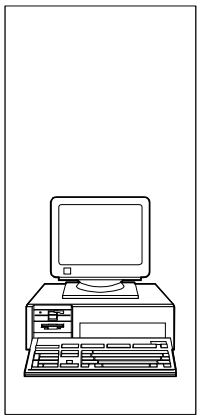
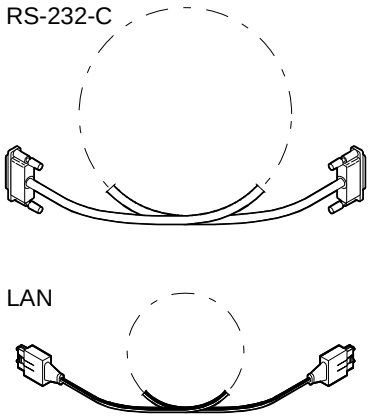
balzers
Instruments

Quadrupole mass spectrometer system

QMG 422





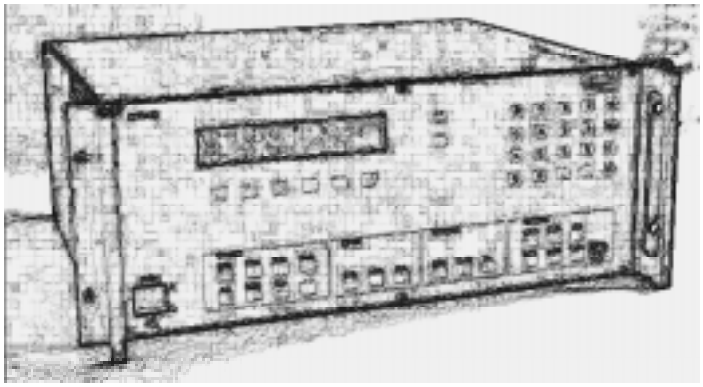


Table of contents

1 Important information

1.1 Explanation of symbols

WARNING

Information on preventing extensive equipment and environmental damage.

Note

Information on correct handling or use. Disregard can lead to malfunctions or minor equipment damage.

400 This symbol is used for information that applies only to the 400 series.

125 This symbol is used for information that applies only to the 125 series.

1.2 Validity

This document applies to QMG 422 systems with QMS 422 quadrupole control unit and QMI 422 controllers.

It is based on the following firmware numbers:

DSP / PRG-NR	BG 509 732 -..
QMS / PRG-NR	BG 509 733 -..
CS 422 / PRG-NR	BG 509 734 -..

The firmware number can be found with *config* TEST or read out with the Balzers Quadstar™ 422 software. The letter (A...Z) at the end of the firmware number is the modification index indicating the status of the software. This document is valid for higher indexes, too, although some additional features of the software may not be described herein.

We reserve the right to make technical changes without prior notice.

1.3 Bibliography

[1] Operating manual Quadrupole mass spectrometer QMG 422
BG 800 451 BE

[2] Operating manual Network controller board OPA 200
SH-ARC BAL

Available at:
Balzers Instruments, FL 9496 Balzers, Fürstentum Liechtenstein

2 Description

2.1 RS-232-C interface

- Standard serial interface according to the RS 232 C standard. Allows various data transmission rates.

RS-232-C ASCII format

- Serial communication interface with ASCII-coded data format and simple communication protocol.

This interface format is very easy to use and is thus often used in combination with BASIC programs.

RS-232-C binary format

- Serial communication interface with binary-coded data format and communica - tion protocol according to 'SECS-1' with higher transmission reliability.

This interface format is used for communication between the control unit and the QUADSTAR 422™ software. However, it can also be used for other purposes.

2.2 LAN interface

- Network-compatible serial interface for high transmission rates and long dis - tances.

This is a fiber optics interface for an 'ARCNET® Local Area Network'. The optical transmission technology used for this interface keeps interference to a minimum.

3 Installation

Installation is described in the operating manual QMG 422 [1].

4 Technical data

Refer to the operating instructions for the QMG 422 [1] for technical data of the interface.

5 RS-232-C interface (ASCII)

5.1 Data transmission

The data transmission is bi-directional i.e. data and control commands can be transmitted in either direction.

5.1.1 Definitions

The following abbreviations are used:

Abbreviations and symbols

Symbols	Definition			
Computer	Computer or terminal			
QC 422	Quadrupole Controller QC 422			
[...]	Optional elements			
ASCII	American Standard Code for Information Interchange			
			Decimal	Hex
<ETX>	END OF TEXT	Reset the interface	3	03
<CR>	CARRIAGE RETURN	Go to the beginning of the line	13	0D
<LF>	LINE FEED	Advance by one line	10	0A
<SP>	SPACE	Leave a space	32	20
<NUL>	NULL	Pertains to a negligible value or a lack of information	0	00
<ENQ>	ENQUIRY	Request for data transmission	5	05
<ACK>	ACKNOWLEDGE	Positive report signal	6	06
<NAK>	NEGATIVE ACKNOWLEDGE	Negative report signal	21	15

Terms

"Transmit": Data transfer from the computer to the Quadrupole Controller
"Receive": Data transfer from the Quadrupole Controller to the computer

Types of data

"Programming data"
such as the parameter data commands transmitted from a computer to a Quadrupole Controller.

"Measured data"
such as signals resulting from measurements which are transmitted to the computer for processing.

"Status data"
information on the momentary operational status of the Quadrupole Controller output as the result of a specific enquiry.

Data formats

Mnemonics
An abbreviation consisting of three letters or two letters and a numeral. Capital or lower case letters (alpha characters) can be used.

Numeric
The whole number contains the numeric information. There are three ways to express the decimal part of the number:

Presentation with whole numbers
Corresponds to a style in which the decimal point at the end of a number is accepted, but not transmitted
(1, 2, 3, ... 10, ... 20 etc.).

Floating point decimal
Its position depends on its place value in any particular in stance. The decimal point should always be preceded by a numeral, even when this is a zero (0.1, ... 1.345, ... 1.0 etc.).

Exponential presentation
with fixed point part and fixed decimal point, the letter E and a two place exponent with sign digit (1.234E-12, etc.).

High order zeros
do not need to be entered. Reports never include them.

Sign digit
The '+' is not written for positive numbers.

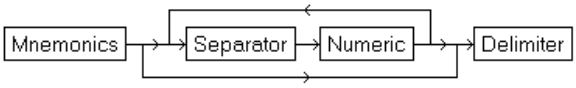
Separator
: The smallest unit is the character string. It is separated from the next block of data by a comma.

Delimiter
: The coding for a legal final character is the ISO 7-bit code <CR> (carriage return). When a final character comes through, the Quadrupole Controller (the transmitter) goes from an active transmission state to an idle state.

5.1.2 Syntax

Arrows located between fields that point to the right indicate the sequence in which the transmission must be made. Arrows pointing to the left are feedback loops in - dicating the possibility of one or more repetitions of the field. Arrows pointing to the right that surround fields indicate that this field can be included as an option.

Record (data block)



5.1.3 Communication protocol (data link)

Transmission format

The data transmission procedure is character-oriented, meaning that the message is transmitted to the control unit as programming data in ASCII strings. Each mes - sage is terminated with <CR> (end of message). <LF> may be transmitted, but it is ignored by the control unit. All other incoming characters are filed in an input buffer. The string is not evaluated until the 'end of message' signal comes through. The computer must wait for the feedback message (<ACK><CR> or <NAK><CR>) before transmitting another string.

Transmission protocol

Computer	Quadrupole Controller	Explanation
Programming data <CR> [<LF>]	→	Receives message with end character
	← <ACK> <CR> <LF>	Positive confirmation of message receipt

Receive format

The output of measured data, status data or parameters must first be initialized with the appropriate programming data (mnemonics). Afterwards, i.e. after the <ACK><CR><LF> message is received, the measured data, status data or the parameters can be called with <ENQ>. A repeated transmission of <ENQ> calls further ASCII strings. <CR> can be entered after <ENQ>, but it is not necessary. <ENQ> always affects the last initialization. The transmission of data does not need to be confirmed by the computer. The computer's input buffer must have a minimum capacity of 256 characters.

Receive protocol

Computer	Quadrupole Controller	Explanation
<ENQ> [<CR> [<LF>]]	→	Request for data transmission
	← measured data, status data or parameters	Data transmitted
	← <CR> <LF>	with end character
:		
<ENQ> [<CR> [<LF>]]	→	Request for data transmission
	← measured data, status data or parameters	Data transmitted
	← <CR> <LF>	with end character
:		

Error control

All strings are checked. If an error is detected, all the characters up to the next <CR> are ignored, and the negative confirmation <NAK> is output. The appropriate flag is set in the error word. Errors can be decoded when the error word in read.

Error recognition protocol

Computer	Quadrupole Controller	Explanation
Programming data ⟶		Receives message with end character
<CR> [<LF>] ⟶		
	****** Transmission or ******	
	***** programming error *****	
⟵	<NAK> <CR> <LF>	Negative confirmation of a message
Programming data ⟶		Receives string with end character
<CR> [<LF>] ⟶		
⟵	<ACK> <CR> <LF>	Positive confirmation of a message

5.1.4 Influencing the measurement by changing a parameter

WARNING

If, as it is entered, a parameter change affects an active measurement cycle, the measured data ring buffer is cleared and the cycle is repeated.

In the same way changes to an *operation* parameter cause the measurement to be repeated.

5.2 Manual / computer operation

only with the CS 422 control unit:

The switchover — from the console or via the interface — from manual to computer operation can be made manually or via the computer. All entry possibilities have equal status i.e. the input control can switch operation to itself, thereby disabling other controls. Any attempt by the computer to address the QMS 421 in «CTRL» «MODE» «CS421» using mnemonics other than CMO,x is acknowledged with <NAK><CR>. This guarantees that the computer always receives an answer.

Note

In the appendix there are two program examples for measurements over the RS-232-C interface in ASCII format.

