SRG - 3

SPINNING ROTOR GAUGE

RS 232 INTERFACE

Instruction Manual

Edition 01/2009

CONTENTS

1 INTRODUCTION

1.1 GENERAL

Remote control via the serial interface enables full access to all instrument resources and in addition provides a set of functions not available in manual operation. The interface is designed to be directly compatible to a personal computer serial port (COMx).

1.2 SCRIPTS

A powerful feature of the SRG-3 is the support of scripting. The instrument may be fully script-controlled, freeing the user from the burden of writing dialog programs. Scripts may be prepared using a normal text editor and then transmitted to the instrument by a simple terminal utility program which in turn logs the instrument replies. A number of formatting options allow logged data to be conveniently imported into spreadsheets. A *learn script* feature is included (see command LRN) to assist the user in writing his own scripts for instrument setup.

2 INTERFACE

2.1 CONNECTION

To connect the SRG-3 to a personal computer serial port, a 9-way *extension cable* (male to female) is required. A null modem cable will not work. The table below shows the pin assignment of the SRG-3 RS-232 connector (female). Note that only pins 2, 3 and 5 are used, the other pins are not connected.

Terminal	Function
1	not connected
2	RXD – data out
3	TXD – data in
4	not connected
5	GND
6	not connected
7	not connected
8	not connected
9	not connected

2.2 CONFIGURATION

The SRG-3 may operate at 1200, 2400, 4800, 9600 (default) and 19200 baud. To change the default setting, open parameter Baud in menu 13.1 and select the desired baud rate.

The computer interface must be configured for the same baud rate, 8 data bits, no parity, one stop bit, no handshake.

2.3 COMMUNICATION

After power-up, the SRG-3 prompts for commands by sending a '>' (62). Command input is buffered up to a maximum of 128 characters and must be terminated by a carriage return (13). An adjacent line feed (10) will be ignored. On receiving the CR, command processing starts. When all commands are processed, reply output is closed by emitting a CRLF, then the instrument prompts for new commands.

2.4 PROMPT OPTION

The parameter Prompt in menu 13.1 controls the prompt option. If set to Std (default), the instrument prompts for commands by emitting a '>' (positive acknowledge), or, if an error was encountered in the commands processed, by emitting a '?' (negative acknowledge). If set to Off, no prompt character is emitted. The parameters Ackn and Nack in menu 13.2 allow free assignment of the positive and negative acknowledge characters.

2.5 SPECIAL CHARACTERS

Incoming bytes are treated as 8-bit characters. The following control characters have a special function, all other control codes are ignored:

BS (8)	deletes last character
CAN (24)	deletes all characters / aborts command execution
CR (13)	terminates input
DEL (127)	deletes last character
EOT (4)	discards input / aborts command execution
ESC (27)	discards input / aborts command execution
ETX (3)	aborts command execution
HT (9)	treated as a single space character

2.6 REMOTE CONTROL STATE

On the first valid command, the SRG-3 enters *remote control state*, forces menu 0.0 and turns on the REMOTE LED. In remote control state, the control keys ENTER, ON and OFF are disabled and respond with the message Key disabled! when being activated.

The instrument can be reset to *local control state* either by sending the RTL command, or, manually, by selecting menu 5.0 and then pressing the OFF key.

In critical applications where manual control must be fully disabled, the keys may be locked out by sending the LLO (local lockout) command. In local-lockout mode, all keys respond with the message Keys disabled!.

3 INSTRUMENT COMMAND LANGUAGE

3.1 SYNTAX

3.1.1 Commands

Command mnemonics are not case-sensitive and must be delimited by spaces or tabs**.** Redundant delimiters are ignored. Multiple commands may be written on a single line.

Example: `amu vis tco`

3.1.2 Arguments

Arguments (required or optional) must *precede* the command (postfix notation) and must be delimited by spaces or tabs. Redundant delimiters are ignored.

Example: `2008 10 16 dat`

Optional arguments determine the type of operation. If the argument is omitted, the command is a read function and sends a reply. If the argument is present, the command is a write operator.

Example:
```
20 mti      'sets measure time to 20s
mti         'queries measure time
```

Integer arguments (*n*) are accepted in free format but must not contain a decimal point or an exponent character (E). Integers may be also entered as hex numbers if prefixed by dollar sign ($). Characters are not case-sensitive.

Example: `0 123 -1 $0D`

Real arguments (*x*) are accepted in free format. Exponent characters are not case-sensitive.

Example: `123.45 10 -0.025 3.8e-5 -1 456.7E+00`

String arguments (*str*) must be enclosed in double quotes ("). A string may be empty.

Example: `"UF6" ""`

3.1.3 Inline Text

Inline text (*txt*) follows the ECH command and may contain any character except backslash (\) which is treated as a delimiter. If not delimited by a backslash, the text extends to the end of line.

Example: `ech Ambient temperature [°C]\ in2`

3.1.4 Comments

Script text starting with a quotation mark (‘) is treated as a comment and skipped up to the matching unquote or to the end of line.

Example:
```
8 gas 'Uranium hexafluoride
'Ball diameter[mm]' 4.5 dia
```

3.2 INSTRUMENT REPLIES

3.2.1 Field Separators

Numbers and labels are padded with a space character to separate the output fields when commands are threaded.

Example: `ech #\ num tim val ulb`
Reply: `#122 13:56:07  3.4567E-05 mbar`

3.2.2 Output Formats

Integer numbers are returned in free format. Positive numbers have no sign holder.

Example: `0 123 -1`

Real numbers are returned in scientific format with four decimal places (may be changed using the FMT command). Positive numbers are preceded by a space.

Example:
```
 1.2345E+02
-2.5000E-02
 3.8000E-05
```

Strings are returned without delimiters to enable concatenation. If delimiting is required, quotation marks may be added using the QUO and UNQ commands.

Example: `mbar User8 'SRG-3 V1.0.4 #500307 '`

3.3 COMMAND EXECUTION

3.3.1 Command Mode

Interactive dialog runs in *command mode* (see also CMD). A number of commands (PRT, RST, STA, STP) start a background task and then terminate immediately, so other things can be done before the task is finished. The completion can be checked by polling the status (commands STS, RCS). This is the default mode after power-up or reset.

3.3.2 Script Mode

In *script mode* (see also SCR), all commands execute in foreground and remain busy until their task is finished. This ensures correct command sequencing. In case of premature termination due to an error message, all succeeding commands are discarded until a CMD statement is processed, which exits script mode and causes command execution to be resumed. In this way, the part of the script that may be rendered pointless by the unsuccessful step will be skipped. Entering script mode also enables talkative messages, so error messages will be included in the output log (see also MSG).

Example:

```
scr                    'enter script mode
0 msg                  'silent messages here
2 use                  'recall setup #2
ech Date \ dat                    'show date
ech Setup #\ use ech from \ sdt   'show setup used
ech Time    Press[\ ulb ech ]\    'show column titles
sta                    'start measurement
5 rpt nxt tim val      'log 5 readings
stp                    'stop rotor
cmd                    'exit script mode, resume command
execution
msg                    'show if successful
```

Reply:

```
Date 2008-10-16
Setup #2 from 2008-10-15
Time     Press[mbar ]
15:23:10  2.4530E-04
15:23:20  2.4531E-04
15:23:30  2.4531E-04
15:23:40  2.4532E-04
15:23:50  2.4531E-04
No message
```

3.3.3 Aborting Execution

Repeat loops (RPT), delays (DLY) and statements synchronizing with events (NXT) may be aborted any time by sending one of the codes ESC (27), ETX (3), EOT (4) or CAN (24). The command line being processed will then be discarded and the instrument returns to command mode.

4 COMMAND SET SUMMARY

Legend	
Symbol	Explanation
[ ]	Optional argument. If present, command is a write operator.
( )	Conditional reply, sent if command is a read function.
0 1..	Fixed argument denoting a command option
c	Ascii code
file	Text file
h m s	Hours, minutes, seconds
i	Channel index
n	Integer number
str	String
txt	Inline text
x	Real number
y m d	Year, month, day

Gas Parameters			
Argum	Cmd	Reply	Description
[*x*]	AMU	(*x*)	Atomic mass units
[*n*]	GAS	(*n*)	Gas type
[*x*]	TCO	(*x*)	Temperature coefficient of viscosity
[*x*]	TMP	(*x*)	Temperature
[*x*]	VIS	(*x*)	Viscosity

User Gas Definitions			
Argum	Cmd	Reply	Description
n	GLB	*str*	Query gas label
"*str*" *n*	GLB		Assign user-defined gas label
	USR	*file*	List user definitions
n	USR		Save as user gas type
0	USR		Reset user definitions

Sensor Parameters			
Argum	Cmd	Reply	Description
[*x*]	ACC	(*x*)	Accommodation factor
[*n*]	AUT	(*n*)	Automatic start
[*n*]	BGA	(*n*)	Background average
[*x*]	DEN	(*x*)	Ball density
[*x*]	DIA	(*x*)	Ball diameter
[*x*]	LSP	(*x*)	Lower speed limit
[*x*]	MTI	(*x*)	Measure time
[*x*]	OFS	(*x*)	Zero offset
[*n*]	SPC	(*n*)	Speed control mode
[*x*]	USP	(*x*)	Upper speed limit

Readout Settings			
Argum	Cmd	Reply	Description
y m d	DAT		Set date
[*n*]	DPL	(*n*)	Decimal places of pressure readout
[*n*]	DTO	(*n*)	Menu timeout
[*n*]	OPT	(*n*)	SI option
h m s	TIM		Set time
[*n*]	TSC	(*n*)	Temperature scale
[*n*]	UNT	(*n*)	Measurement unit

Printer Settings			
Argum	Cmd	Reply	Description
[*n*]	CNT	(*n*)	Maximum count
[*n*]	PDA	(*n*)	Printout data option
[n]	PEJ	(n)	Page eject option
[*n*]	PFT	(*n*)	Printout footer option
[*n*]	PHD	(*n*)	Printout header option
[*n*]	PIN	(*n*)	Printing interval
[*n*]	PPT	(*n*)	Printer port

Output Configuration			
Argum	Cmd	Reply	Description
[*x*]	AFS	(*x*)	Analog output full scale
[*x*]	ASP	(*x*)	Analog output span
[*x*]	HS1	(*x*)	SP1 hysteresis
[*x*]	HS2	(*x*)	SP2 hysteresis
[*x*]	SP1	(*x*)	SP1 trip point
[*x*]	SP2	(*x*)	SP2 trip point

Auxiliary Input Configuration			
Argum	Cmd	Reply	Description
[*n*]	AM1	(*n*)	Auxiliary channel 1 mode
[*n*]	AM2	(*n*)	Auxiliary channel 2 mode
[*x*]	AO1	(*x*)	Auxiliary channel 1 offset
[*x*]	AO2	(*x*)	Auxiliary channel 2 offset
[*n*]	APW	(*n*)	Auxiliary channels power supply
[*x*]	AS1	(*x*)	Auxiliary channel 1 scale factor
[*x*]	AS2	(*x*)	Auxiliary channel 2 scale factor

Serial Comm Settings			
Argum	Cmd	Reply	Description
[*n*]	BDR	(*n*)	Baud rate
[*n*]	PRO	(*n*)	Prompt option
c1 c2	PRO		User-defined prompt characters

Setup File Management			
Argum	Cmd	Reply	Description
	DEF	*n*	Query default status
0	DEF		Clear default status
1	DEF		Default settings and set status
	LRN	*file*	Send learn script
	SDT	*y-m-d h:m*	Timestamp of last setup change
n	STO		Store current settings as setup file *n*
	USE	*n*	Query setup file used
n	USE		Use setup file *n*

