA A, AREA A5**

Area Identification Code of area A respectively zone 5 is switched on

Announcement Identification Code

Header (Query): **TRA**NNOUNCE(**?**)
Data element: ARI (Germany) **ON** | **OFF**
ARI (USA) **M1** | **M2** | **OFF**
Suffix: none

Remark: ARI must be switched on before the Traffic Announcement Code can be switched on

Example: **ARI ON;TRAN ON**

ARI-Germany with Announcement Code (DK) is switched on

TRAN M1 selects ARI-USA Message 1

3.5.6 Combined Modulation Modes

Header: **MOD_ADD(?)**
Data element: **AM** [,**INT** | **EXT**] | **FM** [,**INT** | **EXT**] | **OFF**
STEREO [,**EXT** | **UNMOD** | **SUBCH** | **LEFT** | **RIGHT** | **MONO**]
Suffix: none

Remark: Input of modulation frequency only possible in the single modulation. Possible modulation combinations see Table of Modulation Modes in the Operating Manual.

Example: **MOD_ADD AM,INT**

this message adds, for example,
amplitude modulation with internal modulation source

MOD_ADD OFF

this message switches off added modulation modes

3.5.7 Frequency Counter Function

Header: **CO**UNT(**?**)
Data element: **ON** | **OFF**
Suffix: none

Remark: Frequency range 10 Hz - 199.999 MHz

Input impedance

Header: **IM**PEDANCE(**?**)
Data element: **L**OW | **H**IGH
Suffix: none

Remark: LOW = 50 Ω, HIGH = 1 MΩ

Example: **COUNT ON;IMPEDANCE HIGH** or **CO ON;IM H**

switches counter on,
sets impedance to 1 MΩ

3.5.8 Additional Commands

Frequency increment:

Header: **FREQ**INCRM | **FREQINC**(**?**)
Data element: NRf
Suffix: [**H**z | **k**Hz | **M**Hz]

Remark: NRf for frequency increment min. 10 Hz, max. 50 MHz.
This command serves for input of step width for stepping via keyboard.

Example: **FREQINCRM 100 KHZ** or **FREQI 1E5**

sets frequency increment to 100 kHz

Level increment:

Header: **LEVEL**INCRM | **LEVELINC**(**?**)
Data element: NRf
Suffix: [**d**B]

Remark: NRf for level increment min. 0.1 dB, max. 20 dB.
This command serves for input of step width for stepping via keyboard.

Example: **LEVELINCRM 10 DB** or **LEVELI 10**

sets level increment to 10 dB

Vernier function:

Header: **VE**RNIER(**?**)
Data element: **F**REQ | **L**EVEL | **MODF**REQ | **MODDEV** | **MODDEP** | **OF**F
Suffix: none

Remark: This command determines whether the rotary knob is to act on the RF frequency, output level, modulation frequency, deviation or depth after switching to keyboard operation.

Example: **VERNIER OFF** or **VE OF**

switches the rotary knob off

Display:

Header: **DI**SPMODE(**?**)
Data element: **A**LL | **ON** | **OF**F
Suffix: none

Remark: ALL means ON.

RF output:

Header: **RF**
Data element: **ON** | **OF**F
Suffix: none

3.5.9 Learn Mode

A Header followed by a "?" causes the instrument to generate a response message consisting of a 'Response Header' and the current setting. This message can be read in by a controller, stored in a program and be re-sent as program message to the generator later on. By this also manual keyboard inputs can be read into a program.

Stereo and sweep are modulation modes in this case, the query is MOD? but not STEREO? or SWEEP?.

The query for the state of the output level is RF? or OUTP?; the response is RF ON or RF OFF.

Example: **MOD?** answer: **STEREO SUBCHAN,1E3**

After the query COUNT? the response is COUNT OFF when the counter is switched off. When the counter is active, the response is COUNT followed by the measured frequency, e.g. COUNT 100.000E+6 for 100 MHz. This string can be applied in a user program to display or to print-out the measured values; it doesn't serve to program the generator.