5.3 Mnemonics

5.3.1 *channels* group

Function	Parameter	Mnemonics	Page	Meaning
select	Measure-Ch	**SMC**	11	Selected measurement channel
	Parameter-Ch	**SPC**	11	Selected parameter channel
detect	TYPE	**DTY**	11	Signal source selection
	SEM	**DSE**	11	SEM high voltage for a channel
	AI-CH / PI-CH	**DAI**	11	Analog input or Pirani channel number
	PE-CTRL	**DPC**	11	Enable / disable the cold cathode measurement circuit
mass	MODE	**MMO**	12	Spectrum scan operation
	FIRST / MASS	**MFM**	12	First mass for a scan / mass number
	WIDTH	**MWI**	12	Width of a scan
	SPEED / DWELL	**MSD**	12	Measurement speed / measurement time
	RESOL	**MRE**	12	Resolution
	THRESH	**MTH**	13	Peak processor threshold
	AVERAGE	**MAV**	13	Number of values used for averaging
	Steps	**MST**	13	Measurement channel resolution (points per mass)
amplif	MODE	**AMO**	14	Measurement range switching mode
	RANGE	**ARA**	14	Electrometer range, display range
	RANGE-L	**ARL**	14	Narrowest measurement range for Auto Down
	GAIN	**AGA**	14	Post amplification factor
	FILTER	**AFI**	14	Analog filter setting
	OFFSET	**AOF**	15	Offset correction for the electrometer
	CALIB	**ACA**	15	Calibration factor for the measured value
	P-CAL	**APC**	15	"Break" factor for changing the measurement channel in multichannel operation
	CP-LEV	**ACL**	15	Response threshold for the ion counter preamplifier
	P-Time	**APT**	15	"Break" time for measurement channel switchover
aux	STATE	**AST**	15	Enable measurement channel
	COPY TO CH	**ACO**	15	Copy the parameter set to channel xx
output	AO-CH	**OAC**	16	Analog output channel number
	AO-MODE	**OMO**	16	Analog output mode
	MONITOR	**OAM**	16	Analog output monitor
	LOG-DEC	**ODC**	16	Logarithmic presentation at analog output
trip	TYPE	**TTY**	16	Type of switching function
	LEVEL-A	**TLA**	16	Switching function A / lower threshold for switching funct.
	LEVEL-B	**TLB**	16	Switching function B / upper threshold for switching funct.
	DO-A	**TDA**	16	Digital output bit number for switching function A
	DO-B	**TDB**	17	Digital output bit number for switching function B

5.3.2 *general* group

Function	Parameter	Mnemonics	Page	Meaning
di/do	DIG-IN	**DIS**	17	Digital input status
	DIG-OUT	**DOC**	17	Digital output control
config SYSTEM	QMA	**SQA**	17	Type of analyzer
	MASS-R	**SMR**	17	Type of mass range
	DETECT	**SDT**	17	Type of ion detector
	IS-TYP	**SIT**	18	Type of ion source
	OPTION	**SOP**	18	System expansion information
config QMS-HW	QMS-HW	**QHW**	18	Pc boards in the QMS 422
config INIT	RESET	**IRE**	19	Parameter set (standard / user)
config CTRL	MODE	**CMO**	19	Select type of input
	BAUD	**CBR**	19	Transmission speed for the RS 232 C interface
	NODE	**CNA**	19	Node address for the LAN interface
	SEM+FIL	**CSF**	19	SEM and filament supply
config SIMUL	SIMUL	**TSI**	19	Simulated test spectrum
config TEST	QMS	**TQM**	20	RAM test, EPROM test, program number
	DSP	**TDS**	20	RAM test, EPROM test, program number
error	ERROR	**ERR**	20	Error message from QC 421
	Warning	**EWN**	20	Warning from QC 421
	State-QMS	**ESQ**	21	Control unit status

5.3.3 *ion source* group

Function	Parameter	Mnemonics	Page	Meaning
emiss	EMISS	**EMI**	21	Emission current
	E-PROT	**EPR**	21	Max. filament current
v1...v6	V1 IONREF	**V01**	21	Ion source voltage 1
	V2 CATH	**V02**	21	Ion source voltage 2
	V3 FOCUS	**V03**	22	Ion source voltage 3
	V4 F-AXIS	**V04**	22	Ion source voltage 4
	V5 EXTRACT	**V05**	22	Ion source voltage 5
	V6 DEF-I	**V06**	22	Ion source voltage 6
v7...	V7	**V07**	22	Ion source voltage 7
	V8	**V08**	22	Ion source voltage 8
	V9 WEHNELT	**V09**	22	Ion source voltage 9

5.3.4 *operation* group

Function	Parameter	Mnemonics	Page	Meaning
sem hv	SEM-VOLTAGE	**SHV**	22	Common SEM high voltage
sem	Control	**SEM**	23	Enable / disable the SEM high voltage
ion src	MODE	**ISM**	23	Type of ion source operation
	TYPE	**ITY**	23	Type of ion source
	FILAM	**IFI**	23	Filament change
	FIL1	**IS1**	23	Ion source set number for Filament 1
	FIL2	**IS2**	23	Ion source set number for Filament 2
	Emi-Disp	**IED**	23	Enable / disable the emission current display
	COPY	**ICS**	24	Copy the ion source set
	D-TIME	**IDT**	24	Duration of degas process
	D-EMIS	**IDE**	24	Emission current for degas
	D-PROT	**IDP**	24	Maximum filament current for degas
	CTRL	**ISC**	24	Enable / disable degas
cycle	FUNCT	**CFU**	24	Measurement cycle operation
	MODE	**CYM**	24	Measurement cycle sequence
	CYCLES	**CYS**	24	Number of measurement cycles
	BEGIN	**CBE**	25	First channel in cycle
	END	**CEN**	25	Last channel in cycle
	TRIG	**CTR**	25	Measurement cycle control
	Run-Time	**CWA**	25	Scan time
	ADJ-TYP	**CCF**	25	Measurement cycle coarse / fine peak adjustment
run / halt	RUN / HALT	**CRU**	25	Start / Stop the measurement cycle
filam	Fila-Emi	**FIE**	25	Enable / disable the emission

5.3.5 Group of measured data not defined by a channel

Function	Parameter	Mnemonics	Page	Meaning
TOTAL	Pirani	**TPI**	26	Total pressure Pirani
	Penning	**TPE**	26	Total pressure cold cathode
ANALOG	A-Input	**AIN**	26	Analog input status
	A-Output	**AOU**	26	Analog output status
trip STATUS	T-State	**TST**	26	Switching function status
EMIS	EMI-CUR	**ECU**	27	Emission current display on the QME 125

5.3.6 Group of measured data defined by a channel

Function	Parameter	Mnemonics	Page	Meaning
MESSDATA	B-Counter	**MBC**	27	Contents counter for measured data buffer
	M-Counter			Number of measured values for this type of data
	M-State			Measurement is running / has finished
	M-Data Type			Type of data
	B-Header	**MBH**	27	Measured data buffer header
	B-Data	**MDB**	27–30	Measured data buffer

5.4 Description

5.4.1 *channels* group

5.4.1.1 *select* function

Measure-Ch

Transmit: **SMC** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx <CR><LF>

Meaning	Values x	Comments
selected measurement channel	0 ... 63	

Parameter-Ch

Transmit: **SPC** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx <CR><LF>

Meaning	Values x	Comments
selected measurement channel	0 ... 63	

5.4.1.2 *detect* function

TYPE

Transmit: **DTY** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Selects the signal source	0 = FARAD 1 = SEM 2 = ION-CNT 3 = EXTERN 4 = PIRANI 5 = PENNING 6 = A-INPUT	

SEM

Transmit: **DSE** [,xxxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxx <CR><LF>

Meaning	Values x	Comments
SEM high voltage defined by the channel	0 (SEM-HV) 1 ... 3500 V	*sem hv* applies for SEM-HV

AI-CH / PI-CH

Transmit: **DAI** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx <CR><LF>

Meaning	Values x	Comments
AI channel number / PI channel number	x = 0 ... 15 / x = 0 ... 1	according to «TYPE»

PE-CTRL

Transmit: **DPC** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
The cold cathode measurement circuit is enabled / disabled	0 = OFF 1 = ON	

5.4.1.3 *mass* function

MODE

Transmit: **MMO** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Scan mode	0 = SCAN-N 1 = SCAN-F 2 = STAIR 3 = SAMPLE 4 = PEAK-L 5 = PEAK-F	Standard scan Scan with FIR filter Scan of whole number masses Standard measurement of a single mass Peak processor level criterion Peak processor FIR filter criterion

FIRST / MASS

Transmit: **MFM** [,xxxx.xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxx.xx <CR><LF>

Meaning	Values x	Comments
First mass for a scan / mass number	0.00 ... 2047.99	Internally in steps of $^1/_{64}$ ($^1/_{32}$); dependent on the mass range and «SPEED»

WIDTH

Transmit: **MWI** [,sxxxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: sxxxx <CR><LF>

Meaning	Values x	Comments
Width of the scan	-2047 ... +2047 (Default = 100)	Except for «SAMPLE»; limited by the measurement range; backwards if negative

SPEED / DWELL

Transmit: **MSD** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx <CR><LF>

Meaning	Values x	Comments
Measurement speed per amu (for «SCAN») Measurement time (for «SAMPLE»)	0 = 0,5 ms 1 = 1 ms 2 = 2 ms 3 = 5 ms 4 = 10 ms 5 = 20 ms 6 = 50 ms 7 = 0.1 s 8 = 0.2 s 9 = 0.5 s 10 = 1 s 11 = 2 s 12 = 5 s 13 = 10 s 14 = 20 s 15 = 60 s	

RESOL

Transmit: **MRE** [,xxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxx <CR><LF>

Meaning	Values x	Comments
400 Resolution	0 ... 255	0 = off (integral spectrum) 1 = narrowest peak width 255 = largest peak width
125 Resolution	0 ... 1	0 = integral spectrum) 1 = on (standard spectrum)