Sensor Control			
Argum	Cmd	Reply	Description
0	ARM		Disarm sensor control
1	ARM		Arm sensor control & perform sensor check
	DMT		Dismount sensor
	MNT		Mount sensor
	RST		Restart measurement
	SBY		Standby mode
	STA		Start measurement
	STP		Stop sensor

Measurement Readout			
Argum	Cmd	Reply	Description
	DCR	*x*	Deceleration rate (raw value)
	IN1	*x*	Auxiliary channel 1
	IN2	*x*	Auxiliary channel 2
	PRS	*x*	Pressure (raw value)
	REM	*x*	Remaining time until next readout
	VAL	*x*	Measured value

Zero Adjustment			
Argum	Cmd	Reply	Description
	ZAD	*x*	Return zero adjust value
1	ZAD		Do zero adjustment
0	ZAD		Undo zero adjustment

Status & Messages			
Argum	Cmd	Reply	Description
	MLG	*file*	List logged messages
0	MLG		Erase logged messages
	MSG	*str*	Read message
0	MSG		Clear pending message & set silent mode
1	MSG		Clear pending message & set talkative mode
	OPH	*n*	Operating hours
	RCS	*n*	Rotor control status
	STS	*n*	System status
0	STS		Clear system status

Script Flow Control			
Argum	Cmd	Reply	Description
	CMD		Command mode
	DLY		Delay 600ms
n	DLY		Delay *n* seconds
	NXT		Wait for next reading
	RPT		Repeat until interrupted
n	RPT		Repeat *n* times
	SCR		Script mode

Output Formatting			
Argum	Cmd	Reply	Description
	DAT	*y-m-d*	Date string
	ECH *txt*	*txt*	Echo text
[*n*]	FMT	(*n*)	Real number output format
	GLB	*str*	Gas label
	IDY	*str*	Identify instrument
	NUM	*n*	Return next number
n	NUM		Set number
	QUO	‘	Quote
	SDT	*y-m-d h:m*	Timestamp of last setup change
	TIM	*h:m:s*	Time string
	TLB	*str*	Temperature scale label
	ULB	*str*	Unit label
	UNQ	‘	Unquote

Front Panel & Power Control

Argum	Cmd	Reply	Description
	DIS	*n*	Query menu number
n	DIS		Display menu
"*str*"	DIS		Display string immediate
	KEY	*n*	Return next key
n	KEY		Wait for key stroke
-n	KEY		Push key
	LLO		Local lock-out
	PWR	*n*	Query power state
1	PWR		Power up (operating mode)
0	PWR		Power down (stand-by mode)
	SLK	*n*	Query setup lock
1	SLK		Lock settings
0	SLK		Unlock settings
	RTL		Return to local control

Printer Control

Argum	Cmd	Reply	Description
	PRT	*n*	Query print status
n	PRT		Start print function
0	PRT		Stop print function
"str"	PRT		Print string immediate

Direct Output

Argum	Cmd	Reply	Description
x	OUT		Set analog output voltage
1	OVR		Output override mode
0	OVR		Normal output mode
	RCO	*n*	Query remote control outputs
n	RCO		Set remote control outputs
	RLY	*n*	Query relay status
n	RLY		Set relays

Diagnostics

Argum	Cmd	Reply	Description
	ACL	*x*	Acceleration factor
	CAL	*x*	Calibration factor
	COR	*x*	Correction factor
	DMP	*x*	Damping level A+B
1	DMP	*x*	Damping level A
2	DMP	*x*	Damping level B
	IRS		Instrument reset
	ISP	*x*	Initial speed
	RDS	*n*	Rotor detection status
	RSP	*x*	Rotational speed
	SGL	*x*	Signal level
	TST	*n*	Query test mode
2	TST		Perform signal statistics
1	TST		Enter test mode
0	TST		Exit test mode

Head Adjustment			
Argum	Cmd	Reply	Description
	HDA	*y-m-d h:m*	Timestamp of last adjustment save
0	HDA		Reset adjustments
1	HDA		Levitation adjustment
2	HDA		Motor adjustment
9	HDA		Save adjustment in EEPROM

5 SRG-2CE COMPATIBILITY

The following SRG-2CE aliases are provided for compatibility:

Aliases			
Argum	Cmd	Reply	Description
[*n*]	CAP	(*n*)	Alias of BGA (*n* = 0..2)
n	CPT		Alias of ZAD (*n* = 0..2)
[*x*]	DB1	(*x*)	Alias of AO1
[*x*]	DB2	(*x*)	Alias of AO2
[*x*]	DF1	(*x*)	Alias of AS1
[*x*]	DF2	(*x*)	Alias of AS2
[*n*]	FN1	(*n*)	Alias of AM1
[*n*]	FN2	(*n*)	Alias of AM2
[*n*]	HDO	(*y-m-d h:m)*	Alias of HDA
[*x*]	SIN	(*x*)	Alias of MTI

The following SRG-2CE commands are recognized but not supported:

Unsupported Commands			
Argum	Cmd	Reply	Description
	BAT	0.0000E+00	Battery voltage
[*n*]	DS1	(0)	Display span aux channel 1
[*n*]	DS2	(0)	Display span aux channel 2
[*x*]	RF1	(1.0000E+01)	Reference voltage aux channel 1
[*x*]	RF2	(1.0000E+01)	Reference voltage aux channel 2

The following commands are formally compatible, but differ from their SRG-2CE counterparts:

Command Differences			
Argum	Cmd	Reply	Description
"*str*"	DIS		Flashing option not supported
[*n*]	KEY	(*n*)	Key codes not compatible
7	PRT		Histogram not supported
	RCS		Meaning of status bits 3..0 slightly different

Note: The SRG-3 uses a dollar sign ($) as prefix for hexadecimal numbers, while the SRG-2CE uses an ampersand (&).

6 COMMAND REFERENCE

Accommodation Factor ACC

Syntax: ACC — Returns the accommodation factor.

x ACC — Enter the accommodation factor *x* (0.1 to 2).

Related: DIA, DEN

Example:
```
acc          'query accommodation factor
1.012 acc    'change accommodation factor to 1.012
```

Acceleration Factor ACL

Syntax: ACL — Returns the acceleration factor [$s^{-2}A^{-2}$] used for speed control.

Related:

Example:
```
acl          'query acceleration factor
```

Analog Output Full Scale AFS

Syntax: AFS — Returns the analog output full scale value [*unit*].

x AFS — Enter the value for analog output full scale in the selected unit:

$x = 10^{-5}$ to 10^{3} Pa
$x = 10^{-7}$ to 10 mbar
$x = 7.5 \cdot 10^{-8}$ to 7.5 Torr
$x = 10^{-8}$ to 0.1 s^{-1}

Values entered in mbar or Torr are internally stored in Pa. The stored value is not converted if the unit is changed to or from s^{-1}. A zero value forces the analog output to full scale (10V). The output voltage V_{OUT} for a measured value p is calculated as:

ASP=0: $V_{OUT} = 10V \cdot p/AFS$

ASP>0: $V_{OUT} = 10V \cdot (1 + \log(p/AFS)/ASP)$

Related: ASP, OUT, OVR

Example:
```
afs          'query analog output full scale
2 unt        'select mbar
0.1 afs      'set full scale to 0.1 mbar
```

Auxiliary Channel 1 Mode AM1

Syntax: AM1 Returns the mode of auxiliary input channel 1.

n AM1 Selects the mode *n* of auxiliary input channel 1, determining the presentation of measured values:

0 raw value [V]

1 temperature [*tscal*]

2 pressure [*unit*]

3 special (no unit)

If set to mode 1, aux channel 1 will supply the gas temperature, thereby overriding the stored setting.

Related: AO1, AS1, TMP, TSC, UNT

Example:
```
am1          'query mode of aux channel 1
1 am1        'set up channel 1 for temperature
```

Auxiliary Channel 2 Mode AM2

Syntax: AM2 Returns the mode of auxiliary input channel 2.

n AM2 Selects the mode *n* of auxiliary input channel 2, determining the presentation of measured values:

0 raw value [V]

1 temperature [*tscal*]

2 pressure [*unit*]

3 special (no unit)

Related: AO2, AS2, TMP, TSC, UNT

Example:
```
am2          'query mode of aux channel 2
2 am2        'set up channel 2 for pressure
```

Atomic Mass Units AMU

Syntax: AMU Returns the mean molecular mass in u (atomic mass units).

x AMU Enter the mean molecular mass *x* (1 to 1000 u) and reset the gas type to 0 (`User`).

Related: GAS, TCO, USR, VIS

Example:
```
amu          'query molecular mass
44.1 amu     'change molecular mass to 44.1 u
```

Auxiliary Channel 1 Offset AO1

Syntax: AO1 Returns the offset of auxiliary input channel 1.

x AO1 Enter the offset *x* (-1E30 to +1E30) for channel 1. This value biases the linear scaled input V_{IN1} (*R* displayed reading):

$R = AS1 \bullet V_{IN1} + AO1$.

Related: AM1, AS1, IN1

Example:
```
ao1          'query aux channel 1 offset

1 am1        'temperature input
101 as1      'sensitivity 10 mV/K
-0.21 ao1    'adjust zero (0°C)
```

Auxiliary Channel 2 Offset AO2

Syntax: AO2 Returns the offset of auxiliary input channel 2.

x AO2 Enter the offset *x* (-1E30 to +1E30) for channel 2. This value biases the linear scaled input V_{IN2} (*R* displayed reading):

$R = AS2 \bullet V_{IN2} + AO2$.

Related: AM2, AS2, IN2

Example:
```
ao2          'query aux channel 2 offset

2 am2        'pressure input
0.1 as2      'full scale 1 Pa
-0.0002 ao2  'adjust zero
```

Auxiliary Power APW

Syntax: APW Returns the auxiliary power setting:

0 +/-15V supply off
1 +/-15V supply on

1 APW Turns the auxiliary power on.

0 APW Turns the auxiliary power off.

Related:

Example:
```
apw          'query aux power setting
1 apw        'turn on power for aux channels 1 & 2
```

Arm Sensor Control ARM

Syntax: ARM — Returns the state of the sensor control (0 = disarmed, 1 = armed).

0 ARM — Disarms the automatic sensor control. When the sensor is mounted, nothing occurs.

1 ARM — Arms the automatic sensor control and performs a sensor check by forcing the sensor to the lower and upper position. If present, the sensor is levitated and measurement starts, depending on the AUT setting. When the sensor is already mounted, nothing occurs.

Related: MNT, STA

Example:

```
arm          'query arm state

dmt          'drop sensor
0 arm        'disarm sensor control
```

Auxiliary Channel 1 Scale AS1

Syntax: AS1 — Returns the scale factor of auxiliary input channel 1.

x AS1 — Enter the scale factor *x* (1E-30 to 1E30) for channel 1. In temperature mode (AM1 = 1), the factor must be entered in K/V; in pressure mode (AM1 = 2), the factor must be entered in Pa/V. The displayed value *R* for a measured input voltage V_{IN1} is calculated as:

$R = AS1 \bullet V_{IN1} + AO1$

Related: AM1, AO1, IN1

Example:

```
as1          'query scale factor of aux channel 1

3 unt        'select Torr
2 am1        'chan 1 pressure input
133.33 as1   'scale 133.33 Pa/V = 10 Torr full scale
0 ao1        'zero offset
```

Auxiliary Channel 2 Scale AS2

Syntax: AS2 — Returns the scale factor of auxiliary input channel 2.

x AS2 — Enter the scale factor *x* (1E-30 to 1E30) for channel 2. In temperature mode (AM1 = 1), the factor must be entered in K/V; in pressure mode (AM1 = 2), the factor must be entered in Pa/V. The displayed value *R* for a measured input voltage V_{IN2} is calculated as:

$R = AS2 \bullet V_{IN2} + AO2$

Related: AM2, AO2, IN2

Example:
```
as2          'query scale factor of aux channel 2

1 unt        'select Pa
2 am2        'chan 2 pressure input
1 as2        '1 Pa/V = 10 Pa full scale
```

Analog Output Span ASP

Syntax: ASP — Returns the analog output span.