After receipt of the query BINPROG? the instrument generates a binary coded response message which contents the **complete instrument setting**. It can be used for binary programming the instrument.

Example: **BI**NPROG? answer: **BINPROG #2198**□ **▶pé ▶ ▶ $**□
frequency 100 MHz, level -27 dBm, RF off,
AM internal, modulation frequency 3 kHz

Note: Data are only accepted via RS-232 interface when data length is set to 8 bits.

4 PROGRAMMING EXAMPLES

4.1 IEEE-488 INTERFACE

The following example is related to a IBM compatible PC with built-in IEEE-488/GPIB interface PM 2201. For this we assume that you are acquainted with basic knowledge of the operating system MS-DOS of the controller and the programming language GWBASIC.

The program allows to input commands via the controller keyboard and to send them via the interface to the generator.

From line 1 to 55 the calling addresses of the GPIB subroutines are defined, in order to have access to them from GWBASIC. This program part is accessible within the interface software package under the file name DECL.BAS; after loading it can be linked with the application program starting at line 100.

```
1  'Copyright 1986, N.V. Philips Gloeilampenfabrieken
2  CLS
3  CLEAR ,64000!
4  GPIBINIT1 = 64000! : GPIBINIT2 = GPIBINIT1 + 2
5  DIM A%(26)
6  BLOAD "IOBIB.M",GPIBINIT1
7  CALL GPIBINIT1(A%(0),A%(1),A%(2),A%(3),A%(4),A%(5),A%(6),A%(7),A%(8),A%(9),A%
(10),A%(11),A%(12),A%(13),A%(14),A%(15),A%(16),A%(17),A%(18),A%(19),A%(20),A%(21
),A%(22),A%(23),A%(24))
8  CALL GPIBINIT2(A%(25),A%(26))
9  '
10  IOINIT        = GPIBINIT1 + A%(0)
11  IORESET       = GPIBINIT1 + A%(1)
12  IOABORT       = GPIBINIT1 + A%(2)
13  IOCONTROL     = GPIBINIT1 + A%(3)
14  IOEOI         = GPIBINIT1 + A%(4)
15  IOEOL         = GPIBINIT1 + A%(5)
16  IOGETTERM     = GPIBINIT1 + A%(6)
17  IOMATCH       = GPIBINIT1 + A%(7)
18  IOOUTPUTS     = GPIBINIT1 + A%(8)
19  IOOUTPUT      = GPIBINIT1 + A%(9)
20  IOOUTPUTA     = GPIBINIT1 + A%(10)
21  IOENTERS      = GPIBINIT1 + A%(11)
22  IOENTER       = GPIBINIT1 + A%(12)
23  IOENTERA      = GPIBINIT1 + A%(13)
24  IOSEND        = GPIBINIT1 + A%(14)
25  IOSPOLL       = GPIBINIT1 + A%(15)
26  IOSTATUS      = GPIBINIT1 + A%(16)
27  IOTIMEOUT     = GPIBINIT1 + A%(17)
28  IOREMOTE      = GPIBINIT1 + A%(18)
29  IOLOCAL       = GPIBINIT1 + A%(19)
30  IOLLOCKOUT    = GPIBINIT1 + A%(20)
31  IOCLEAR       = GPIBINIT1 + A%(21)
32  IOTRIGGER     = GPIBINIT1 + A%(22)
33  IOGTS         = GPIBINIT1 + A%(23)
34  IORSV         = GPIBINIT1 + A%(24)
35  IOWAIT        = GPIBINIT1 + A%(25)
36  '
37  DEF.ERR       = GPIBINIT1 + A%(26)
38  PCIB.ERR$     = SPACE$(40)
39  CALL DEF.ERR(PCIB.ERR, PCIB.ERR$)
40  FALSE         = 0
41  TRUE          = 1
42  NOERR         = 0
43  EOFLW         = 14
44  EUNKNOWN      = 100001!
45  ESEL          = 100002!
46  ERANGE        = 100003!
47  ETIME         = 100004!
48  ECTRL         = 100005!
49  EPASS         = 100006!
50  ENUM          = 100007!
51  EADDR         = 100008!
52  '
53  ERASE A%
54  '
55  'Start application program after this line
```