THRESH

Transmit: **MTH** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Threshold for peak processor	0 ...7	Electrometer operation in Fix range 0 = 0.01 %F.S. 1 = 0.03 %F.S. 2 = 0.1 %F.S. 3 = 0.3 %F.S. 4 = 1 %F.S. 5 = 3 %F.S. 6 = 10 %F.S. 7 = 30 %F.S. referenced to RANGE Electrometer operation in Auto range 0 = 0.01 %F.S. 1 = 1E-14 A 2 = 1E-13 A 3 = 1E-12 A 4 = 1E-11 A 5 = 1E-10 A 6 = 1E-9 A 7 = 1E-8 A Ion counter operation 0 = 10^0 cps 1 = 10^1 cps 2 = 10^2 cps 3 = 10^3 cps 4 = 10^4 cps 5 = 10^5 cps 6 = 10^6 cps 7 = 10^7 cps

AVERAGE

Transmit: **MAV** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx <CR><LF>

Meaning	Values x	Comments
Number of samples used for averaging	0 = 1 Values 1 = 2 Values 2 = 4 Values 3 = 8 Values 4 = 16 Values 5 = 32 Values 6 = 64 Values 7 = 128 Values 8 = 256 Values 9 = 512 Values 10 = 1024 Values	

Steps

Transmit: **MST** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Measurement channel resolution for Fix range	0 = $^1/_4$ u 1 = $^1/_8$ u 2 = $^1/_{16}$ u	SPEED: 0.5 ms/u, 1 ms/u MASS-R: all
	0 = $^1/_8$ u 1 = $^1/_{16}$ u 2 = $^1/_{32}$ u	SPEED: 2 ms/u, 5 ms/u MASS-R: all
	0 = $^1/_{16}$ u 1 = $^1/_{32}$ u 2 = $^1/_{64}$ u	SPEED: from 10 ms/u MASS-R: to 1024
	0 = $^1/_8$ u 1 = $^1/_{16}$ u 2 = $^1/_{32}$ u	SPEED: from 10 ms/u MASS-R: 2048

Measurement channel resolution for Auto range	0 = — 1 = — 2 = —	SPEED: 0.5 ms/u ... 5 ms/u MASS-R: all
	0 = $^1/_4$ u 1 = $^1/_8$ u 2 = $^1/_{16}$ u	SPEED: 10 ms/u, 20 ms/u MASS-R: all
	0 = $^1/_8$ u 1 = $^1/_{16}$ u 2 = $^1/_{32}$ u	SPEED: 50 ms/u, 100 ms/u MASS-R: all
	0 = $^1/_{16}$ u 1 = $^1/_{32}$ u 2 = $^1/_{64}$ u	SPEED: 200 ms/u ... 60 s/u MASS-R: to 1024
	0 = $^1/_8$ u 1 = $^1/_{16}$ u 2 = $^1/_{32}$ u	SPEED: 200 ms/u ... 60 s/u MASS-R: 2048

5.4.1.4 *amplif* function

MODE

Transmit: **AMO** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Measurement range switchover mode	0 = FIX 1 = AUTO-D 2 = AUTO	

RANGE

Transmit: **ARA** [,sxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: sxx <CR><LF>

Meaning	Values x	Comments
Electrometer range in Fix range	E-12 ... E-5	Measurement range
Electrometer range in Auto range	E-12 ... E-5	Output display range
Ion counter operation	E-1 ... E+8	Output display range

RANGE-L

Transmit: **ARL** [,sxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: sxx <CR><LF>

Meaning	Values x	Comments
Lowest electrometer range for Auto-D	E-12 ... E-5	For «FARAD» or «SEM»

GAIN

Transmit: **AGA** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Post gain factor	0 = x-10 1 = x-1 2 = x1 3 = x10	Only for *detect* «TYPE» : «EXTERN»

FILTER

Transmit: **AFI** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Analog filter setting	0 = AUTO 1 = 18 µs 2 = 85 µs 3 = 400 µs 4 = 1.7 ms 5 = 8 ms 6 = 40 ms 7 = 180 ms 8 = 800 ms	Auto = appropriate for «SPEED »

OFFSET

Transmit: **AOF** [,0] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: sxxxxx,sxxxxx,...,sxxxxx <CR><LF>

Meaning	Values x	Comments
Offset correction for the electrometer	(8×) –32768 ... +32676	Offset values for range E-5, E-6, ..., E-12 I_{offset} = value x / 32000 × range Transmission of value 0 results in Clear of all offset values

CALIB

Transmit: **ACA** [,sx.xxEsxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: sx.xxEsxx <CR><LF>

Meaning	Values x	Comments
Calibration factor for measured value	±(1.00 E-10 ... ... 9.99 E+10)	

P-CAL

Transmit: **APC** [,x.x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x.x <CR><LF>

Meaning	Values x	Comments
Measurement pause for changing the channel in multichannel operation	0.0 ... 9.9	

CP-LEV

Transmit: **ACL** [,x.xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x.xx <CR><LF>

Meaning	Values x	Comments
Measurement pause for changing the channel in multichannel operation	0.10 ... 1.00 V	In steps of 0.02 V

P-Time (channel change)

Transmit: **APT** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxxx <CR><LF>

Meaning	Values x	Comments
Post gain factor for chopper lock-in amplifier	0 ... 65,535	Resolution = Pause time for changing channels 1 ms

5.4.1.5 *aux* function

STATE

Transmit: **AST** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Measurement channel enable	0 = ENABLE 1 = SKIP	The channel is enabled The channel is skipped

COPY TO CH

Transmit: **ACO** [,x,xx[,yy]] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: 0,0,0 <CR><LF>

Meaning	Values x, y	Comments
Copy the parameter set to channel yy	x = 0 ... 2 0 = to all 1 = to one 2 = swap xx = 0 ... 63 yy = 0 ... 63	 Copy from channel xx to all channels Copy from channel xx to channel yy Swap channel xx with yy

5.4.1.6 *output* function

AO-CH

Transmit: **OAC** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx <CR><LF>

Meaning	Values x	Comments
Analog output channel number	0 ... 12	0 = no channel

AO-MODE

Transmit: **OMO** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Analog output mode for AO	0 = linear 1 = logarithmic	

MONITOR

Transmit: **OAM** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Analog output mode for mon	0 = linear 1 = logarithmic 2 = RNG code	

LOG-DEC

Transmit: **ODC** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Logarithmic presentation	0 = 3 DEC 1 = 10 DEC	Only for ion counting operation

5.4.1.7 *trip* function

TYPE

Transmit: **TTY** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Type of switching function	0 = OFF 1 = ABS 2 = HYST	Switching function disabled Switching function without hysteresis Switching function with hysteresis

LEVEL-A

Transmit: **TLA** [,x.xxEsxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x.xxEsxx <CR><LF>

Meaning	Values x	Comments
Switching function A / lower threshold for the switching function	1.00 E-24 ... ... 9.99 E+24	

LEVEL-B

Transmit: **TLB** [,x.xxEsxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x.xxEsxx <CR><LF>

Meaning	Values x	Comments
Switching function B / upper threshold for the switching function	1.00 E-24 ... ... 9.99 E+24	

DO-A

Transmit: **TDA** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx <CR><LF>

Meaning	Values x	Comments
Digital output bit number for switching function A	0 ... 95 99	off

DO-B

Transmit: **TDB** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx <CR><LF>

Meaning	Values x	Comments
Digital output bit number for switching function B	0 ... 95 99	 off

5.4.2 *general* group

5.4.2.1 *di/do* function

DIG-IN

Transmit: **DIS** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx,x <CR><LF>

Meaning	Values x	Comments
Digital input statuses	xx = 0 ...63 x = 0 ... 1 0 = Low 1 = High	Bit number Read bit status

DIG-OUT

Transmit: **DOC** [,xx[,x]] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx,x <CR><LF>

Meaning	Values x	Comments
Digital output control	xx = 0 ...95 99 x = 0 ... 1 0 = Clear 1 = Set	Bit number All bits Bit manipulation

5.4.2.2 *config* SYSTEM function

QMA

Transmit: **SQA** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Defines the type of analyzer	0 = QMA 125 1 = QMA 400 2 = QMA 410 3 = QMA 430 4 = QMA 200	 only for information

MASS-R

Transmit: **SMR** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments	
Defines the mass range	0 = 100 1 = 200 2 = 128 3 = 512 4 = 1024 5 = 2048 6 = 340 7 = 300	QME 125-1 QME 125-2 QMH 400-1 QMH 400-5 QMH 410-1 QMH 410-2 QMH 410-3 QMH 400-5	QMA 125 QMA 125 QMA 410 QMA 400 QMA 400 QMA 400 QMA 410 QMA 430

DETECT

Transmit: **SDT** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
400 Defines the type of ion detection	0 = FARAD 1 = SEM 2 = CD-SEM 3 = H-SEM	 Faraday 0° SEM 90° SEM — conversion dynode floating SEM

125 Defines the type of ion detection	0 = FARAD 1 = SEM 4 = CH-TRON	Faraday 90° SEM Channeltron

IS-TYP

Transmit: **SIT** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
400 Defines the type of RF ion source	0 = AXIAL 1 = CB 2 = GRID 3 = SPM 4 = SPEC+ 5 = SPEC–	Axial ion source Crossbeam ion source Grid ion source Sputter process monitor Special ion source — positive ions Special ion source — negative ions
125 Defines the type of RF ion source	0 = AXIAL 1 = CB 2 = GRID 3 = SPM	Axial ion source Crossbeam ion source Grid ion source Sputter process monitor

OPTION

Transmit: **SOP** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
System expansions	0 = NO 3 = CP	No expansion Ion counter preamplifier

5.4.2.3 *config* QMS-HW function

QMS-HW

Transmit: **QHW** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x,x,x,x,x,x,x,x,x,x <CR><LF>