0 ASP — Selects linear scale.

n ASP — Selects logarithmic scale spanning *n* decades (1 to 10).

The output voltage V_{OUT} for a measured value *p* is calculated as:

ASP=0: V_{OUT} = 10V • *p*/AFS

ASP>0: V_{OUT} = 10V • (1 + log(*p*/AFS)/ASP)

Related: AFS

Example:
```
asp          'query output span
0 asp        'select linear output
5 asp        'select log output (2 volt/decade)
```

Automatic Start AUT

Syntax: AUT — Returns the automatic start mode.

0 AUT — Disables automatic start on power-up.

1 AUT — Enables automatic start on power-up. Note that speed control should also be set to an automatic mode to allow continuous measurement (see SPC).

Related: SPC

Example:
```
aut          'query automatic start mode
1 aut        'enable automatic start
```

Background Average BGA

Syntax: BGA — Returns the selected background average span.

n BGA — Sets the background average span to *n* readings (*n* = 0..50). If n < 2, no averaging is performed and the current reading is used for zero adjustment.

Note: The moving background average is the mean value of the last *n* pressure (PRS) or DCR readings, depending on the selected unit. This mean value is used for zero adjustment by the command ZAD. Changing the unit will flush the buffer and reset the average value.

Related: OFS, ZAD

Example:
```
bga          'query backgound average
30 bga       'set span to 30 readings
```

Baud Rate BDR

Syntax: BDR — Returns the baud rate setting.

n BDR — Selects baud rate *n* (1200, 2400, 4800, 9600, 19200).

Note: The baud rate returned is the stored value and may differ from the actual baud rate. Changing the baud rate remotely causes the new setting to be stored, but switching of the baud rate is deferred until the next instrument reset. If the baud rate is to be changed immediately, an IRS command must follow the BDR on the same line.

Related:

Example:
```
bdr              'query stored baud rate
19200 bdr irs    'go to 19200 baud
```

Calibration Factor CAL

Syntax: CAL — Returns the calibration factor [*unit* s] for the selected unit. If DCR is selected (unit = 0), the value is returned in Pa•s.

Note: The calibration factor is calculated as: CAL = PRS / (DCR • COR).

Related: COR, DCR, PRS

Example:
```
1 unt        'select Pa
10 gas       'select Argon
nxt cal      'query calibration factor of next reading
```
Reply:
```
 2.1455E+03
```

Command Mode CMD

Syntax: CMD — Exits script mode (see section 3.3.2), selects silent messages and resumes command execution.

Related: SCR

Example:

```
scr                    'enter script mode
0 msg                  'silent messages
2 use                  'recall setup #2
ech Date \ dat                    'show date
ech Setup #\ use ech from \ sdt  'show setup used
sta                    'start measurement
30 rpt nxt tim val     'log 30 readings
stp                    'stop rotor
cmd                    'exit script mode, resume cmd execution
ech Message: \ msg     'show possible message
```

Maximum Count CNT

Syntax: CNT — Returns the maximum count for continuous printing.

n CNT — Enter maximum count *n* (0 to 100) for continuous printing. On reaching the maximum count, continuous printing stops and the footer selected by the PFT option will be added to the printout. A zero count selects printing to be unlimited.

Note: The mode is also affected by the printing interval: If the interval is ≤ 120 min, the CNT value determines the total number of readings to be printed. If the interval is > 120 min, the CNT value specifies a set of consecutive readings to be printed each time the interval expires (see also PIN). For example, setting CNT = 10 and PIN = 60 will result in a total of 10 readings being printed at one hour intervals, while setting PIN = 180 will result in 10 consecutive readings printed every 3 hours until stopped by operator action.

Related: PFT, PIN, PRT

Example:

```
cnt          'query maximum count
30 cnt       'set count to 30
```

Correction Factor COR

Syntax: COR — Returns the DCR correction factor linearizing the current pressure reading. The correction factor is calculated as: COR = PRS / (DCR • CAL).

Related: CAL, DCR, PRS

Example:

```
nxt val cor 'query value and correction factor of next reading
```

Reply:

```
 1.5791E-03  1.0014E+00
```

Date DAT

Syntax: DAT — Returns a string with the current date formatted *yyyy-mm-dd*.

y m d DAT — Sets the date to year *y* (2000 to 2099), month *m* (1 to 12) and day *d* (1 to 31).

Related: SDT, TIM

Example:
```
ech Measurement #\ num ech dated \ dat
```
Reply:
```
Measurement #122 dated 2008-10-08
```

Example:
```
2008 10 12 dat   'set date to 2008-10-12
```

Deceleration Rate DCR

Syntax: DCR — Returns the measured deceleration rate [s^{-1}] and clears system status bit 4 (Data available).

Note: DCR always returns the raw, ie non-offset, value. To read the zero-adjusted deceleration rate, the VAL command must be used.

Related: STS, CPT, VAL

Example:
```
1 unt            'select Pa
rpt nxt dcr prs  'log pressure vs DCR
```

Default Settings DEF

Syntax: DEF — Returns the value of status bit 6 (Backup failed/Setup defaulted).

0 DEF — Clears status bit 6 (Backup failed/Setup defaulted).

1 DEF — Defaults all settings, resets all user gas definitions, unlocks the setup and sets status bit 6 (Backup failed/Setup defaulted). The instrument is reset to the factory settings.

Related: STS

Example:
```
def          'check if setup has been defaulted
1 def        'restore the default settings
```

Ball Density DEN

Syntax: DEN — Returns the stored rotor ball density [g cm^{-3}].

x DEN — Enter the rotor ball density *x* (6 to 10 g cm^{-3})[1].

Note 1: This is a formal range for the density value. There may be tighter limitations imposed by the instrument hardware.

Related: ACC, DIA

Example:
```
den          'query ball density
7.87 den     'change ball density to 7.87 g/cm3
```

Ball Diameter DIA

Syntax: DIA — Returns the stored rotor ball diameter [mm].

x DIA — Enter the rotor ball diameter *x* (1 to 6 mm)[1].

Note 1: This is a formal range for the diameter value. There may be tighter limitations imposed by the instrument hardware.

Related: ACC, DEN

Example:
```
dia          'query ball diameter
4.7 dia      'change ball diameter to 4.7 mm
```

Display Control DIS

Syntax: DIS — Returns the number of the menu displayed. The number returned corresponds to the menu number times 10, eg 60 stands for menu 6.0. To maintain compatibility with the SRG-2CE display options, there are two exceptions: 3 is returned instead of 10 and 6 is returned instead of 40.

n DIS — Selects menu *n* (0 to 150), *n* being the menu number times 10. To maintain compatibility with the SRG-2CE display options, there are two additions: *n* = 3 to 5 selects menu 1.0 and *n* = 6 selects menu 4.0.

"*str*" DIS — Displays *str* immediate. The string may be up to 32 characters. An empty string blanks the display. The menu number changes to 9.

Related: KEY

Example:
```
dis          'query menu number
2 dis        'show menu 0.2 (aux channel 2)
3 dis        'show menu 1.0 (DCR)
10 dis       'same as above

"Test:           ENTER" dis      'occupies 2 rows
```

Delay DLY

Syntax: DLY — Delays command processing for approx. 600 ms.

n DLY — Delays command processing for *n* seconds (1 to 3600).

Related: DIS

Example:
```
rpt in1 60 dly   'log aux channel 1 once a minute
```

Damping Level DMP

Syntax: DMP — Returns the output level [dB] of the sensor damping channels A+B.

1 DMP — Returns the output level [dB] of damping channel A.

2 DMP — Returns the output level [dB] of damping channel B.

Note: The value may serve as an indication of the level of mechanical interference the gauge head is exposed to.

Related: SGL

Example:
```
rpt dmp 1 dly    'check damping level every second
```

Dismount Sensor DMT

Syntax: DMT — Turns off the levitation control, causing the sensor to drop.

Caution: DMT should only be commanded when the sensor is idle!

Related: MNT, STP

Example:
```
scr          'execute in foreground
stp dmt      'stop rotor and dismount
cmd          'exit foreground
```

Decimal Places DPL

Syntax: DPL — Returns the number of decimal places for pressure readout.

0 DPL — Selects auto-ranging mode:

1 if $p < 10^{-3}$ Pa (10^{-5} mbar/Torr)
2 if 10^{-3} Pa (10^{-5} mbar/Torr) $\leq p < 10^{-2}$ Pa (10^{-4} mbar/Torr)
3 if 10^{-2} Pa (10^{-4} mbar/Torr) $\leq p < 10^{-1}$ Pa (10^{-3} mbar/Torr)
4 if $p \geq 10^{-1}$ Pa (10^{-3} mbar/Torr)

n DPL — Selects fixed number of decimal places (1 to 4).

Note: Digits rounded off are blanked when displayed and zero-filled when printed. Values returned by VAL and PRS, however, are always output with the number of decimal places set by the FMT option (4 by default).

Related: FMT

Example:
```
dpl          'query decimal places
3 dpl        'round pressure to 3 decimal places
```

Display Menu Timeout DTO

Syntax: DTO — Returns the timeout [s] for menus 1.0 to 6.4 (readout menus).

n DTO — Sets the timeout to *n* s (5 to 60). The value is internally rounded to multiples of 5s. On timeout, the display is reset to menu 0.0.

0 DTO — Disables timeout, so menus 1.0 to 6.4 may be viewed continuously.

Note: Menus 0.1 and 0.2 are not affected by the timeout and may be viewed continuously. The timeout for menus 7.0 to 13.2 (setup menus) is 60s and may not be changed.

Related: DIS

Example:
```
dto          'query display timeout
0 dto        'disable display timeout
30 dto       'set timeout to 30s
```

Echo Text ECH

Syntax: ECH *txt* — Copies *txt* to the output. This inline text may be delimited by a backslash (\) if not extending to the end of line. No space is added for separation.

Related: DAT, GLB, IDY, NUM, QUO, TIM, TLB, ULB, UNQ

Example:
```
ech Measurement #\ num ech dated \ dat
```
Reply:
```
Measurement #122 dated 2008-10-12
```

Example: `ech Pressure[\ ulb ech ]`
Reply: `Pressure[mbar ]`

Example: `quo ech Temperature[\ tlb ech ] unq tmp ech tmp`
Reply: `'Temperature[K ]' 2.9871E+02 tmp`

Real Number Format FMT

Syntax: FMT — Returns the decimal places selected for real number output format.

n FMT — Selects *n* (1 to 6) decimal places for real number output format. The value applies to *all real numbers* transmitted by the instrument. The format setting is not saved. On reset, the format defaults to 4 places.