Application program:

```
100 CLS
110 PRINT" "
120 PRINT" "
130 PRINT"                ***** DEMO PROGRAM FOR PM5330 *****"
140 PRINT" "
150 PRINT"            Please set device address of your instrument to 21 "
160 PRINT" "
170 PRINT"                  PRESS  ''RETURN''  TO CONTINUE  "
180 PRINT" ":BEEP:BEEP
190 PRINT"                To leave running program type 'END' "
200 PRINT" "
210 B$=INKEY$
220 IF B$=""THEN GOTO 210
230 IF ASC(B$) <> 13 THEN 240 ELSE 280
240 COLOR 23,0
250 PRINT" ":PRINT"              Wrong key! press ''RETURN'' to continue"
260 BEEP
270 GOTO 210

280                                     'Initialisations
290 COLOR 7,0
300 CLS                                 'Clear screen
310 AD=7                                'Adapter number is 7
320 RFG=721                             'GPIB address of PM5330 (RFG) is 21
330 CALL IORESET(AD)                    'Initialisation of GPIB
340 IF PCIB.ERR>0 THEN PRINT PCIB.ERR$  'Direct error check
350 CALL IOCLEAR(RFG)                   'Clears the PM5330
360 TIME=3
370 CALL IOTIMEOUT(AD,TIME)             'Timeout value is 3 seconds
380 IF PCIB.ERR>0 THEN PRINT PCIB.ERR$  'Direct error check

400 WR$="*CLS" : NCHAR=LEN(WR$)         'Sets event and status register to 0
410 CALL IOOUTPUTS(RFG,WR$,NCHAR)       'Sends string to set up PM5330
420 GOSUB 1000                          'To error handling routine
430 WR$="*SRE 49;*ESE 60"               'SRQ if ERROR, MAV or Power Protection
440 NCHAR=LEN(WR$)
450 CALL IOOUTPUTS(RFG,WR$,NCHAR)       'Sends string to set up PM5330
460 GOSUB 1000                          'To error handling routine

500                                     'Gets identification
510 '
520 WR$="*IDN?;" : NCHAR=LEN(WR$)
530 CALL IOOUTPUTS(RFG,WR$,NCHAR)
540 MAXIMUM=64 : INFO$=SPACE$(MAXIMUM) : ACTUAL=0
550 PRINT "Device:  ";
560 GOSUB 1000                          'To error handling routine

600                                     'Query for options
610 '
620 WR$="*OPT?;" : NCHAR=LEN(WR$)
630 CALL IOOUTPUTS(RFG,WR$,NCHAR)
640 MAXIMUM=128 : INFO$=SPACE$(MAXIMUM) : ACTUAL=0
650 PRINT "Options: ";
660 GOSUB 1000                          'To error handling routine

700 PRINT" "
710 PRINT" "
720 LINE INPUT"COMMAND     : ",A$       'Reading keyboard input
730 PRINT "CONFIRMATION: "A$
740 IF A$="end" THEN 1280
750 WR$=A$                              'Input to WR-string
760 NCHAR=LEN(WR$)
770 CALL IOOUTPUTS(RFG,WR$,NCHAR)       'Sends string to PM5330
780 GOSUB 1000                          'To error handling routine
790 GOTO 710
```