Meaning	Values x	Comments
QMS 422 pc board configuration	0 = No; 1 = HV 420	
	0 = No; 1 = HV 421	
	0 = No; 1 = IS 420	
	0 = No; 1 = AO 422	
	0 = No; 1 = IC 422	
	0 = No; 1..3 = DI 420	1 = DI 420 No. 0 2 = DI 420 No. 1 3 = No. 0 + 1
	0 = No; 1..7 = DO 420	1 = DO 420 No. 0 2 = DO 420 No. 1 3 = No. 0 + 1 4 = DO 420 No. 2 5 = No. 0 + 2 6 = No. 1 + 2 7 = No. 0, 1 + 2
	0 = No; 1 = AI 421	
	0 = No; 1 = PI 420	
	0 = No; 1 = PE 420	

5.4.2.4 *config* INIT function

RESET

Transmit: **IRE** ,x <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: 0 <CR><LF>

Meaning	Values x	Comments
Set of parameters for the ion source and the measurement channels	0 = NO 1 = FACTORY	no action Default parameters

5.4.2.5 *config* CTRL function

MODE

Transmit: **CMO** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Type of input	0 = CS 422 1 = ASCII 2 = BIN 3 = MODEM 4 = LAN	Console keyboard (QMS 422) RS 232 C with ASCII format RS 232 C with binary format RS 232 C with binary format Field bus interface format

BAUD

Transmit: **CBR** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Transmission speed for the serial interface	0 = 300 bit/s 1 = 1200 bit/s 2 = 2400 bit/s 3 = 4800 bit/s 4 = 9600 bit/s 5 = 19200 bit/s	

NODE

Transmit: **CNA** [,xxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxx <CR><LF>

Meaning	Values x	Comments
Node address for the field bus interface	1 ... 255 (Default = 83)	53H

SEM+FIL

Transmit: **CSF** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Defines the SEM and filament supply	0 = INTERN 1 = EXTERN 2 = EXT-PROT	

5.4.2.6 *config* SIMUL function

SIMUL

Transmit: **TSI** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Spectrum simulation for testing purposes	0 = OFF 1 = INTERN 2 = EXTERN	No simulation Internal simulation External simulation

5.4.2.7 *config* TEST function

> **Note**
>
> Depending on the test, two to three seconds can elapse between trans - mission and receipt.

QMS

Transmit: **TQM** ,x <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x[,yyyyyyyyyy] <CR><LF>

Meaning	Values x, y	Comments
Control unit test routine	x = 0 ... 3 0 = RAM-T 1 = EPROM-T 2 = PRG-NR 3 = no test yyyyyyyyyy	Checksum for test 1 or Program number for test 2

DSP

Transmit: **TDS** ,x <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x[,yyyyyyyyyy] <CR><LF>

Meaning	Values x, y	Comments
Digital signal processor test	x = 0 ... 3 0 = RAM-T 1 = EPROM-T 2 = PRG-NR 3 = no test yyyyyyyyyy	Checksum for test 1 or Program number for test 2

5.4.2.8 *error* function

ERROR

Transmit: **ERR** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxxxxxxxx <CR><LF>

Meaning	Values x	Comments
Error messages (are cleared when a response to a query is transmitted)	xxxxxxxxx = 0 ... 2^{32}-1	Bit Error Bit Error 0: No. 17 16: No. 33 1: No. 18 17: No. 34 2: No. 19 18: No. 35 3: No. 20 19: No. 36 4: No. 21 20: No. 37 5: No. 22 21: No. 38 6: No. 23 22: No. 39 7: No. 24 23: No. 40 8: No. 25 24: No. 41 9: No. 26 25: No. 42 10: No. 27 26: No. 43 11: No. 28 27: No. 44 12: No. 29 28: No. 45 29: No. 46 30: No. 47

Warning

Transmit: **EWN** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxxx <CR><LF>

Bedeutung	Werte x	Bemerkungen
Warnings (are cleared when a response to a query is transmitted)	xxxxx = 0 ... 2^{16}-1	Bit Warning 0: No. 17 1: No. 18 2: No. 19 3: No. 20 4: No. 21 5: No. 22

State-QMS

Transmit: **ESQ** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxxx,xxx <CR><LF>

Meaning	Values x	Comments
Control unit status	xxxxx = 0 ... 2^{16}-1	Bit Status 0 / 1 0: Cycle halt / run 1: Mono / Multi 2: Emission off / on 3: SEM supply off / on 4: Waiting for external trigger 5: Settling halt / run 6: I-Undergr. halt / run 7: Electrometer value / Emission current display 8: Degas off / on 9: Adjust off / on 10: Adjust run 11: 12: 13: 14: Ring buffer empty 15: Ring buffer overflow
125 State of the emission	xxx = 0 ... 255	Bit 0...7 = QMU 0...7 0 = Emission okay 1 = Emission not okay

Note

The status 'Ringbuffer overflow' (Bit 15) is not cancelled until the next cycle is started (»Run«).

5.4.3 *ion source* group

5.4.3.1 *emiss* function

EMISS

Transmit: **EMI** [,x.xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x.xx <CR><LF>

Meaning	Values x	Comments
400 Emission current	0.00 ... 2.00 mA	

E-PROT

Transmit: **EPR** [,x.xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x.xx <CR><LF>

Meaning	Values x	Comments
400 Maximum filament current	0.00 ... 5.00 A	

5.4.3.2 *v1...v6* and *v7...* functions

V1

Transmit: **V01** [,xxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxx <CR><LF>

Meaning	Values x	Comments
400 Voltage 1: IONREF	0 ... 150 V	In steps of 1 V

V2

Transmit: **V02** [,xxx.x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxx.x <CR><LF>

Meaning	Values x	Comments
400 Voltage 2: CATH	0.0 ... 125.0 V	In steps of 0.5 V

V3

Transmit: **V03** [,sxx.xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: sxx.xx <CR><LF>

Meaning	Values x	Comments
400		
Voltage 3: FOCUS	-30.00 ... ... +30.00 V	In steps of 0.25 V

V4

Transmit: **V04** [,xx.xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx.xx <CR><LF>

Meaning	Values x	Comments
400		
Voltage 4: F-AXIS	0.00 ... 60.00 V	In steps of 0.25 V

V5

Transmit: **V05** [,xxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxx <CR><LF>

Meaning	Values x	Comments
400		
Voltage 5: EXTRACT	0 ... 450 V	In steps of 2 V

V6

Transmit: **V06** [,xxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxx <CR><LF>

Meaning	Values x	Comments
400		
Voltage 6: DEF-I	0 ... 450 V	In steps of 2 V

V7

Transmit: **V07** [,xxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxx <CR><LF>

Meaning	Values x	Comments
400		
Voltage 7:	0 .. 250 V	In steps of 1 V

V8

Transmit: **V08** [,sxxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: sxxx <CR><LF>

Meaning	Values x	Comments
400		
Voltage 8:	-125 ... +125 V	In steps of 1 V

V9

Transmit: **V09** [,xx.xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx.xx <CR><LF>

Meaning	Values x	Comments
400		
Voltage 9: WEHNELT	0.00 ... 60.00 V	In steps of 0.25 V

5.4.4 *operation* group

5.4.4.1 *sem hv* and *sem* functions

SEM-VOLTAGE

Transmit: **SHV** [,xxxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxx <CR><LF>

Meaning	Values x	Comments
Defined common SEM high voltage	0 ... 3500 V	SEM high voltage not defined in a measurement channel

Control

Transmit: **SEM** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Define SEM high voltage status on / off	0 = OFF 1 = ON	with «FARAD» = off

5.4.4.2 *ion src* function

MODE

Transmit: **ISM** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Defines the type of ion source operation	0 = NORMAL 1 = DEGAS	Emission

TYPE

Transmit: **ITY** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
400 Defines the type of ion source	0 = according to configuration 1 = SPEC+ 2 = SPEC–	

FILAM

Transmit: **IFI** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
400 Filament selection	x = 0 ... 2 0 = 1 1 = 2 2 = 1+2	Filament 1 with «FIL1-SET» Filament 2 with «FIL2-SET» If Filament 1 fails, switchover to Filament 2 with filament set change
125 Filament selection	x = 0 ... 1 0 = 1 1 = 2	Filament 1 Filament 2

FIL1

Transmit: **IS1** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
400 Ion source set number for Filament 1	0 ... 3	

FIL2

Transmit: **IS2** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
400 Ion source set number for Filament 2	0 ... 3	

Emi-Disp

Transmit: **IED** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
125 Emission current display	0 = OFF 1 = ON	Emission current display off (standard operation) Emission current display on

COPY

Transmit: **ICS** [,x,y] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x,y <CR><LF>

Meaning	Values x, y	Comments
400		
Copy the ion source set	x = 0 ... 3 y = 0 ... 3	Copy from set x to set y

D-TIME

Transmit: **IDT** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx <CR><LF>

Meaning	Values x	Comments
Duration of Degas	0 = MANUAL 1 ... 99 min	Continue Degas until stop command is entered manually

D-EMIS

Transmit: **IDE** [,xx.x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx.x <CR><LF>

Meaning	Values x	Comments
400		
Emission current for Degas	0.0 ... 20.0 mA	

D-PROT

Transmit: **IDP** [,x.xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x.xx <CR><LF>

Meaning	Values x	Comments
400		
Maximum filament current for Degas	0.00 ... 5.00 A	

CTRL

Transmit: **ISC** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Turn Degas on / off	0 = STOP 1 = START / RUN	

5.4.4.3 *cycle* function

FUNCT

Transmit: **CFU** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Defines the type of measurement cycle	0 = CYCLE 1 = ADJUST 4 = Offset-Measure	Measurement operation Mass number adjustment

MODE

Transmit: **CYM** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Measurement cycle sequence	0 = MONO 1 = MULTI	Single channel cycle Multichannel cycle

CYCLES

Transmit: **CYS** [,xxxxx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxxx <CR><LF>

Meaning	Values x	Comments
Number of measurement cycles	0 = REPEAT 1 ... 10,000	Continuous cycle repeat