Related: DPL

Example:
```
fmt          'query format
5 fmt        'output real with 5 places
rpt nxt val 'log readings
```

Reply:
```
 2.45308E-04
 2.45310E-04
 2.45311E-04
...
```

Gas Type GAS

Syntax: GAS Returns the current gas type. Gas type 0 (`User`) is returned if gas properties have been modified.[1]

n GAS Selects predefined gas type *n* (1 to 25). The gas type numbers are assigned as follows (the strings in parentheses are the labels returned by command GLB):

1	user-definable (`Usr1`)
2	user-definable (`Usr2`)
3	user-definable (`Usr3`)
4	user-definable (`Usr4`)
5	user-definable (`Usr5`)
6	user-definable (`Usr6`)
7	user-definable (`Usr7`)
8	user-definable (`Usr8`)
9	Air (`Air`)
10	Argon (`Ar`)
11	Acethylene (`C2H2`)
12	Freon-14 (`CF4`)
13	Methane (`CH4`)
14	Carbon dioxide (`CO2`)
15	Deuterium (`D2`)
16	Hydrogen (`H2`)
17	Helium (`He`)
18	Hydrogen fluoride (`HF`)
19	Nitrogen (`N2`)
20	Nitrous oxide (`N2O`)
21	Neon (`Ne`)
22	Oxygen (`O2`)
23	Sulfur dioxide (`SO2`)
24	Sulfur hexafluoride (`SF6`)
25	Xenon (`Xe`)

Note 1: If any gas property is set (see AMU, TCO, VIS), the gas type is reset to 0 (`User`). As the gas parameters are stored as part of the setup file, up to 15 different `User` gas types may be used in addition to `Usr1` to `Usr8`.

Related: AMU, TCO, USR, VIS

Example:
```
gas          'query gas type
8 gas        'select Usr8
20 gas       'select N2
```

Gas Type Label GLB

Syntax: GLB — Returns a string identifying the selected gas type (see GAS). If the gas type is 0, the string "`User`" is returned.

n GLB — Returns the identifier of gas type *n* (1 to 25).

"*str*" *n* GLB — Sets the identifier of user-definable gas type *n* (1 to 8) to *str*. If *str* is longer than 4 characters, the first 4 characters are used. The new label will replace the standard label `Usr`*n*.

Related: ECH, GAS, QUO, UNQ

Example:
```
ech Gas: \ glb
```
Reply:
```
Gas: CH4
```

Example:
```
14 glb       'get label of gas type 14
```
Reply:
```
CO2
```

Example:
```
"UF6" 3 glb 'rename Usr3 to UF6
```

Head Adjust HDA

Syntax: HDA — Returns a string with the timestamp of the last head adjustment save. If no adjustment has been done by the user, this is the timestamp of the factory initialization.

0 HDA — Resets the adjustment to default values.[1]

1 HDA — Adjusts levitation control by zeroing the sensor detection voltage. The sensor has to be removed for this procedure.[1]

2 HDA — Optimizes speed control by tuning the motor to its resonant frequency. The drive frequency is swept from high to low values until the drive current peak is located. The command runs in foreground.[1]

9 HDA — Saves the adjusted parameters in EEPROM and adds the timestamp. Unless 9 HDO is executed, the adjustment remains voltatile and the previously saved parameters are restored on instrument initialization.

Note 1: The results are not automatically saved in EEPROM memory. To make the adjustment permanent, a subsequent command 9 HDA is required. If the operation is attempted while the sensor is mounted, script error 99 occurs.

Related:

Example:
```
hda          'query date of last adjustment
0 hda        'reset adjustment
```

Example:
```
1 hda        'adjust levitation
2 hda        'tune motor
9 hda        'save adjustment
```

Setpoint 1 Hysteresis HS1

Syntax: HS1 — Returns the hysteresis of setpoint 1.

x HS1 — Enter the hysteresis *x* (-0.5 to 1) for setpoint 1. The sign of the value determines the hysteresis mode:

HS1<0: relay activated at *p* > SP1 and released at *p* < (1+HS1) • SP1

HS1>0: relay activated at *p* > (1+HS1) • SP1 and released at *p* < SP1

Related: SP1

Example:
```
hs1          'query hysteresis of SP1

3 unt        'select Torr
1.e-3 sp1    'change SP1 level to 1.E-3 Torr
-0.05 hs1    'SP1 is activated at p > 1.E-3 Torr
             'and released at p < 9.5E-4 Torr
```

Setpoint 2 Hysteresis HS2

Syntax: HS2 — Returns the hysteresis of setpoint 2.

x HS2 — Enter the hysteresis *x* (-0.5 to 1) for setpoint 2. The sign of the value determines the hysteresis mode:

HS2<0: relay activated at *p* > SP2 and released at *p* < (1+HS2) • SP2

HS2>0: relay activated at *p* > (1+HS2) • SP2 and released at *p* < SP2

Related: SP2

Example:
```
hs2          'query hysteresis of SP2

3 unt        'select Torr
1.e-3 sp2    'change SP2 level to 1.E-3 Torr
-0.05 hs2    'SP2 is activated at p > 1.E-3 Torr
             'and released at p < 9.5E-4 Torr
```

Identify IDY

Syntax: IDY — Returns a string identifying the instrument stating model, firmware version and serial number.

Related: ECH, QUO, UNQ

Example:
```
quo idy unq
```
Reply:
```
'SRG-3 V1.0.4 S/N G500307G40 '
```

Auxiliary Channel 1 Input IN1

Syntax: IN1 — Returns the value of auxiliary input channel 1, scaled according to the selected mode (see AM1, AO1, AS1).

Related: AM1, AO1, AS1

Example:
```
in1 in2     'read aux channel values
```

Auxiliary Channel 2 Input IN2

Syntax: IN2 — Returns the value of auxiliary input channel 2, scaled according to the selected mode (see AM2, AO2, AS2).

Related: AM2, AO2, AS2

Example:
```
in1 in2     'read aux channel values
```

Instrument Reset IRS

Syntax: IRS — Resets the instrument and performs the power-up initialization procedure.

Caution: IRS turns off the gauge head power immediately!

Related: AUT, BDR

Example:
```
0 pwr       'power down sensor
irs         'reset instrument
```

Initial Speed ISP

Syntax: ISP — Returns the initial sensor speed, ie the sensor speed after the last acceleration, in Hz.

Related: RSP, USP

Example:
```
isp          'query initial speed
```

Wait for Key Stroke KEY

Syntax: KEY — Waits for a key stroke and returns the code.

n KEY — Wait for the key *n* to be pressed:

n	**Key**
1	POWER
2	ON
3	OFF
4	ESC
5	ENTER
6	↑
7	↓
8	←
9	→

-n KEY — Push key, ie perform action of key *n*. The disabled keys POWER, ON, OFF and ENTER will be enabled first.

0 KEY — Disable keys again.

While waiting for operator response, the REMOTE LED keeps flashing to indicate that key action is requested by remote control.

Related: DIS

Example:
```
"Press any key:" dis  'announce test
rpt key     'read key codes

"Continue with   ENTER:" dis     'inform operator
5 key       'wait for key

71 dis      'show gas setup menu
-9 key      'set cursor on gas selection
```

Local Lock Out LLO

Syntax: LLO — Locks out local control by disabling the manual return feature in menu 5.0. After execution of LLO, return to local control is only possible by sending the RTL or IRS command, or by switching the instrument off and on again.

Related: RTL

Example:
```
llo          'disable local control
...          'perform critical operations
rtl          'enable local control
```

Learn Script LRN

Syntax: LRN

Returns a script file restoring the currently active settings when sent back to the instrument. The script includes a header identifying the instrument and the setup file being transmitted. Each setting is commented. The learn script may serve as a template to set up the instrument, or may be used for backup and/or documentation purpose.

Related: STO, USE

Example: lrn 'download settings
Reply:
```
'Date 2008-10-08 13:27:42 '
'SRG-3 V1.0.4 S/N G500307G40'
'Setup 0 from 2008-10-08 12:25 '
'Readout:'
'Display unit' 1 unt
'Temperature scale' 0 tsc
'Decimal places' 3 dpl
'Display timeout [s]' 0 dto
'Gas:'
'Name: Ar'
'Select gas' 10 gas
'Temperature [K]'  2.9315E+02 tmp
'Sensor:'
'Accommodation'  1.0000E+00 acc
'Measure time [s]'  3.0000E+00 mti
'Ball diameter [mm]'  4.5000E+00 dia
'Ball density [g/cm^3]'  7.7000E+00 den
'Upper speed limit [Hz]'  4.4000E+02 usp
'Lower speed limit [Hz]'  4.3000E+02 lsp
'Automatic start' 1 aut
'Speed control mode' 1 spc
'Background average' 10 bga
'Zero offset  [Pa]'  0.0000E+00 ofs
'Printout:'
'Maximum count' 10 cnt
'Print interval' 0 pin
'Printout header' 1 phd
'Printout footer' 1 pft
'Printout data' 0 pda
'Printer port' 1 ppt
'Page eject' 1 pej
'Outputs:'
'Setp 1 [Pa]'  1.0000E+00 sp1
'Setp 2 [Pa]'  1.0000E+00 sp2
'Hyst 1' -5.0000E-02 hs1
'Hyst 2' -5.0000E-02 hs2
'Analog full scale [Pa]'  1.0000E+00 afs
'Analog span' 5 asp
'Aux inputs:'
'Mode 1' 2 am1
'Mode 2' 0 am2
'Scale 1'  1.0000E+04 as1
'Scale 2'  1.0000E+00 as2
'Offset 1'  0.0000E+00 ao1
'Offset 2'  0.0000E+00 ao2
'Aux power' 1 apw
```

Example:
```
lrn         'active settings
1 use lrn   'stored setup files...
2 use lrn
...
```

Lower Speed Limit LSP

Syntax: LSP Returns the actual[1] lower speed limit [Hz].

x LSP Enter the lower operational speed limit *x* (405 to 805 Hz). The value is clipped to 5 Hz below the upper speed limit.

Note 1: When operating in speed control mode 2, the actual speed limits may be dynamically extended to meet the specified sampling interval. When changing USP, the LSP value will be adjusted automatically to retain the speed window size.

Related: MTI, SPC, USP

Example:
```
lsp              'query lower speed limit
450 usp 430 lsp  'select speed range 450..430 Hz
```

Message Log MLG

Syntax: MLG Returns the message log file. The message log contains the last 63 messages with their timestamps. If the message log is empty, a no-messages statement with the actual timestamp is returned (see example).

0 MLG Erases the logged messages.

Related: MSG

Example:
```
mlg          'examine message log
```
Reply:
```
2008-10-12 08:17  Err 33: Controlling speed failed
2008-10-12 12:45  Err 34: Bad signal level
2008-10-12 14:38  Err 22: Mounting rotor failed
```

Example:
```
0 mlg        'flush message log
mlg          'read message log
```
Reply:
```
2008-10-12 11:43  No messages
```

Mount Rotor MNT

Syntax: MNT Turns on the magnetic bearing causing the sensor to levitate. The sensor remains in idle mode (Idle). MNT runs in background. If the rotor is already mounted, no action is taken.

Note: If armed (see ARM), the sensor is automatically mounted when it is detected inside the air gap of the magnetic bearing.

Related: ARM, DMT, RCS, SBY, STA

Example:
```
scr          'execute in foreground
'Exercise levitation:
3 rpt mnt 2 dly dmt 2 dly
...
```

Message MSG

Syntax: MSG — Returns the message waiting in the message buffer and clears system status flag 5 (Message). If the buffer is empty, the string "No message" is returned.

0 MSG — Selects silent messages (default) and clears system status flag 5, flushing an old message. A new message will be buffered.

1 MSG — Selects talkative messages and clears system status flag 5, flushing an old message. A new message will be transmitted.

Note: Messages are also logged in the message log file (see also MLG).

Related: MLG, STS

```
Example:  msg          'read silent message
Reply:    Err 33: Controlling speed failed

Example:  0 msg        'flush old message
          1 msg        'get new messages immediately
```

Measure Time MTI

Syntax: MTI — Returns the actual[1] measure time [s].

x MTI — Enter the measure time. The value *x* (5 to 60 s) is internally rounded to tenths of seconds. If the interval is changed during measurement, a reduction will take effect immediately, whereas an extension will be deferred until the next measurement cycle.

Note 1: If not measuring, the stored value is returned. When operating in speed control mode 1, the actual measure time may vary dynamically to meet the specified speed limits.