Program continues next page

```
1000                                    'Error handling subroutine (GOSUB)
1010 IF PCIB.ERR>0 THEN PRINT "GPIB error: ",PCIB.ERR$
1020 IF (PCIB.ERR=100007!) OR (PCIB.ERR=0) THEN 1040
1030 GOTO 1160                          'Interface check
1040 STAT=0
1050 FOR I=1 TO 1000 : NEXT I           'Time delay
1060 CALL IOSPOLL(RFG,STAT)             'Asks for status byte
1070 IF (STAT AND 64)=0 THEN RETURN     'Checks whether Request for Service
1080 IF (STAT AND 1)=1 THEN 1240        'Checks overload protection
1090 IF (STAT AND 16)=16 THEN 1120      'Checks whether message available
1100 WR$="*ESR?;ERR?" : NCHAR = LEN(WR$)'Asks for error type
1110 BEEP : CALL IOOUTPUTS(RFG,WR$,NCHAR)
1120 MAXIMUM=100 : INFO$=SPACE$(MAXIMUM) : ACTUAL=0
1130 CALL IOENTERS(RFG,INFO$,MAXIMUM,ACTUAL)
1140 PRINT LEFT$(INFO$,ACTUAL)          'Prints error type
1150 RETURN
1160 PRINT: PRINT " PLEASE CHECK ADDRESS AND CONNECTIONS ":PRINT
1170 PRINT "(After power-on via GPIB the device is busy for about 5 secs)"
1180 PRINT:PRINT "Press 'RETURN' to continue when the device is ready."
1190 B$=INKEY$
1200 IF B$="" THEN GOTO 1190
1210 IF ASC(B$)=13 THEN RETURN 330
1220 BEEP : PRINT" ":PRINT"                Wrong key!"
1230 GOTO 1190
1240 PRINT "Reverse Power Protection tripped"
1250 WR$="*CLS;RF ON" : NCHAR=LEN(WR$)  'Registers to 0, reset of RPP
1260 CALL IOOUTPUTS(RFG,WR$,NCHAR)
1270 RETURN
1280 CLS : CALL IOLOCAL(RFG)            'Sets generator to LOCAL,
1290 END                                'if input was ''end''
```

The lines 700 to 790, comprising the read-in from controller keyboard and the transfer to the generator, can be replaced by a program part in which distinct instrument settings are fixed.

Example:

```
700 LOCATE 10,25:PRINT "PROGRAM IS RUNNING"
710 A=0
720 GOTO 750
730 A=A+1                               'Counting
740 IF A=20 THEN CALL IOLOCAL(RFG):CLS:END
750 WR$="MOD OFF;FREQ 89.9e6;LEVEL 7;MOD FM,INT,400;RF ON"
760 NCHAR=LEN(WR$)                      'Frequency modulation
770 CALL IOOUTPUTS(RFG,WR$,NCHAR)
780 GOSUB 1000
790 FOR I=1 TO 5000:NEXT I              'Time delay
800 WR$="MOD OFF;FREQ 90.2e6;LEVEL 13"  'Unmodulated signal
810 NCHAR=LEN(WR$)
820 CALL IOOUTPUTS(RFG,WR$,NCHAR)
830 GOSUB 1000
840 FOR I=1 TO 5000:NEXT I              'Time delay
850 GOTO 730
```

By this the generator is set to frequency modulation: Carrier frequency 89.9 MHz, modulation frequency 400 Hz, level 7 dBm.
After passing a delay loop the generator is set to unmodulated frequency of 90.2 MHz and to +13 dBm level. After the 20th repetition the program is finished.