BEGIN

Transmit: **CBE** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx <CR><LF>

Meaning	Values x	Comments
First channel in the cycle	0 ... 63	Only for »multi«, otherwise the first channel is always the selected channel

END

Transmit: **CEN** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx <CR><LF>

Meaning	Values x	Comments
Last channel in the cycle	0 ... 63	Only for »multi«, otherwise the first channel is always the selected channel

TRIG

Transmit: **CTR** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Measurement cycle control	0 = INTERN 1 = EXT-AUTO 2 = EXT-NORM 3 = EXT-SNGL	

Run-Time (stop watch)

Transmit: **CWA** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x,xxx,yy,xx,yyy <CR><LF>

Meaning	Values x, y	Comments
Measurement cycle time	x = 0 ... 1 xxx = 0 ... 119 h yy = 0 ... 59 min xx = 0 ... 59 s yyy = 0 ... 999 ms	0 = LAP off; 1 = LAP on automatic Run Time transmission

ADJ-TYP

Transmit: **CCF** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Coarse / fine peak adjustment search	0 = COARSE 1 = FINE	coarse; only in «SAMPLE» fine; only in «SAMPLE»

5.4.4.4 *run/halt* function

RUN / HALT

Transmit: **CRU** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Start / stop of the measurement cycle	0 = HALT 1 = START 2 = JOB-RUN	

5.4.4.5 *filam* function

Fila-Emi

Transmit: **FIE** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x <CR><LF>

Meaning	Values x	Comments
Emission enabled / disabled	0 = OFF 1 = ON	

5.4.5 Measured data not defined in measurement channels

5.4.5.1 Total pressure

Pirani

Transmit: **TPI** [,x] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x,x,y.yEsy <CR><LF>

Meaning	Values x, y	Comments
Pirani total pressure	x = 0 ... 1	Sensor definition
	x = 0 ... 3 0 = Okay 1 = Underrange 2 = Overrange 3 = Error	Status for Pirani circuit 1 or 2 Measured data ok Measurement underrange Measurement overrange Error at the measuring unit
	1.0 E+3 ... 8.0 E-4	Pressure value in [mbar]

Penning

Transmit: **TPE** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x,y.yEsyy <CR><LF>

Meaning	Values x, y	Comments
Cold cathode pressure	x = 0 ... 4 0 = Okay 1 = Underrange 2 = Overrange 3 = Error 4 = Off	Cold cathode circuit status Measured data ok Measurement underrange Measurement overrange Error at the measuring unit Measuring unit disabled
	1.0 E-3 ... 5.0 E-10	Pressure value in [mbar]

5.4.5.2 Analog

A-Input

Transmit: **AIN** [,xx] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx,sxxxxx <CR><LF>

Meaning	Values x	Comments
Analog input statuses	xx = 0 ... 15	AI channel
	sxxxxx = -10240 ... ... +10238 mV	Read out AI voltage

A-Output

Transmit: **AOU** [,xx[,sxxxxx]] <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx,sxxxxx <CR><LF>

Meaning	Values x	Comments
Analog output statuses	xx = 1 ... 12 99	AO channel All AO channels together
	sxxxxx = -10240 ... ... +10238 mV	Change AO voltage

5.4.5.3 *trip* STATUS

T-State

Transmit: **TST** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x,y <CR><LF>

Meaning	Values x, y	Comments
Switching function statuses for the selected parameter channel	x = 0 ... 1 0 = passive 1 = active	Switching function status A
	y = 0 ... 1 0 = passive 1 = adtive	Switching function status B

5.4.5.4 Emission

EMI-CUR

Transmit: **ECU** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxxx <CR><LF>

Meaning	Values x	Comments
125 Emission current	0 ... 20.000 µA	

5.4.6 Measured data defined in measurement channels

B-Counter

Transmit: **MBC** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxxxx <CR><LF>

Meaning	Values x	Comments
Measured data buffer for intensity counter	0 ... 131.071	0 to 128k

B-Header

Transmit: **MBH** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x,xx,yy,xxxxxx,xxx <CR><LF>

Meaning	Values x, y	Comments
Measured data buffer header	x = 0 ... 1 0 = running 1 = ended	Measurement status
	xx = 0 ... 63	Measurement channel number
	yy = 0 ... 16	0 = No block available 1 = Data type SCAN, STAIR-Integer 2 = Data type PEAK-Integer 7 = Data type SCAN-Float 8 = Data type PEAK-Float 9 = Data type SAMPLE-Float 10 = Data type ADJUST-Float 13 = Data type PIRANI 14 = Data type PENNING 15 = Data type A-INPUT 16 = Data type Run-Time
	xxxxxx = 0 ... 131.071	Number of values for the type of data 0 to 128k
	xxx = 0 ... 120	Counter

5.4.6.1 Electrometer operation

Measured data in scan and stair operation

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: sxxxxx <CR><LF>

Meaning	Values x	Comments
Peak intensity	-10240 ... +10238	[mV]

Measured data in peak processing mode

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxx.xx,syyyyy <CR><LF>

Meaning	Values x, y	Comments
Mass number	0.00 ... 2047.99	Internally in steps of $^1/_{64}$ ($^1/_{32}$); as a function of the measurement range and «SPEED »
Peak intensity	-10240 ... +10238	[mV]

Measured data in sample mode

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: sx.xxxxxEsxx <CR><LF>

Meaning	Values x	Comments
Peak intensity	1.00000 E-27 ... ... 9.99999 E+5	E-5 ... E-13 without «CALIB» [A]

Adjust data

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx,xx,xxxx.xx,syyyyy <CR><LF>

Meaning	Values x, y	Comments
Status message	xx = 0 ... 31	0 = gut Bit 0 = 1: «MASS» too low Bit 1 = 1: «MASS» too high Bit 2 = 1: Intensity didn't drop to 66% Bit 3 = 1: Intens. > F.S. Bit 4 = 1: Intens. < «THRESH»
Measurement channel number	xx = 0 ... 63	
Mass number	0.00 ... 2047.99	
Peak intensity	-10240 ... +10238	[mV]

Measured data for channel settling (while channel is being changed)

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxx,sxxxxx <CR><LF>

Meaning	Values x	Comments
Channel measured data rate	1 = 0.1 ms/value 2 = 0.2 ms/alue 5 = 0.5 ms/alue 10 = 1 ms/alue 20 = 2 ms/alue 50 = 5 ms/alue 100 = 10 ms/alue 200 = 20 ms/alue 500 = 50 ms/alue	
Peak intensity	-10240 ... +10238	[mV]

Measured data for DWELL settling (after channel change)

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxx,sxxxxx <CR><LF>

Meaning	Values x	Comments
DWELL measured data rate	1 = 0.1 ms/value 2 = 0.2 ms/value 5 = 0.5 ms/value 10 = 1 ms/value 20 = 2 ms/value 50 = 5 ms/value 100 = 10 ms/value 200 = 20 ms/value 500 = 50 ms/value	
Peak intensity	-10240 ... +10238	[mV]

5.4.6.2 Ion counting operation

Measured data in scan and stair operation

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: sx.xxxxEsxx <CR><LF>

Meaning	Values x	Comments
Peak intensity	1.0000 E0 ... ... 9.9999 E16	E+6 without «CALIB» [cps]

Measured data in Peak Processing Mode

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxx.xx,sy.yyyyEsyy <CR><LF>

Meaning	Values x, y	Comments
Mass number	0.00 ... 2047.99	Internally in steps of $^1/_{64}$ ($^1/_{32}$); as a function of the measurement range and «SPEED»
Peak intensity	1.0000 E0 ... ... 9.9999 E16	E+6 without «CALIB» [cps]

Measured data in Sample Mode

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: sx.xxxxxEsxx <CR><LF>

Meaning	Values x	Comments
Peak intensity	1.00000 E0 ... ... 9.99999 E16	24-bit mantissa; E+6 without «CALIB»; [cps]

Adjust data

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx,xx,xxxx.xx,sy.yyyyyEsyy <CR><LF>

Meaning	Values x, y	Comments
Status report	xx = 0 ... 31	00 = good Bit 0 = 1: «MASS» too low Bit 1 = 1: «MASS» too high Bit 2 = 1: Intensity didn't drop to 66% Bit 3 = 1: Intens. > F.S. Bit 4 = 1: Intens. < «THRESH»
Measurement channel number	xx = 0 ... 63	
Mass number	0.00 ... 2047.99	
Peak intensity	1.00000 .... 9.99999 E16	[cps]

Measured data for Channel settling (while channel is being changed)

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxx,sy.yyyyyEsyy <CR><LF>

Meaning	Values x, y	Comments
Channel measured data rate	1 = 0.1 ms/value 2 = 0.2 ms/value 5 = 0.5 ms/value 10 = 1 ms/value 20 = 2 ms/value 50 = 5 ms/value 100 = 10 ms/value 200 = 20 ms/value 500 = 50 ms/value	
Peak intensity	1.00000 E0 ... ... 9.99999 E16	[mV]

Measured data for DWELL settling (after channel change)

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxx,sy.yyyyyEsyy <CR><LF>

Meaning	Values x, y	Comments
DWELL measured data rate	1 = 0.1 ms/value 2 = 0.2 ms/value 5 = 0.5 ms/value 10 = 1 ms/value 20 = 2 ms/value 50 = 5 ms/value 100 = 10 ms/value 200 = 20 ms/value 500 = 50 ms/value	
Peakintensität	1.00000 E0 ... ... 9.99999 E16	[mV]

5.4.6.3 Total pressure

Measured data from Pirani measurement

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x,y.yEsy,x,y.yEsy <CR><LF>

Meaning	Values x, y	Comments
Total pressure Pirani	x = 0 ... 3 0 = Okay 1 = Underrange 2 = Overrange 3 = Error	Status Pirani-Messkreis 1 Status for Pirani circuit 1 Measured data ok Measurement underrange Measurement overrange Error at the measuring unit
	1.0 E+3 ... 8.0 E-4	Pressure in [mbar]
	x = 0 ... 3 0 = Okay 1 = Underrange 2 = Overrange 3 = Error	Status for Pirani circuit 2 Measured data ok Measurement underrange Measurement overrange Error at the measuring unit
	1.0 E+3 ... 8.0 E-4	Pressure in [mbar]