Related: LSP, SPC, USP

```
Example:  mti          'query measure time
          5 mti        'change measure time to 5 s
```

Numbering NUM

Syntax: NUM — Returns the next consecutive number in unsigned format.

n NUM — Presets the number to *n* (0 to 4294967295). The next number returned will be *n*+1.

Note: The command may be used to number the iterations of RPT, etc. The number resets to 0 when the instrument is switched on.

Related: RPT

Example:
```
0 num            'clear number
rpt nxt num val  'log numbered readings
```

Reply:
```
1  2.4530E-04
2  2.4531E-04
3  2.4531E-04
...
```

Wait for Next Reading NXT

Syntax: NXT — Waits for system status bit 4 (Data available) to be asserted. The status flag is not changed.

Note: If used inside a loop (RPT), the status flag must be cleared between iterations by one of the commands VAL, PRS, DCR or 0 STS.

Related: DCR, VAL, STS

Example:
```
0 sts       'begin with new status
rpt nxt val 'log measured values
```

Reply:
```
 2.4530E-04
 2.4533E-04
 2.4531E-04
...
```

Zero Offset OFS

Syntax: OFS — Returns the zero offset [*unit*].

x OFS — Enter the zero offset in the selected unit:

x = 0 to 10^3 Pa
x = 0 to 10 mbar
x = 0 to 7.5 Torr
x = 0 to 10^{-3} s^{-1}

Values entered in mbar or Torr are internally stored in Pa. The stored value is not converted if the unit is changed to or from s^{-1}.

Related: UNT

Example:
```
ofs              'query offset

3 unt            'select Torr
2.321e-6 ofs     'enter zero offset 2.321E-6 Torr
```

Operating Hours OPH

Syntax: OPH — Returns the number of instrument operating hours.

Related:

Example:
```
oph          'check operating hours
```

Instrument Options OPT

Syntax: OPT — Returns the selected instrument options.

1 OPT — Sets option 1 (SI only). The unit is forced to Pa and the temperature scale is forced to K..

0 OPT — Resets options.

Note: With option 1 set, UNT does not accept values > 1 and TSC does not accept 1.

Related: DEF, UNT

Example:
```
opt          'check instrument options
1 opt        'force SI units
0 opt        'reset instrument options
```

Analog Output OUT

Syntax: OUT — Returns the analog output voltage [V].

x OUT — Sets the analog output voltage to *x* (0 to 11V). The override mode must be set or else the analog output will periodically be overwritten by the measured value (see OVR).

Related: AFS, ASP, OVR

Example:
```
out          'compare with the actual output voltage
1 ovr        'set override mode
10 out       'force output to full scale
```

Output Override OVR

Syntax: 1 OVR — Sets output override mode. Analog output and relay switches may be set directly by the OUT and RLY commands.

0 OVR — Resets output override mode. Analog output and relay switches are automatically set by the measurement results.

Related: OUT, RLY

Example:
```
1 ovr        'set override mode
10 out       'force output to full scale
```

Printout Data PDA

Syntax: PDA Returns the printout data option:

0 standard (time & measured value)

1 auxiliary channel 1 & measured value

2 auxiliary channel 2 & measured value

3 time & setpoint status & measured value

n PDA Selects printout data option *n* (0 to 3). If enabled by the printout header option (see also PHD), column titles as shown below will be included, the *tscal* and *unit* holders being filled in by the respective labels.

n	**Column titles**
0	`Time Press[unit]` or `Time DCR[1/s]`
1	`Aux1[V] Press[unit]` or `Aux1[tscal] Press[unit]` or `Aux1[unit] Press[unit]` or `Aux1[] Press[unit]`
2	`Aux2[V] Press[unit]` or `Aux2[tscal] Press[unit]` or `Aux2[unit] Press[unit]` or `Aux2[] Press[unit]`
3	`Time SP Press[unit]` or `Time SP DCR[1/s]`

Related: AM1, AM2, PHD, TSC, UNT

Example:
```
pda          'query printout data option
0 pda        'select standard printout
2 pda        'select logging of ain2
```

Page Eject PEJ

Syntax: PEJ Returns the automatic page eject option:

0 page eject disabled

1 page eject enabled

1 PEJ Enables automatic page eject after printing. Print jobs are terminated by sending a FF character (ASCII 12) to the parallel printer or a double CLRF sequence to the serial printer.

0 PEJ Disables automatic page eject. Print jobs are terminated by sending a double CRLF sequence.

Related: PRT

Example:
```
pej          'query page eject option
1 pej        'enable page eject
```

Printout Footer PFT

Syntax: PFT — Returns the printout footer option:

0	no footer
1	standard footer[1]
2	count statement only

n PFT — Selects the printout footer option *n* (0 to 2). The selected footer will be added to the printout when continuous printing stops having reached the maximum count or being terminated by operator action. The footer will be omitted for a count < 2.

Note 1: For count > 1, the standard footer shows count and mean value. For count > 2, the standard footer comprises count, mean value, maximum deviation, standard deviation and mean standard deviation of the printed readings.

Related: CNT, PHD

Example:
```
pft          'query footer option
0 pft        'no footer printed
```

Example:
```
1 pft        'standard footer
```

```
------------------------
Count                 13
Mean value    1.8989E-03
Max. dev.     5.3000E-07
Std. dev.     3.4000E-07
Mean std.     9.3000E-08
```

Example:
```
2 pft        'count statement only
```

```
------------------------
Count                 30
```

Printout Header PHD

Syntax: PHD Returns the printout header option:

0 no header

1 standard header

2 column titles only

n PHD Selects the printout header option *n* (0 to 2).

Note: The printout number resets when the header option is entered, when the system date is set (DAT command), and on start of the print function when date has changed since the last printout.

Related: PDA, PFT

Example:
```
phd          'query header option
0 phd        'no header printed
```

Example:
```
1 phd        'standard header
```

```
SRG-3 Vacuum Gauge 1.0.4
Setup 14 from 2008-10-10
Date 2008-10-13      #17
------------------------
Time        Press[Torr ]
------------------------
```

Example:
```
2 phd        'column titles only
```

```
Time        Press[Torr ]
------------------------
```

Printing Interval PIN

Syntax: PIN Returns the printing interval [min].

n PIN Enter the printing interval *n* (0 to 300 min).

Note: The printing interval also controls the maximum count mode: If set to ≤ 120 min, the CNT value determines the total number of readings to be printed. If set to > 120 min, the CNT value specifies a set of consecutive readings to be printed each time the printing interval expires (see also CNT). For example, setting CNT = 10 and PIN = 60 will result in a total of 10 readings being printed at one hour intervals, while setting PIN = 180 will result in 10 consecutive readings printed every 3 hours until stopped by operator action.

0 PIN Select printing of consecutive readings.

Related: CNT, PRT

Example:
```
pin          'query printing interval
0 pin        'print each value
30 pin       'print a value every 30 min
```

Printer Port PPT

Syntax: PPT — Returns the selected printer port:

0	off (printing disabled)
1	parallel printer port
2	serial port (RS-232)

n PPT — Selects the printer port *n* (0 to 2).

Related: PRT

Example:
```
ppt          'query printer port
2 ppt        'print to serial port
0 ppt        'disable printer output
```

Prompt Option PRO

Syntax: PRO — Returns the selected prompt option:

0	off (no prompt)
1	standard (‘>‘ and ‘?’)
2	user-assigned characters

1 PRO — Enables prompt feature using the standard prompt characters greater sign (>) for positive and question mark (?) for negative acknowledge.

c1 c2 PRO — Assigns ASCII code *c1* (1 to 255, $01 to $FF) to the positive and ASCII code *c2* (1 to 255, $01 to $FF) to the negative acknowledge character and sets prompt option 2 (User).

0 PRO — Disables the prompt feature.

Related:

Example:
```
pro          'query option
0 pro        'disable prompting
6 21 pro     'prompt with ACK and NAK codes
```

Pressure PRS

Syntax: PRS Returns the raw, ie non-offset, pressure value [*unit*] and clears system status bit 4 (Data available).

Note: To read the zero-adjusted pressure, the VAL command must be used.

Related: STS, CPT, VAL

Example:
```
rpt nxt prs 'log pressure
```

Print Control PRT

Syntax: PRT Returns the printer status:

0	printer idle
1	printing next reading
2	printing in continuous mode
3	printing setup listing
4	printing message log
5	printing system parameter listing
6	printing status snapshot
8	printing string

n PRT Controls printer function:

0	stop printing
1	print (next) reading
2	(start) continuous printing
3	print setup listing
4	print message log
5	print system parameter listing for diagnostic purpose
6	print status snapshot for diagnostic purpose
9	form feed: send a FF character to the parallel port, or a double CRLF sequence to the serial port, resp.

"*str*" PRT Sends *str* to the printer and adds a CRLF.

Note: In script mode, printer control is performed in foreground, so the PRT command does not terminate until the print job is finished. The statement 2 PRT (continuous printing), however, will always execute in background if CNT = 0 or PIN > 60 min.

Related: PPT

Example:
```
prt          'query printer status
4 prt        'get hardcopy of message log
2 prt        'start continuous printing
```

Power Control PWR

Syntax: PWR — Returns the power status:

- 0 power down (standby)
- 1 power on (operation)

0 PWR — Turns power off. The following actions will be performed:

- stop and dismount sensor
- switch off auxiliary power (+/-15V)
- switch off analog output and relays
- switch off gauge head power
- switch off display

The communication via RS-232 stays active.

1 PWR — Turns power on.

Related:

Example:
```
pwr          'query power status
0 pwr        'shut down instrument
```

Quote QUO

Syntax: QUO — Outputs a quotation mark (‘). May be used in conjunction with UNQ to enclose consecutive reply fields that are to be treated as a single string, e.g. when importing data into a spreadsheet.

Related: ECH, UNQ

Example:
```
quo ech Measure time [s]\ unq mti
```
Reply:
```
'Measure time [s]'  2.0000E+01
```

Remote Control Output RCO

Syntax: RCO — Returns the state of the remote control outputs.

n RCO — Sets the remote control status outputs to *n* (0 to 3):

Bit	Value	Relay
0	1	ERROR
1	2	MEASURE

Related:

Example:
```
rco          'query output status
1 rco        'activate ERROR
0 rco        'release ERROR
```

Rotor Control Status RCS

Syntax: RCS — Returns the rotor control status:

Bit	Value	Meaning
3..0	0	Disarmed (automatic sensor control off)
	1	No sensor detected
	2	Dismount sensor
	3	Idle (sensor at rest)
	4	Standby (sensor coasting)
	5	Starting...
	6	Measuring (READY relay on)
	7	Stopping...
	8	Shutdown...
4	16	Drive direction (0=accelerate, 1=decelerate)
5	32	Drive operating
6	64	Sensor unstable
7	128	Busy (background task executing)

Related: DMT, MNT, RST, SBY, STA, STP

Example:
```
rcs          'get sensor status

scr          'execute in foreground
mnt          'mount sensor
rcs          'check result
...
```

Remaining Time REM

Syntax: REM — Returns the remaining time [s] until the next reading. If not measuring, the selected measure time is returned.

Related: MTI

Example:
```
rem          'check the time to go
```
Reply:
```
 2.2734E+01
```

Relay Control RLY

Syntax: RLY — Returns the relay state.

n RLY — Sets the relays to *n* (0 to 7):

Bit	Value	Relay
0	1	SP1
1	2	SP2
2	4	READY

The override mode must be set or else the relays will periodically be driven according to the measurement status (see OVR).

Related: OUT, OVR

Example:
```
rly          'query relay state
1 ovr        'set override mode
4 rly        'activate READY
```

Repeat RPT

Syntax: RPT — Repeats execution of the succeeding commands infinitely.

n RPT — Repeats execution of the succeeding commands *n* times (2 to 10000).