4.2 RS-232 INTERFACE

```
100 KEY OFF: CLS
110 PRINT"       ************************************************************"
120 PRINT"       *********    Demonstration program for PM5330   **************"
130 PRINT"       *********      with RS-232 interface            **************"
140 PRINT"       ************************************************************"
150 PRINT: PRINT: PRINT
160 '****** Enviroment : IBM AT or Compatible with GWBASIC 3.20 *********
200 '****** Initialisation of PM5330 ******************************
210 PRINT"       Please set the instrument address to 20,
215 PRINT"       representing the following RS-232 configuration:
220 PRINT"                Mode      : COmmunication "
230 PRINT"                Baudrate  : 9600"
240 PRINT"                Parity    : off"
250 PRINT"                Data      : 8"
260 PRINT"                Handshake : on"
270 PRINT"                Wire      : 3"
280 PRINT:PRINT
290 '
300 '****** Initialisation of PC communication port ***************
310 GOSUB 1400                              'inilize comm. port
320 '
350 '****** Initialisation of error routine ***********************
360 ON ERROR GOTO 3000                      'error check
370 '
400 GOSUB 1200                              'special commands
410 '
450 '****** Initialisation of PM5330 ******************************
460 SEND$=CHR$(27)+"2" : GOSUB 2000         'send goto remote
470 SEND$="*cls;*ese 255": GOSUB 2000       'send status clear
480 SEND$="*idn?": GOSUB 2000               'send identifikation query
490 GOSUB 2100                              'get response message
500 IF LEN(REC$)>0 THEN GOTO 550            'if buffer not empty
510 PRINT:PRINT"No answer! Please check the connection and setting!"
520 CLOSE COMFILE
530 KEY ON: END
540 '
550 CLS
560 PRINT "connected instrument : ";REC$    'display identity string
570 PRINT
580 '
600 '****** main loop *********************************************
610 PRINT:PRINT
620 LINE INPUT"COMMAND : ";SEND$            'command input
630 GOSUB 1000                              'checks the command
640 IF C>0 THEN GOTO 700                    'test of no end
650 SEND$=CHR$(27)+"1": GOSUB 2000          'sets instrument to local
660 CLS: KEY ON: END
670 '
700 GOSUB 2000                              'sends command
710 IF (INSTR(SEND$,"?")=0) AND (C<>3) THEN GOTO 760   'if no query
720 PRINT: PRINT"RESPONSE :  ";
730 GOSUB 2100                              'get response message
740 PRINT REC$                              'display response message
750 '
760 SEND$=CHR$(27)+"7": GOSUB 2000          'ask for status byte
770 GOSUB 2100                              'get response message
780 C=VAL(REC$)
790 PRINT: PRINT"STATUS : ";REC$            'display status
800 IF C =0 THEN GOTO 600                   '
810 IF (C AND 32)<>32  THEN GOTO 600        'if ESB set
820 SEND$="err?": GOSUB 2000                'ask for error message
830 PRINT: PRINT"ERROR MESSAGE  : ";
```

```
840 GOSUB 2100                                  'get response message
850 PRINT REC$                                  'display error message
860 SEND$="*cls": GOSUB 2000                    'clear status register
870 GOTO 600
880 '
1000 '****** command check ***************************************
1010 C=2: IF LEN(SEND$)<>3 GOTO 1170            'no special command ?
1020 IF INSTR(SEND$,"END") THEN C=0 : RETURN    'test END
1030 IF INSTR(SEND$,"end") THEN C=0 : RETURN    'test end
1040 IF INSTR(SEND$,"GTL") THEN SEND$=CHR$(27)+"1": RETURN
1050 IF INSTR(SEND$,"gtl") THEN SEND$=CHR$(27)+"1": RETURN
1060 IF INSTR(SEND$,"GTR") THEN SEND$=CHR$(27)+"2": RETURN
1070 IF INSTR(SEND$,"gtr") THEN SEND$=CHR$(27)+"2": RETURN
1080 IF INSTR(SEND$,"DCL") THEN SEND$=CHR$(27)+"4": RETURN
1090 IF INSTR(SEND$,"dcl") THEN SEND$=CHR$(27)+"4": RETURN
1100 IF INSTR(SEND$,"LLO") THEN SEND$=CHR$(27)+"5": RETURN
1110 IF INSTR(SEND$,"llo") THEN SEND$=CHR$(27)+"5": RETURN
1120 IF INSTR(SEND$,"STB") THEN SEND$=CHR$(27)+"7": C=3 : RETURN
1130 IF INSTR(SEND$,"stb") THEN SEND$=CHR$(27)+"7": C=3 : RETURN
1150 IF INSTR(SEND$,"dtr") THEN SEND$=CHR$(27)+"8": RETURN
1160 IF INSTR(SEND$,"DTR") THEN SEND$=CHR$(27)+"8": RETURN
1170 C=1: SEND$=SEND$+CHR$(10)                  'append terminator
1180 RETURN
1190 '
1200 '****** special commands *************************************