Measured data from Cold cathode measurement

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: x,y.yEsyy <CR><LF>

Meaning	Values x, y	Comments
Total pressure cold cathode	x = 0 ... 4 0 = Okay 1 = Underrange 2 = Overrange 3 = Error 4 = Off	Cold cathode circuit status Measured data ok Measurement underrange Measurement overrange Error at the measuring unit Measuring circuit disabled
	1.0 E-3 ... 5.0 E-10	Pressure in [mbar]

5.4.6.4 Analog

Measured data from Analog input

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xx,sxxxxx <CR><LF>

Meaning	Values x	Comments
Analog input statuses	xx = 0 ... 15	AI channel
	sxxxxx = -10240 ... ... +10238 mV	Read out AI voltage

5.4.6.5 Run Time

Run Time measured data

Transmit: **MDB** <CR>[<LF>]
Receive: <ACK><CR><LF>
Transmit: <ENQ>[<CR>[<LF>]]
Receive: xxxxx <CR><LF>

Meaning	Values x	Comments
Measurement cycle time	0 ... 2^{32}-1 ms	

6 RS-232-C interface (binary)

6.1 Data transmission

The data transmission is bidirectional i.e. data and control commands can be transmitted in either direction.

6.1.1 Definitions

The following abbreviations are used:

Abbreviations and symbols

Symbols	Definition		Decimal	Hex
Computer	Computer or terminal			
QC 422	QC 422 Quadrupol Controller			
<ENQ>	ENQUIRY	Request for data transmission	5	05
<EOT>	END OF TEXT	End of transmission	4	04
<ACK>	ACKNOWLEDGE	Positive report signal	6	06
<NAK>	NEGATIVE ACKNOWLEDGE	Negative report signal	21	15

Terms

"Transmit": Data transfer from the computer to the Quadrupole Controller
"Empfangen": Data transfer from the Quadrupole Controller to the computer

Floating point data format according to IEEE 754, Single Precision

Sign digit	8-bit exponent	23-bit mantissa
S	E_7 ... E_0	M_{22} ... M_0

Range of values:
$(-1)^S \cdot 1.M \times 2^{(E-127)} \rightarrow 1.17 \times 10^{-38}$ ... 3.4×10^{38}

Exponent:
8-bit US (unsigned) with an offset of –127 for base 2 number.
Example: 2^3 --> 8-bit Exponent = 127 + 3 = 130

Mantissa:
Sign digit +23-bit fixed point part for base 2 number with place value without the leading 1.

Number value 0:
Fixed point part and exponent are set to 0. The sign digit retains its validity (+0 and –0 are thus possible).

Number value ∞:
Mantissa = 0 and exponent = 255. The sign digit distinguishes between +∞ and –∞

Non-numbers (NAN):
Mantissa > 0 and exponent = 255.

6.1.2 Communication protocol (data link)

The data transmission takes place according to the SECS-1 standard (semi equipment communication standard 1).with the following two deviations:

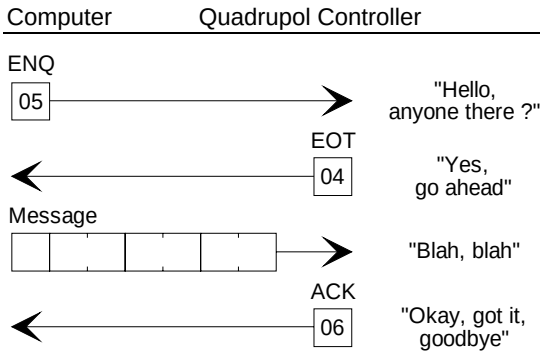
- minimum Header size = 1
- LSB comes before MSB

6.1.2.1 Normalverkehr nach "SECS-1"

Format

The data transmission request <ENQ> must be confirmed by the transmitter with <EOT> before data is transmitted. Once the data has been transmitted, the check sum is transmitted and the transmitter waits for the <ACK> confirmation. When <ACK> is received, the transmission is ended.

Protocol

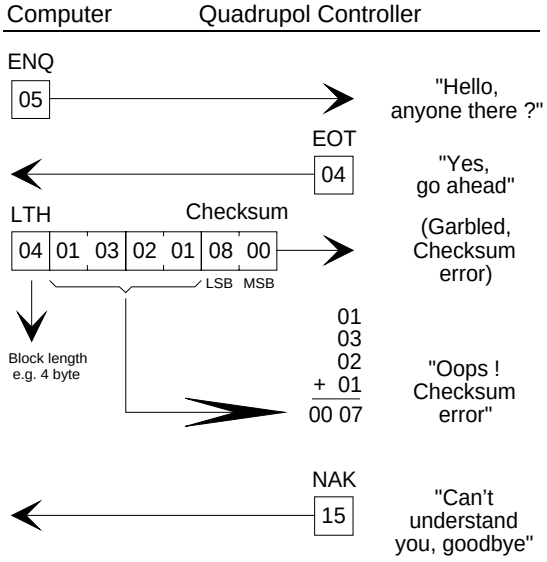


6.1.2.2 Error control according to "SECS-1

Check sum error

When the checksum turns up an error, <NAK> is output as a transmission confirmation. When <NAK> is received, the previous transmission will be repeated a maximum of six times.

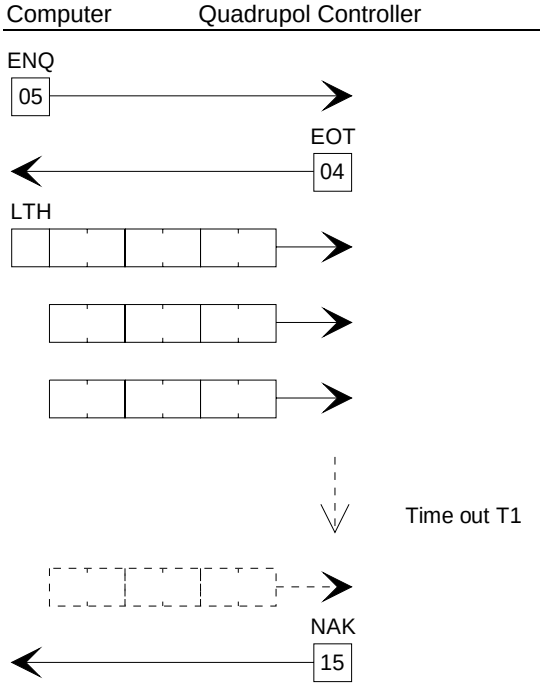
Protocol for check sum error



Timeout T1

The receiver only waits for a character for a certain amount of time during a transmission. If this time expires, the transmission is aborted.

Protocol for timeout T1



Note

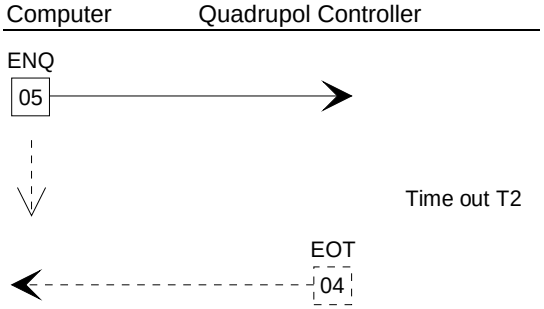
The time between two characters may not be longer than 0.5 s.

Timeout T2

If no there is no response to the data transmission within a cer tain time, the transmission is aborted after seven attempts.

This is the case when the <ENQ> request is not confirmed with <EOT> or when no message is transmitted after <EOT> or when the transmission is not acknowledged with <ACK> or <NAK>.

Protocol for timeout T2



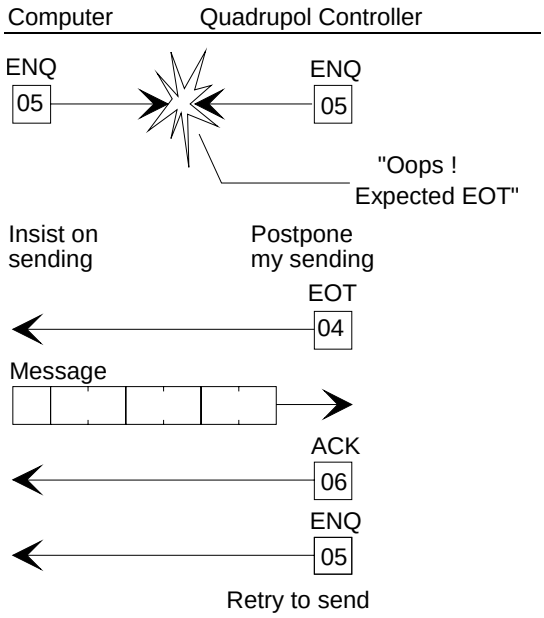
Note

The minimum delay time for the reception of the response is 1 s.

Request collision

If two requests for data transmission are made at the same time, the computer temporarily postpones its request and confirms the request from the control unit with <EOT>.

Protocol for collision



6.1.3 Influencing the measurement by changing a parameter

WARNING

If, as it is entered, a parameter change affects an active measurement cycle, the measured data ring buffer is cleared and the cycle is repeated.