Note: RPT refers to the commands following up to the end of line. RPT statements may be cascaded, only limited by the command buffer size of 128 characters.

Related:

Example:
```
rpt nxt val      'continuously log measured values
10 rpt nxt val   'get next 10 readings
```

Rotational Speed RSP

Syntax: RSP — Returns the rotational speed in Hz.

Note: During drive operation and below about 390 Hz the rotational speed is not measured but calculated.

Related: SGL

Example:
```
rsp sgl      'check speed and signal level
```

Restart Measurement RST

Syntax: RST — Restarts measurement and causes reacceleration if the sensor speed is not within -1% to +2% of the upper speed limit. If the sensor is dismounted or idle, STA is performed instead. RST runs in background.

Note: The RST command in conjunction with speed control mode 0 enables user-initiated sensor reacceleration. This may be useful in cases where sensor heat-up is of concern.

Related: SBY, SPC, STA, STP

Example:
```
rst          'restart measurement
```

Return to Local Control RTL

Syntax: RTL — Return to local control. The REMOTE LED turns off and the display shows menu 0.0.

Related: LLO

Example:
```
...          'perform commands
rtl          'return to local
```

Standby Mode SBY

Syntax: SBY — Turns off speed control, leaving the sensor coasting (Standby). If the sensor is dismounted, MNT is performed instead.

Related: MNT, RST

Example:
```
sta              'start measurement
10 rpt nxt val   'get 10 readings
sby              'remain in standby mode
```

Script Mode SCR

Syntax: SCR — Enters script mode (see section 3.3.2) and enables talkative messages.

Note: When using the SCR statement in a script, make sure that also a CMD statement is included (at or near the end of the script) to allow command execution to be resumed in case of error.

Related: CMD

Example:
```
scr                    'enter script mode
0 msg                  'silent messages
2 use                  'recall setup #2
ech Date \ dat                    'show date
ech Setup #\ use ech from \ sdt   'show setup used
sta                    'start measurement
30 rpt nxt tim val     'log 30 readings
stp                    'stop rotor
cmd                    'exit script mode, resume cmd execution
ech Message: \ msg     'show possible message
```

Setup Date SDT

Syntax: SDT — Returns date and time of the last change of the active settings, formatted *yyyy-mm-dd hh:mm*. Each setup file has its own timestamp.

Related: ECH, QUO, UNQ, USE

Example:
```
quo ech Setup #\ use ech from \ sdt unq
```
Reply:
```
'Setup #1 from 2008-10-11 15:28 '
```

Signal Level SGL

Syntax: SGL — Returns the sensor signal level [dB]. The value corresponds to the level which can be measured at the SCOPE output.

Note: The signal input is muted during drive operation and when the sensor is idle or not mounted.

Related: RSP

Example:
```
rsp sgl     'check speed and signal level
```

Setup Lock SLK

Syntax: SLK — Returns the state of the setup lock.

1 SLK — Locks the setup menus (menu 7.0 to 13.2) by disabling the ENTER key, preventing inadvertent access to the instrument settings.

0 SLK — Unlocks the setup menus (menu 7.0 to 13.2).

Note: The state of the setup lock may also be changed manually by selecting menu 6.0 and pressing the ON key to lock and the OFF to unlock.

Related:

Example:

```
slk          'query state of lock

...          'set up the instrument
1 slk        'inhibit accidental manipulation
rtl          'return to local control
```

Speed Control SPC

Syntax: SPC — Returns the speed control mode.

n SPC — Selects the speed control mode *n*:

0 off [1]

1 automatic with *fixed speed limits* (measure time will be reduced to meet the specified speed limits at higher pressure)

2 automatic with *fixed measure time* (speed limits will be extended to meet the specified measure time at higher pressure)

Note 1: Disabling the speed control causes the rotor to enter standby mode when the rotational speed drops below the lower speed limit.

Related: AUT, LSP, MTI, USP

Example:

```
spc          'query speed control mode
1 spc        'select fixed speed limits
```

SP1 Trip Point SP1

Syntax: SP1 Returns the trip point [*unit*] of SP1.

x SP1 Enter the trip point of SP1 in the selected unit:

$x = 10^{-5}$ to 10^{3} Pa
$x = 10^{-7}$ to 10 mbar
$x = 7.5 \cdot 10^{-8}$ to 7.5 Torr
$x = 10^{-8}$ to 0.1 s^{-1}

Values entered in mbar or Torr are internally stored in Pa. The stored value is not converted if the unit is changed to or from s^{-1}. A zero value forces SP1 on.

Related: HS1

Example:
```
sp1          'query SP1 trip point

3 unt        'select Torr
1.e-3 sp1    'change SP1 trip point to 1.E-3 Torr
```

SP2 Trip Point SP2

Syntax: SP2 Returns the trip point [*unit*] of SP2.

x SP2 Enter the trip point of SP2 in the selected unit:

$x = 10^{-5}$ to 10^{3} Pa
$x = 10^{-7}$ to 10 mbar
$x = 7.5 \cdot 10^{-8}$ to 7.5 Torr
$x = 10^{-8}$ to 0.1 s^{-1}

Values entered in mbar or Torr are internally stored in Pa. The stored value is not converted if the unit is changed to or from s^{-1}. A zero value forces SP2 on.

Related: HS2

Example:
```
sp2          'query SP2 trip point

3 unt        'select Torr
1.e-3 sp2    'change SP2 trip point to 1.E-3 Torr
```

Start Measurement STA

Syntax: STA Starts measurement. If necessary, the sensor is mounted and driven to its operational speed (USP). STA runs in background.

Related: SBY, STP, RST, USP

Example:
```
sta          'start measurement
rpt nxt val 'log measured values
```

Store Setup STO

Syntax: *n* STO — Stores the currently active settings as setup file #*n* (1 to 15) .

Related: USE

Example:
```
11 sto      'store as setup file #11
```

Stop Rotor STP

Syntax: STP — Halts measurement and stops the sensor. The sensor remains mounted (Idle). STP runs in background.

Related: DMT, STA

Example:
```
scr         'execute in foreground
...
stp dmt     'stop rotor and dismount
...
cmd         'exit foreground
```

System Status STS

Syntax: STS — Returns the system status and clears status bit 7.

Bit	Value	Meaning
0	1	SP1 activated
1	2	SP2 activated
2	4	RDY activated
3	8	Printer not ready
4*	16	Data available
5*	32	Message pending
6	64	Backup failed/Setup defaulted[1]
7*	128	Power failure

0 STS — Clears system status bits 4, 5 and 7.

Note 1: Status bit 6 is set during power-up when the internal clock/calendar has lost information due to low backup battery. The bit is also set by command 1 DEF (restore defaults). The bit is reset by executing 0 DEF.or by modifying the setup.

Related: DCR, MSG, NXT, VAL

Example:
```
sts         'get status

0 sts       'begin with new status
rpt nxt val 'log readings
```

Temperature Coefficient TCO

Syntax: TCO — Returns the temperature coefficient of the viscosity [μPa•s•K^{-1}].

x TCO — Enter the temperature coefficient x (0 to 0.1 μPa•s•K^{-1}) and reset the gas type to 0 (`User`).

Note: The TCO value is used to calculate the actual gas viscosity η for the gas temperature TMP [K] according to: η = VIS + TCO • (TMP - 293.15 K). If set to zero, the stored viscosity value must relate to the actual gas temperature.

Related: AMU, GAS, TMP, USR, VIS

Example:
```
tco          'query tempco of viscosity
0.0465 tco   'change tempco to 4.65E-2 uPa s 1/K
```

Time TIM

Syntax: TIM — Returns a string with the time of day formatted *hh*:*mm*:*ss*.

h m s TIM — Sets the time to *h* hours (0 to 23), *m* minutes (0 to 59) and *s* seconds (0 to 59).

Related: DAT, SDT

Example:
```
ech Time \ tim
```
Reply:
```
Time 08:45:53
```

Example:
```
12 13 0 tim      'set time to 12:13:00
```

Temperature Scale Label TLB

Syntax: TLB — Returns a string identifying the selected temperature scale.

Related: ECH, QUO, TSC, UNQ

Example:
```
ech T_amb[\ tlb ech ]
```
Reply:
```
T_amb[°C ]
```

Example:
```
tmp tlb
```
Reply:
```
 2.9835E+02 K
```

Temperature TMP

Syntax: TMP — Returns the actual[1] gas temperature [*tscal*].

x TMP — Enter the gas temperature *x* in the selected temperature scale (10 to 2000 K or -263.15 to 1726.85 °C). Values entered in °C are internally converted to K.

Note 1: If auxiliary channel 1 is configured for temperature (AM1 = 1), it will supply the actual temperature and override the stored value. TMP then returns the measured value.

Related: AM1, TCO, TSC, VIS

Example:

```
tmp          'query gas temperature
1 tsc        'select °C scale
24.7 tmp     'change gas temperature to 24.7 °C
```

Temperature Scale TSC

Syntax: TSC — Returns the selected temperature scale.

0 TSC — Selects absolute temperature (K).

1 TSC — Selects degrees (°C).

Note: The TSC setting controls the interpretation of the TMP value and the display format of the auxiliary channels if set up for temperature.

Related: AM1, AM2, TLB, TMP

Example:

```
tsc          'query temperature scale
1 tsc        'select °C
```

Test Mode TST

Syntax: TST Returns the test status:

0 normal mode

1 test mode

2 TST Stops measurement and computes a statistics of the sensor signal, comprising mean value, standard as well as relative deviation of the measured periods and the signal scatter SSC, ie the uncertainty of the measured periods in µs. Note that a subsequent 0 TST is required to exit this mode and resume normal operation!

1 TST Enters test mode. In test mode, no gauge head is required and no sensor control takes place. The PICKUP signal is assumed to be supplied by an external source, eg a synthesizer. The supplied signal must exceed the minimum level of -10dB ($0.316V_{rms}$). Measurement starts as soon as the signal frequency exceeds the selected USP value. Measurement is suspended when the lower limit LSP is reached and is resumed when the frequency exceeds the USP value again.

0 TST Exits test mode. If the sensor is spinning, it is placed in Standby mode, if the sensor is mounted but not spinning, it stays Idle.

Related:

Example:
```
tsc          'query test mode
1 tst        'enter test mode
```

Example:
```
2 tst        'get signal statistics
```
Reply:
```
Collecting data...
Computing statistics...
Count    = 8000
Mean val = 68063.12
Std dev  = 75.11
Rel dev  = 0.0011
SSC [us] = 1.252
```

Unit Label ULB

Syntax: ULB Returns a string identifying the selected measurement unit.

Related: ECH, QUO, UNQ, UNT

Example:
```
ech Pressure[\ ulb ech ]
```
Reply:
```
Pressure[Pa ]
```

Example:
```
val ulb
```
Reply:
```
3.706E-04 mbar
```

Unquote UNQ

Syntax: UNQ — Outputs a quotation mark (‘) followed by a space character as a field separator. May be used in conjunction with QUO to enclose consecutive reply fields that are to be treated as a single string, e.g. when importing data into a spreadsheet.

Related: ECH, QUO

Example:
```
quo ech Sampling interval[s]\ unq sin
```
Reply:
```
'Sampling interval[s]'  2.0000E+01
```

Measurement Unit UNT

Syntax: UNT — Returns the current measurement unit:

0 s^{-1} (DCR) [1]

1 Pa

2 mbar [2]

3 Torr [2]

n UNT — Selects the measurement unit *n* (0 to 3) [2]

Note 1: If unit 0 (DCR) is selected, pressure calculation is not performed, so gas parameters are not used and need not be defined. The analog output and the setpoints then relate to the DCR reading.