1210 CLS: PRINT"Special commands : ": PRINT
1220 PRINT"          GTL  : go to local"
1230 PRINT"          GTR  : go to remote"
1240 PRINT"          DCL  : device clear"
1250 PRINT"          LLO  : local lock out"
1260 PRINT"          STB  : get status byte"
1270 PRINT"          DTR  : device trigger"
1280 PRINT: PRINT: PRINT"To leave running programm type 'END' "
1290 PRINT: PRINT: PRINT"                    press a key to continue ";
1300 C$=INKEY$: IF C$="" THEN GOTO 1300
1310 PRINT"      please wait!": PRINT: PRINT
1320 RETURN
1400 '****** Initialisation of PC communication port ***************
1410 PRINT"       Which communication port of the PC do you use ?"
1420 PRINT:PRINT"                COM1   [1]"
1430 PRINT"                      COM2   [2]    please select "
1440 PORT=0: C$=INKEY$                          'get key code
1450 IF C$="1" THEN PORT=1
1460 IF C$="2" THEN PORT=2
1470 IF PORT=0 THEN GOTO 1440
1480 MCREG= &H3FC: IF PORT=2 THEN MCREG=&H2FC   'modem control register address
1490 COMFILE=1                                  'file buffer handle
1500 SER$="COM"+CHR$(48+PORT)+":9600,N,8,1,CS,DS,CD,RS"
1510 OPEN SER$ AS #COMFILE
1520 WIDTH#COMFILE,255
1530 GOSUB 2500                                 'clear input buffer
1540 COM.DELAY=5                                'timeout is 5s
1550 RETURN
1560 '
1600 'delay 100ms
1610 T1=TIMER
1620 IF T1+.1>TIMER THEN GOTO 1620
1630 RETURN
2000 '******** send command to instrument ***********************
2010 IF LEFT$(SEND$,1)=CHR$(27) THEN GOTO 2030
2020 SEND$=SEND$+CHR$(10)                       'append terminator
2030 PRINT#COMFILE,SEND$;                       'send command string
2040 GOSUB 1600                                 '100ms delay
2050 RETURN
```

```
2100 '******** receive message from instrument ******************
2110 REC$=""                                    'clear response string
2120 TR!=TIMER                                  'start timeout timer
2130 IF TIMER<TR! THEN TR!=TR!-86400!           'adjust 24.00h
2140 IF (LOC(COMFILE)=0) AND (TIMER-TR! < COM.DELAY) THEN GOTO 2130
2150 IF LOC(COMFILE)=0 THEN RETURN              'if there no characters
2160 '
2200 TR!=TIMER                                  'start timeout timer
2210 IF TIMER<TR! THEN TR!=TR!-86400!           'adjust 24.00h
2220 IF (LOC(COMFILE)=0) AND (TIMER-TR! < COM.DELAY) THEN GOTO 2210
2230 IF LOC(COMFILE)<>0 THEN GOTO 2300          'if there are characters
2240 PRINT"**** receive timeout ****"
2250 RETURN
2260 '
2270 '
2300 C$=INPUT$(1,#COMFILE)                      'read one character
2310 GOSUB 2400                                 'test buffer size
2320 IF C$=CHR$(10) THEN RETURN                 'stop if terminator
2330 REC$=REC$ + C$                             'append character
2340 IF LEN(REC$)<200 THEN GOTO 2200            'if string not full
2350 PRINT REC$;: REC$=""                       'display string
2360 GOTO 2200                                  'get next character
2370 '
2400 '******** buffer size check *********************************
2410 IF XOFF=1 THEN GOTO 2470
2420 'if input buffer becomes full then reset DTR to stop transmission
2430 IF LOC(COMFILE)< 200 THEN RETURN
2440 PRINT#COMFILE,CHR$(19): XOFF=1
2450 RETURN
2460 'if input buffer has enough space then  continue transmission
2470 IF LOC(COMFILE)> 100 THEN RETURN
2480 PRINT#COMFILE,CHR$(17): XOFF=0
2490 RETURN
2500 '******** clear buffer ***************************************
2510 GOSUB 2450                                 'set DTR on
2520 IF LOC(COMFILE)=0 THEN RETURN              'buffer empty
2530 C$=INPUT$(1,#COMFILE)                      'read one character
2540 GOSUB 2450                                 'set DTR on again
2550 GOTO 2510                                  'next character
2560 '
3000 '******** error check ***************************************
3010 PRINT
3020 IF ERR<>57 THEN GOTO 3100                  'if communication error
3030 PRINT"communikation error : ";             'then display comm. status
3040 S=INP(MCREG-1)
3050 IF (S AND 2)=2 THEN PRINT"overrun "
3060 IF (S AND 4)=4 THEN PRINT"parity "
3070 IF (S AND 8)=8 THEN PRINT"framing "
3080 IF (S AND 16)=16 THEN PRINT"break detected "
3090 GOTO 3130
3100 IF ERR<>24 THEN GOTO 3120                  'if timed out then
3110 PRINT"Instrument not connected ": GOTO 3130
3120 PRINT"unknown error "
3130 RESUME
```