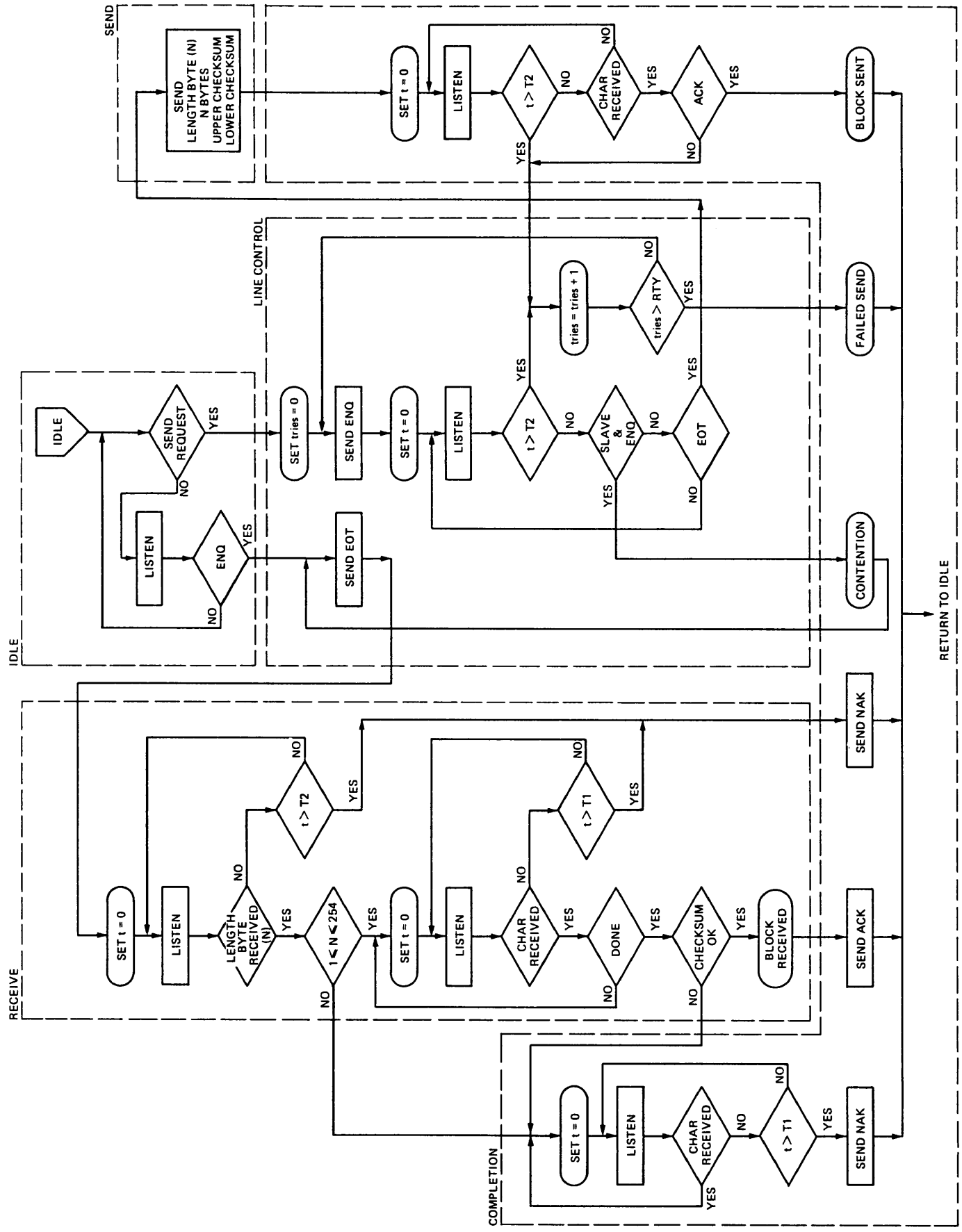
In the same way changes to an *operation* parameter cause the measurement to be repeated.

6.2 Manual / computer operation

Only with the CS 422 control unit:

The switchover: from the console or via the interface, from manual to computer operation can be made manually or via the computer All entry possibilities have equal status i.e. the input control can switch operation to itself, thereby disabling other controls. Any attempt by the computer to address the QMS 422 in *config* CTRL MODE:CS422 using a block identification that does not equal 38 is ack - nowledged with <NAK>. In this case there is the danger that the computer always receives an answer.

6.3 Block transfer diagram



6.4 Block identification

6.4.1 *channels* group

Frame	Parameter	Block identification	Page	Meaning
select	Measure-Ch	**01 / 02**	39	Selected measurement channel
	Parameter-Ch	**03 / 04**	39	Selected parameter channel
detect	TYPE	**05 / 06**	39	Signal source selection
	SEM			SEM high voltage for a channel
	AI-CH / PI-CH			Analog input or Pirani channel number
	PE-CTRL	**103 / 104**	40, 56	Enable / disable the cold cathode measurement circuit
mass	MODE	**07 / 08**	41	Spectrum scan operation
	FIRST / MASS			First mass for a scan / mass number
	WIDTH			Width of a scan
	SPEED / DWELL			Measurement speed / measurement time
	RESOL			Resolution
	AVERAGE			Number of values used for averaging
amplif	MODE	**11 / 12**	42	Measurement range switching mode
	RANGE			Electrometer range
	RANGE-L			Narrowest measurement range for Auto Down
	GAIN			Post amplification factor
	FILTER			Analog filter setting
	CALIB			Calibration factor for the measured value
	P-CAL			Break factor for changing the measurement channel in multichannel operation
	CP-LEV			Response threshold for the ion counter preamplifier
	P-Time	**69 / 70**	43	Break time for measurement channel switchover
aux	STATE	**13 / 14**	43	Enable measurement channel
	COPY TO CH	**16**	43	Copy the parameter set to channel xx
output	AO-CH	**17 / 18**	44	Analog output channel number
	AO-MODE			Analog output mode
	MONITOR			Analog output monitor
	LOG-DEC			Logarithmic presentation at analog output
	O-RNG			Display range
trip	TYPE	**19 / 20**	44	Type of switching function
	LEVEL-A			Switching function A / lower threshold for switching funct.
	LEVEL-B			Switching function B / upper threshold for switching funct.
	DO-A			Digital output bit number for switching function A
	DO-B			Digital output bit number for switching function B

6.4.2 *general* group

Frame	Parameter	Block identification	Page	Meaning
di/do	DIG-IN	**23 / 24**	45	Digital input status (block operation)
		25 / 26	45	" (single bit operation)
	DIG-OUT	**27 / 28**	46	Digital output control (block operation)
		29 / 30	46	" (single bit operation)
config SYSTEM	QMA	**31 / 32**	47	Type of analyzer
	MASS-R			Type of RF generator
	DETECT			Type of ion detector
	IS-TYP			Type of ion source
	OPTION			System expansion information
config QMS-HW	QMS-HW	**33 / 34**	47	Pc boards in the QMS 422
config INIT	RESET	**36**	48	Parameter set (standard / user)
config CTRL	MODE	**37 / 38**	48	Select type of input
	BAUD			Transmission speed for the RS 232 C interface
	NODE			Node address for the LAN interface
	SEM+FIL			SEM and filament supply
config SIMUL	SIMUL	**71 / 72**	48	Simulated test spectrum
config TEST	QMS	**39 / 40**	49	RAM test, EPROM test, program number
	DSP			RAM test, EPROM test, program number
error STATUS	ERROR	**41 / 42**	50	Error message from QC 422
	Warning			Warning from QC 422
	State-QMS			Control unit status (only interface)

6.4.3 *ion source* group

Function	Parameter	Block identification	Page	Meaning
emiss	EMISS	**43 / 44**	51	Emission current
	E-PROT			Max. filament current
v1...v6	V1 IONREF	**45 / 46**	51	Ion source voltage 1
	V2 CATH			Ion source voltage 2
	V3 FOCUS			Ion source voltage 3
	V4 F-AXIS			Ion source voltage 4
	V5 EXTRACT			Ion source voltage 5
	V6 DEF-I			Ion source voltage 6
v7...	V7			Ion source voltage 7
	V8			Ion source voltage 8
	V9 WEHNELT			Ion source voltage 9

6.4.4 *operation* group

Frame	Parameter	Block identification	Page	Meaning
sem hv *sem*	SEM-VOLTAGE Control	**49 / 50**	52	Common SEM high voltage Enable / disable the SEM high voltage
ion src	MODE TYPE FILAM FIL1 FIL2	**51 / 52**	52	Type of ion source operation Type of ion source Filament change Ion source set number for Filament 1 Ion source set number for Filament 2
	Emi-Disp			Enable / disable the emission current display
	COPY	**53 / 54**	53	Copy the ion source set
	D-TIME D-EMIS D-PROT	**55 / 56**	53	Duration of degas process Emission current for degas Maximum filament current for degas
	CTRL	**57 / 58**	53	Enable / disable degas
cycle	FUNCT MODE CYCLES BEGIN END TRIG	**59 / 60**	54	Measurement cycle operation Measurement cycle sequence Number of measurement cycles First channel in cycle Last channel in cycle Measurement cycle control
	Run-Time	**61 / 62**	54	Scan time
	ADJ-TYP	**63 / 64**	54	Measurement cycle Coarse / fine peak adjustment
run / halt	RUN / HALT	**65 / 66**	55	Start / Stop the measurement cycle
filam	Fila-Emi	**67 / 68**	55	Enable / disable the emission

6.4.5 Group of measured data not defined by a channel

Frame	Parameter	Block identification	Page	Meaning
TOTAL	Pirani Penning	**101 / 102** **103 / 104**	56 56, 40	Total pressure Pirani Total pressure cold cathode
ANALOG	A-Input A-Output	**105 / 106** **107 / 108**	57 57	Analog input status Analog output status
trip STATUS	T-State	**109 / 110** **111 / 112**	58 58	Switching function status (block operation) " (single bit operation)
EMIS	EMI-CUR	**113 / 114**	59	Emission current display on the QME 125
Offset-Value		**119 / 120**	59	

6.4.6 Group of measured data defined by a channel

Frame	Parameter	Block identification	Page	Meaning
MESSDATA	B-Counter M-Counter M-State M-Data Type B-Header B-Data	**131 / 132** **133 / 134**	60 61-69	Contents counter for measured data buffer Number of measured values for this type of data Measurement is running / has finished Type of data Measured data buffer header Measured data buffer