Note 2: If option 1 is selected (SI units only), unit settings 2 (mbar) and 3 (Torr) are not available. See also command OPT.

Related: AFS, OPT, PRS, SP1, SP2, VAL

Example:
```
unt          'query unit
2 unt        'select mbar
```

Use Setup USE

Syntax: USE — Returns the number of the setup file currently used. If the parameters have been modified, 0 is returned.

n USE — Use setup file #*n* (1 to 16). Note that setup file #0 contains the active settings and thus cannot be recalled. The number automatically resets to 0 when settings are modified. Files #1 to #15 are assigned to user storage, while setup file #16 is read-only and contains the default settings.

Related: STO

Example:
```
use          'query setup number
7 use        'use setup #7
```

Upper Speed Limit USP

Syntax: USP Returns the actual[1] upper speed limit in Hz.

x USP Enter the upper speed limit *x* (410 to 810 Hz). The lower speed limit is adjusted to retain the speed window size.

Note 1: When operating in speed control mode 2, the actual speed limits may be dynamically extended to meet the specified sampling interval.

Related: LSP, MTI, SPC

Example:
```
usp          'query upper speed limit
450 usp      'shift speed window to 450 Hz upper limit
```

User Gas Type USR

Syntax: USR Lists the user-definable gas types Usr1 to Usr8. Each record comprises label, molecular mass, viscosity and tempco setting.

n USR Saves the active gas parameters as gas type Usr*n* (1 to 8).

0 USR Resets user-definable gas types Usr1 to Usr8 to the default values (N2). The active gas parameters will not be affected if one of the user-definable gas types is currently selected. On instrument reset, however, the parameters will be restored from the defaulted table.

Related: AMU, DEF, GAS, TCO, VIS

Example:
```
44.01 amu    'enter molecular mass [u]
18.2 vis     'enter viscoity at 20°C [uPa s]
0.0465 tco   'enter tempco of viscosity [uPa s 1/K]
1 usr        'save as Usr1
```

Example:
```
usr          'query user defintions
```
Reply:
```
Usr1  4.4010E+01  1.8200E+01  4.6500E-02
Usr2  2.8016E+01  1.7630E+01  4.6040E-02
Usr3  2.8016E+01  1.7630E+01  4.6040E-02
Usr4  2.8016E+01  1.7630E+01  4.6040E-02
Usr5  2.8016E+01  1.7630E+01  4.6040E-02
Usr6  2.8016E+01  1.7630E+01  4.6040E-02
Usr7  2.8016E+01  1.7630E+01  4.6040E-02
Usr8  2.8016E+01  1.7630E+01  4.6040E-02
```

Example:
```
0 usr        'reset user definitions
```

Measured Value VAL

Syntax: VAL — Returns the measured value [*unit*] and clears system status bit 4 (Data available). The measured value *V* is calculated as:

UNT=0: *V* = DCR - OFS

UNT>0: *V* = PRS - OFS

Related: BGA, DCR, PRS, STS, UNT

Example:
```
rpt nxt tim val  'log measured values
```
Reply:
```
18:24:35  2.4530E-04
18:24:55  2.4556E-04
18:25:16  2.4574E-04
...
```

Viscosity VIS

Syntax: VIS — Returns the viscosity [μPa•s].

x VIS — Enter the viscosity *x* (0 to 100 μPa•s) at 20°C gas temperature and reset the gas type to 0 (`User`).

Note: The viscosity is used for compensation of DCR saturation at higher pressure. A zero value will disable pressure linearization. When the tempco is set to zero, the viscosity value entered must relate to the actual gas temperature. The actual viscosity η entering the computation is calculated as: $\eta = VIS + TCO \bullet (TMP - 293.15\ K)$

Related: AMU, GAS, TCO, TMP, USR

Example:
```
vis         'query viscosity
18.2 vis    'change viscosity to 18.2 uPa s
```

Zero Adjust ZAD

Syntax: ZAD — Returns the offset value [*unit*] to be used for zero adjustment (see BGA).

1 ZAD — Zero adjust. Set offset according to background average option (see BGA, OFS).

0 ZAD — Undo the adjustment (reset the offset to zero).

Related: BGA, OFS

Example:
```
nxt zad     'read the next average value
1 zad       'use it
```

7 MESSAGES

7.1 SCRIPT ERRORS

In response to an invalid command, one of the messages below may be issued. In talkative mode, messages are transmitted immediately, in silent mode, messages are buffered and may be read with the MSG command. If menu 0.0 is selected, the flashing error number will be displayed until the message is cleared by pressing the ESC key or by receiving an appropriate command, eg MSG. If the prompt option is enabled, the negative acknowledge character (?) will be sent to prompt for the next command.

`Err 90: Power down`

The command ARM, DIS, DMP, DMT, HDA, KEY, MNT, NXT, OUT, OVR, RLY, RST, SBY, SGL, STA, STP or ZAD failed because the instrument is powered down.

`Err 91: Syntax error`

The processed token does not comply with the syntax of numbers, strings, command identifiers or comments.

`Err 92: Unknown command`

The specified command is not implemented or not available in user mode.

`Err 93: Illegal argument type`

A string argument is encountered where a number is expected or vice versa, or a real number is encountered where an integer argument is required.

`Err 94: Missing argument(s)`

Too few arguments are supplied or the desired phrase is not supported.

`Err 95: Unexpected argument(s)`

Too many arguments are supplied or the desired phrase is not supported.

`Err 96: Argument out of range`

The numeric value exceeds the range limits or denotes an unimplemented option or an undefined user gas type.

`Err 97: Not measuring`

The command NXT, 1 PRT or 2 PRT failed because the instrument is neither ready nor in start-up phase. Possible causes are:

1. Measurement has not yet been started or has been aborted due to an error.
2. The instrument entered standby mode because the rotor speed passed the lower speed limit with speed control mode 0 selected.

`Err 98: Printer not available`

The command *n* PRT or "*str*" PRT failed. Possible causes are:

1. The printer is disabled (printer port set to 0).
2. The printer is still busy with a previous print job.

`Err 99: Operation not allowed`

The desired operation could not be performed. Possible causes are:

1. The sensor is mounted when command HDA is executed.
2. The sensor is spinning when command 1 TST is executed.
3. The sensor speed has fallen below 390Hz when command 2 TST is executed.

7.2 RUN-TIME ERRORS

In case of operation abort due to run-time error, one of the messages below may be issued. In talkative mode, messages are transmitted immediately, in silent mode, messages are buffered and may be read with the MSG command. If menu 0.0 is selected, the flashing error number will be displayed until the message is cleared by pressing the ESC key or by receiving an appropriate command, eg MSG.

`Err 07: MLC not recognized`

The levitation controller (MLC) could not be recognized during power-up. A hardware problem is likely. Contact service for assistance.

`Err 13: Motor current failure`

The motor output is not capable of providing the required drive current. Possible causes are:

1. The MOTOR plug is not in place. Make sure that the gauge head is connected properly and try again.
2. The motor circuit is not tuned to its resonant frequency. Dismount the gauge head (see command DMT) and start the tuning procedure (see command HDA), then reinstall the head and try again.

`Err 14: Adjusting head failed`

The adjustment procedure has been started with the sensor fitted. Dismount the gauge head/remove the sensor and try again.

`Err 15: Tuning motor failed`

The tuning procedure terminated unsuccessfully. Possible causes are:

1. The MOTOR plug is not in place. Make sure that the gauge head is connected properly and try again.
2. The resonant frequency of the motor circuit could not be found within the predefined range. Make sure that both gauge head and unit have assumed room temperature and try again. If the error persists, a hardware problem is likely. In this case, contact service for assistance.

`Err 21: No rotor detected`

No sensor was detected. Make sure that the sensor is fitted and the gauge head is mounted properly, then try again.

`Err 22: Mounting rotor failed`

The instrument is unable to levitate the sensor. Possible causes are:

1. The suspension circuit of the gauge head shows significant zero error. Dismount the gauge head and perform a zero adjustment (see command HDA), then reinstall the head and try again.
2. The sensor is of a non-supported size or type or the gauge head is mounted in a way as to prevent the sensor from reaching its levitated position. Make sure that you are using the correct type of sensor and that the gauge head is mounted properly.

`Err 23: Rotor touched down`

A persistent overload caused a safety shutdown of the levitation controller while the rotor was spinning. Possible causes are:

1. A DMT command was sent before the sensor had been stopped (RCS > 3). Mind to stop the sensor before issuing the DMT command (see commands RCS and STP).
2. The gauge head was dismounted before the sensor had been stopped (RCS > 3). Mind to stop the sensor before dismounting the head (see commands RCS and STP).
3. The gauge head was bumped or exposed to vibration causing levitation control excitation. Mount the gauge head in a way as to avoid mechanical disturbance.

`Err 31: Drive test failed`

The sensor speed did not increase during acceleration test. The sensor signal is most likely interfered by stray signals or by vibration picked up by the gauge head. Such interference may originate from vacuum pumps operating in close vicinity.

Monitor the sensor signal at the SCOPE output with a spectrum analyzer or an oscilloscope to identify the problem. Make sure that the signal path is free from interference. If this is not possible, try shifting the speed window (see commands USP and LSP).

`Err 32: Brake test failed`

The sensor speed did not decrease during deceleration test. See Err 31.

`Err 33: Controlling speed failed`

The sensor could not reach its initial speed with the allowed number of tries. This may occur if the sensor signal is interfered or too noisy to obtain a useful speed indication.

Monitor the sensor signal at the SCOPE output with a spectrum analyzer or an oscilloscope to identify the problem. Make sure that the signal path is free from interference. In case of a weak signal, dismount the gauge head, magnetize the sensor, then reinstall the head and try again.

`Err 34: Bad signal level`

The sensor signal did not gain the minimum level (-10dB) required for measurement. Possible causes are:

1. The PICKUP plug is not in place. Make sure that the gauge head is connected properly and try again.
2. The remanent magnetization of the sensor is too small to produce a sufficient signal. Dismount the gauge head, magnetize the sensor, then reinstall the head and try again.
3. The sensor may experience excessive friction due to (a) high pressure, (b) touching the tube wall (excentric suspension) or (c) electrostatic fields (if the sensor is contained in a glass tube). Make sure the gauge head is mounted properly, the pressure is in the specified range, and, if a glass tube is used, take measures to prevent electrostatic charging.

`Err 35: Speed window too small`

The measurement could not be completed within the speed limits. The window is too small to attain a reading at the current pressure. Either increase the window by adjusting the speed limits (see commands USP and LSP) or change to automatic mode 2 (see command SPC), then try again.

`Err 36: Spurious signal`

The measured signal is not the sensor signal. Possible causes are:

1. The measured sensor speed seems to increase due to interfering signals picked up by the gauge head.
2. An internal overflow occurred due to interfering signals picked up by the gauge head.
3. The measured sensor acceleration is out of range, so the speed control is very likely locked to a harmonic of the sensor signal.

Monitor the sensor signal at the SCOPE output with a spectrum analyzer or an oscilloscope to identify the problem. Make sure the signal path is free from interference and try again.