5 ERROR MESSAGES

Using the IEEE-488 interface the error messages can be read out in Serial Poll mode after Service Request. Hereto it is necessary that the corresponding bits of the 'Status Byte Register' and of the 'Standard Event Status Register' have been enabled. Read out without Service Request is also possible by the query ERR?. The generator sends the response message: ERROR, followed by an error number and a description in clear text.
For the RS-232 interface the instrument generates an error message after receiving the query ERR?, which can be read-in by the controller.

Error number, Description

0,"NO ERROR"

Command errors

101,"SYNTAX ERROR"
102,"UNKNOWN HEADER"
103,"AMBIGUOUS HEADER"
104,"ILL. CHARACTER DATA"
105,"ERROR IN SUFFIX"
106,"ERROR IN BINPROG DATA"

Execution errors

110,"NUMERICAL OVERFLOW"
111,"VALUE OUT OF RANGE"
112,"AM / LEVEL MISMATCH"
113,"FM / FREQ MISMATCH"
114,"SWPWIDTH OUT OF RANGE"
115,"MODULATION MISMATCH"
116,"STEREO / FREQ MISMATCH"
117,"COUNT / SWEEP MISMATCH"
118,"RDS PROGRAMMING FAILED"

Instrument-specific errors

120,"NO STEREO MODULE"
121,"NO RDS/ARI MODULE"

130,"NO CALIBRATION MODE"
131,"FINE ATT.: CAL. ERROR"
132,"COARSE ATT.: CAL. ERROR"
133,"WRONG CALIBRATION FREQ."
134,"SWP-CORR. OUT OF RANGE"

Instrument-specific errors continue next page

Instrument-specific errors

151,"IIC-BUS FAILURE EEPROM 1"
152,"IIC-BUS FAILURE EEPROM 2"
153,"IIC-BUS FAILURE COARSE ATT"
154,"IIC-BUS FAILURE STEREO"
155,"IIC-BUS FAILURE RDS"
157,"IIC-BUS FAILURE DISPLAY"
162,"PLL 2 NOT LOCKED"
163,"PLL 3 NOT LOCKED"
166,"SWEEP CENTER FREQ.NOT OK"
170,"LEVEL CORRECTION FAILED"