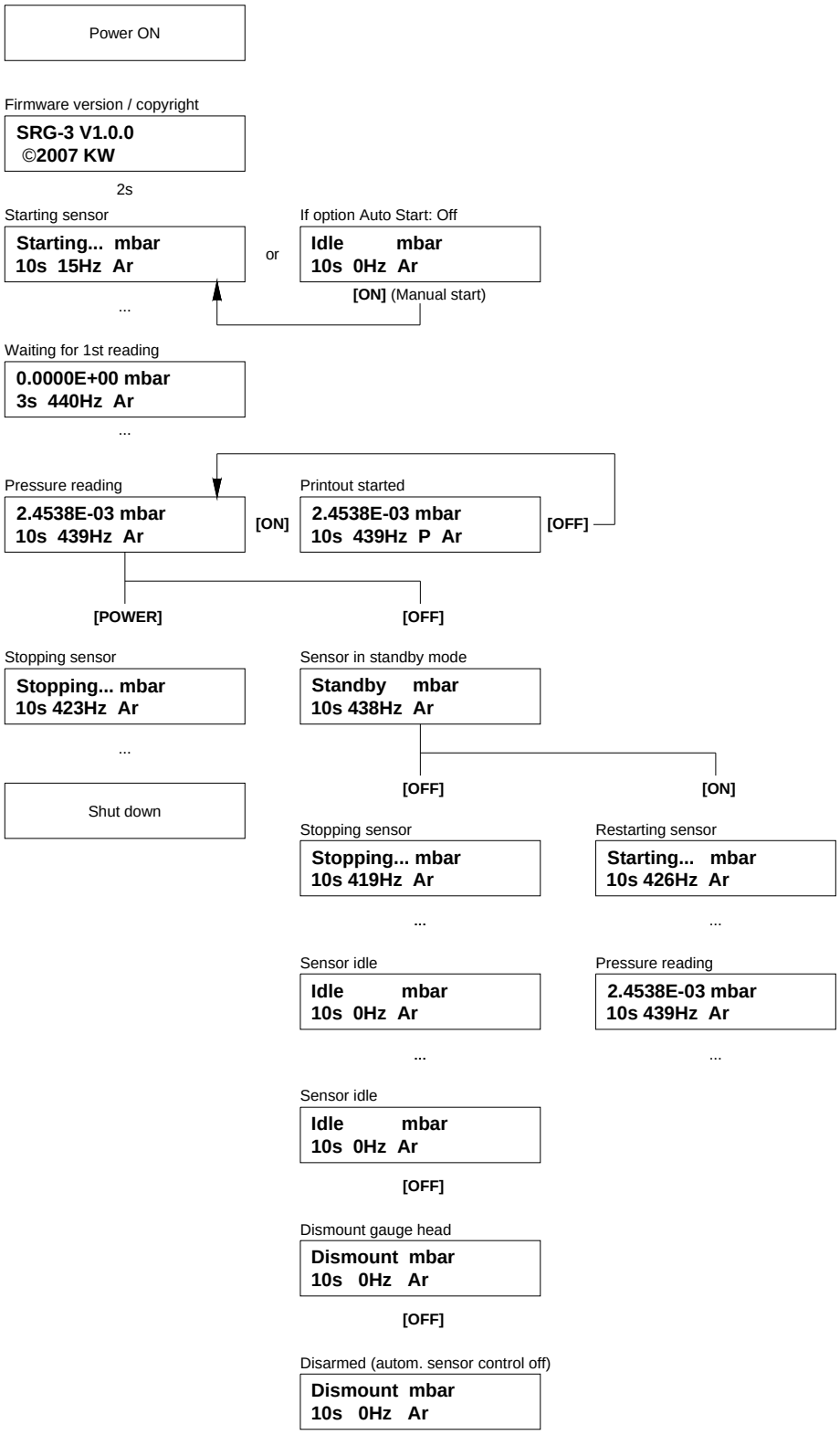
`Err 61: Printer data overrun`

Data overrun occurred in continuous print mode because the printer is not ready to accept data (see also STS). The print job has been aborted. Possible causes are:

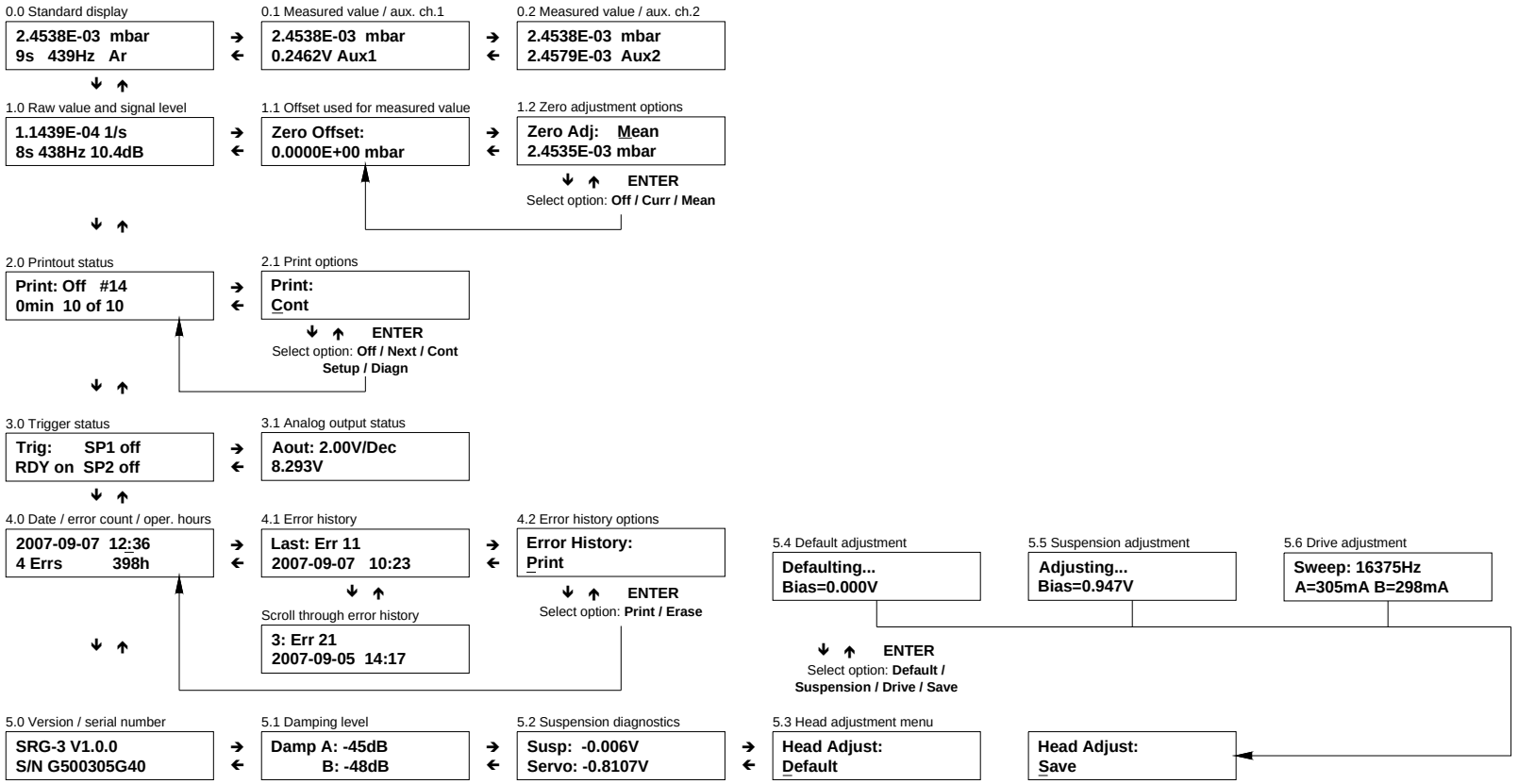
1. The printer is stopped by paper out or another error. Make sure that the printer is ready and has sufficient paper, then try again.
2. The printer is not online. Make sure the printer is online and ready, then try again.
3. The printer may have received a spurious command during hot plugging. Reset the printer by cycling the power switch, then try again.
4. The printer cable is not connected properly. Check the connection, then try again.

8 APPENDIX

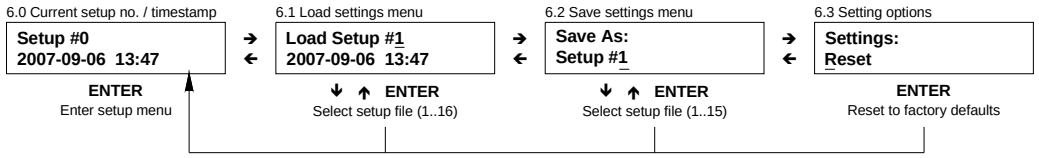
8.1 CONTROL DISPLAYS



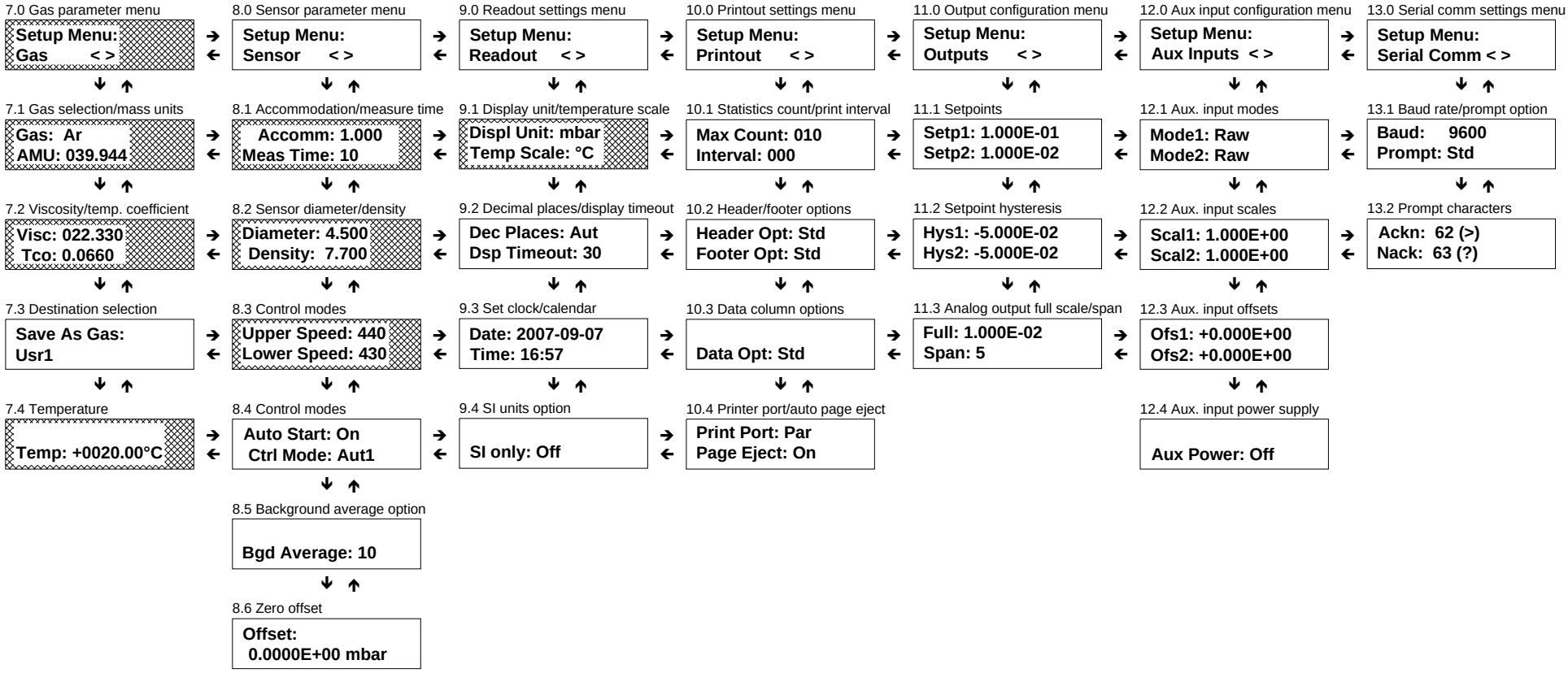
8.2 MEASUREMENT MODES



8.3 DATA SETS



8.4 SETUP



Only the shade marked fields have an influence to the measurement result.