Query errors

140,"OUTPUT DATA DESTROYED"
141,"NO DATA AVAILABLE"

"UNKNOWN ERROR" (error message, not listed in the error table)

6 COMMANDS IN ALPHABETICAL ORDER

Allowed abbreviations are printed in bold letters

6.1 COMMON COMMANDS AND QUERIES (IEEE-488.2)

Header	Function
***CLS**	sets 'Standard Event Status Register' and 'Status Byte Register' to zero
***ESE** <NRf>	'Standard Event Status Enable' command
***ESE?**	'Standard Event Status Enable' query
***ESR?**	reads 'Standard Event Status Register'
***IDN?**	identification query
***OPC**	'Operation Complete' command
***OPC?**	'Operation Complete' query
***OPT?**	option identification query
***RCL** 0...99	recall command
***RST**	reset command
***SAV** 0...99	save command
***SRE** <NRf>	'Service Request Enable' command
***SRE?**	'Service Request Enable' query
***STB?**	read status byte query
***TST?**	self-test query
***WAI**	wait-to-continue command

6.2 DEVICE SPECIFIC COMMANDS

Header	Function
AMDEPTH(**?**)	AM depth (m)
AREACODE(**?**)	ARI Areacode
ARI(**?**)	ARI
BINPROG(**?**)	binary programming
CALCOARSE	calibrate coarse attenuator
CALFINE	calibrate fine attenuator
CALREADY	calibration successful done
CALSWEEP	calibrate sweep oscillator
COUNT(**?**)	counter function
DISPMODE(**?**)	display on or off
ERROR**?**	error query
FMDEVIATION(**?**)	FM deviation
FREQUENCY(**?**)	RF frequency
FREQINCR(**?**)	frequency increment
IMPEDANCE(**?**)	impedance (counter)
LEVEL(**?**)	output level
LEVELINCR(**?**)	level increment
MODULATION(**?**) | **MODLN**(**?**)	modulation mode
MODDEV | **MODDEP**	set position rotary knob
MODFREQ(**?**)	modulation frequency
MODSOURCE(**?**) | **MODSRC**(**?**)	modulation frequency source
MOD_ADD(**?**)	combined modulations

DEVICE SPECIFIC COMMANDS

Header	Function
OUTPSTATUS?	RF output query
PILOT(?)	pilot on or off
PREEMPHASIS(?)	pre-emphasis
RDS_DATA(?) ★	transfer RDS-data
RDS_DEVIATION(?)	set RDS-deviation
RDS_PHASE(?)	set RDS-phase
RDS_RECORD(?)	recall RDS-record
RDS_SEQ(?) ★	transfer RDS-sequence
RF(?)	RF output on or off
SETCOARSE	set coarse attenuator
SETFINE	set fine attenuator
SETSWEEP	switch sweep oscillator on
STEREO	stereo modulation
SWEEP | **SWP**	sweep
SWPFREQ(?)	sweep frequency
SWPWIDTH(?)	sweep width
TRANNOUNCE(?)	ARI traffic announcement
TRM	response terminator setting
VERNIER(?)	rotary knob

★ only when MessageWriter is used

? only as query possible
(?) additional as query possible

6.3 USED SUFFIX

Suffix	used for
dB	level increment
db | **dBf** | **dBm**W | **dBmV** | **dBu**V	level
DEG	RDS-phase
Hz | **k**Hz | **M**Hz	carrier frequency, frequency increment, modulation frequency, sweep frequency, sweep-width
s | **m**s | **u**s	pre-emphasis
V | **m**V | **u**V	output amplitude (level)

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