6.5 Description

6.5.1 *channels* group

6.5.1.1 *select* frame

Measurement channel

Read parameters
Transmit: Block 01
Receive: Block 02

Transmit parameters
Transmit: Block 02

Block 01 Byte		Block 02 Byte		Parameter	Variable type	Mne	Comments
	1		2		8-bit US		Block length
1	01	1	02		8-bit US		Block identification
		2	0 ... 63	channel	8-bit US	SMC	Selected measurement channel
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Parameter channel (load channel)

Read parameters
Transmit: Block 03
Receive: Block 04

Transmit parameters
Transmit: Block 04

Block 03 Byte		Block 04 Byte		Parameter	Variable type	Mne	Comments
	1		2		8-bit US		Block length
1	03	1	04		8-bit US		Block identification
		2	0 ... 63	channel	8-bit US	SPC	Selected parameter channel
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.1.2 *detect* frame

Read parameters
Transmit: Block 05
Receive: Block 06

Transmit parameters
Transmit: Block 06

Block 05 Byte		Block 06 Byte		Parameter	Variable type	Mne	Comments
	2		9		8-bit US		Block length
1	05	1	06		8-bit US		Block identification
2	0 ... 63	2	0 ... 63	channel	8-bit US	SPC	Selected parameter channel
		3	0 ... 6	TYPE	8-bit US	DTY	0 = Farad; 1 = SEM 2 = Ion-Cnt; 3 = Extern 4 = Pirani; 5 = Penning 6 = A-Input
		4	0 ... LSB	SEM	16-bit US	DSE	0 = Common high voltage 1 ... 3500 V
		5	... 3500 MSB	"			
		6	0		8-bit US		GAP (empty byte)
		7	0 ... 15	AI-CH / PI-CH	8-bit US	DAI	AI-CH = 0 ... 15 or PI-CH = 0 ... 1, according to TYPE
		8	0		8-bit US		GAP (empty byte)
		9	0		8-bit US		GAP (empty byte)
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Cold cathode control parameters

Read parameters Transmit: Block 103 Receive: Block 104		Transmit parameters Transmit: Block 104					
Block 103		**Block 104**		**Para-meter**	**Variable type**	**Mne**	**Comments**
Byte		**Byte**					
	1		7		8-bit US		Block length
1	103	1	104		8-bit US		Block identification
		2	0 ... 1	PE-CTRL	8-bit US	DPC	0 = Turn off measurement circuit 1 = Turn on measurement circuit
		3	0		8-bit US		GAP (empty byte)
		4	0		FLOAT		GAP (empty byte)
		5					GAP (empty byte)
		6					GAP (empty byte)
		7					GAP (empty byte)
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

Note

Bytes 3 ... 7 have no significance for data transmission. The frame content cor - responds to that given in section 6.5.5.1 (cold cathode data) for data reception.

6.5.1.3 *mass* frame

Read parameters
Transmit: Block 07
Receive: Block 08

Transmit parameters
Transmit: Block 08

Block 07 Byte		Block 08 Byte		Parameter	Variable type	Mne	Comments
	2		14		8-bit US		Block length
1	07	1	08		8-bit US		Block identification
2	0 ... 63	2	0 ... 63	channel	8-bit US	SPC	Selected parameter channel
		3	0 ... 5	MODE	8-bit US	MMO	0 = Scan-N; 1 = Scan-F 2 = Stair; 3 = Sample 4 = Peak-L; 5 = Peak-F
		4	0 ... LSB	FIRST / MASS	32-bit US	MFM	0.00 ... 2047.99 u
		5	"	"			
		6	"	"			
		7	... 204,799 MSB	"			
		8	-2047 ... LSB	WIDTH	16-bit S	MWI	-2047 ... +2047 u
		9	... +2047 MSB	"			
		10	0 ... 15	SPEED / DWELL	8-bit US	MSD	0 = 0.5 ms/amu; 1 = 1 ms/amu 2 = 2 ms/amu; 3 = 5 ms/amu 4 = 10 ms/amu; 5 = 20 ms/amu 6 = 50 ms/amu; 7 = 0.1 s/amu 8 = 0.2 s/amu; 9 = 0.5 s/amu 10 = 1 s/amu; 11 = 2 s/amu 12 = 5 s/amu; 13 = 10 s/amu 14 = 20 s/amu; 15 = 60 s/amu
		11	0 ... 255	RESOL	8-bit US	MRE	400: 0 = off (integral spectr.) 1 ... 255 = Peak width 125: 0 = off (integral spectr.) 1 = on (standard spectr.)
		12	0 ... 7	THRESH	8-bit US	MTH	see the following tables ①
		13	0 ... 10	AVERAGE	8-bit US	MAV	2^0 = averaging 2^1 ... 2^{10} = number of steps for averaging
		14	0 ... 2	Steps	8-bit US	MST	see the following tables ② + ③
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

Table ①

Threshold for peak processor		
Electrometer mode in Fix range	Electrometer mode in Auto range	Ion counting mode
0 = 0.01 %F.S.	0 = 1E-15 A	0 = 10^0 cps
1 = 0.03 %F.S.	1 = 1E-14 A	1 = 10^1 cps
2 = 0.1 %F.S.	2 = 1E-13 A	2 = 10^2 cps
3 = 0.3 %F.S.	3 = 1E-12 A	3 = 10^3 cps
4 = 1 %F.S.	4 = 1E-11 A	4 = 10^4 cps
5 = 3 %F.S.	5 = 1E-10 A	5 = 10^5 cps
6 = 10 %F.S.	6 = 1E-9 A	6 = 10^6 cps
7 = 30 %F.S.	7 = 1E-8 A	7 = 10^7 cps
referenced to RANGE		

Table ②

	Mass scale resolution for Fix range			
Steps	SPEED: 0.5 ms/amu 1 ms/amu MASS-R: all	SPEED: 2 ms/amu 5 ms/amu MASS-R: all	SPEED: from 10 ms/amu MASS-R: to 1024	SPEED: from 10 ms/amu MASS-R: 2048
0	$^1/_4$ u	$^1/_8$ u	$^1/_{16}$ u	$^1/_8$ u
1	$^1/_8$ u	$^1/_{16}$ u	$^1/_{32}$ u	$^1/_{16}$ u
2	$^1/_{16}$ u	$^1/_{32}$ u	$^1/_{64}$ u	$^1/_{32}$ u

Table ③

Steps	Mass scale resolution for Auto range				
	SPEED: 0.5 ms/amu ... ...5 ms/amu MASS-R: all	SPEED: 10 ms/amu 20 ms/amu MASS-R: all	SPEED: 50 ms/amu 100 ms/amu MASS-R: all	SPEED: from 200 ms/amu MASS-R: to 1024	SPEED: from 200 ms/amu MASS-R: 2048
0	—	$^1/_4$ amu	$^1/_8$ amu	$^1/_{16}$ amu	$^1/_8$ amu
1	—	$^1/_8$ amu	$^1/_{16}$ amu	$^1/_{32}$ amu	$^1/_{16}$ amu
2	—amu	$^1/_{16}$ amu	$^1/_{32}$ amu	$^1/_{64}$ amu	$^1/_{32}$ amu

6.5.1.4 *amplif* frame

Read parameters
Transmit: Block 11
Receive: Block 12

Transmit parameters
Transmit: Block 12

Block 11 Byte		Block 12 Byte		Parameter	Variable type	Mne	Comments
	2		16		8-bit US		Block length
1	11	1	12		8-bit US		Block identification
2	0 ... 63	2	0 ... 63	channel	8-bit US	SPC	Selected parameter channel
		3	0 ... 2	MODE	8-bit US	AMO	0 = Fix 1 = Auto-D 2 = Auto
		4	-12 ... +8	RANGE	8-bit S	ARA	-12 ... -5 Exponent not calibrated, for electrometer operation
		5	-12 ... -5	RANGE-L	8-bit S	ARL	-12 ... -5 Exponent not calibrated, only for Auto-D)
		6	0 ... 3	GAIN	8-bit US	AGA	0 = x-10; 1 = x-1 2 = x1; 3 = x10
		7	0 ... 8	FILTER	8-bit US	AFI	0 = Auto; 1 = 18 µs 2 = 85 µs; 3 = 400 µs 4 = 1.7 ms; 5 = 8 ms 6 = 40 ms; 7 = 180 ms 8 = 800 ms
		8	0		16-bit S		GAP (empty byte)
		9	0				
		10	according to IEEE 754	CALIB	FLOAT	ACA	±(1.00 E-10 ...9.99 E+10)
		11		"			
		12		"			
		13		"			
		14	0 ... 99	P-CAL	8-bit US	APC	0.0 ... 9.9
		15	010 ... 100	CP-LEV	8-bit US	ACL	0.10 ... 1.00 V In steps of 0.02 V
		16	0		8-bit US		GAP (empty byte)
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

Pause time parameters

Read parameters		Transmit parameters	
Transmit:	Block 69	Transmit:	Block 70
Receive:	Block 70		

Block 69 Byte		Block 70 Byte		Parameter	Variable type	Mne	Comments
	2		6		8-bit US		Block length
1	69	1	70		8-bit US		Block identification
2	0 ... 63	2	0 ... 63	channel	8-bit US	SPC	Selected parameter channel
		3	0		8-bit US		GAP (empty byte)
		4	0 ... LSB	P-Time	16-bit US	APT	Pause time for channel changeover Resolution = 1 ms
		5	... 65,535 MSB	"			
		6	0		8-bit US		GAP (empty byte)
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.1.5 *aux* frame

Channel status

Read parameters		Transmit parameters	
Transmit:	Block 13	Transmit:	Block 14
Receive:	Block 14		

Block 13 Byte		Block 14 Byte		Parameter	Variable type	Mne	Comments
	2		3		8-bit US		Block length
1	13	1	14		8-bit US		Block identification
2	0 ... 63	2	0 ... 63	channel	8-bit US	SPC	Selected parameter channel
		3	0 ... 1	STATE	8-bit US	AST	0 = enable; 1 = skip
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Copy parameter

Transmit parameters	
Transmit:	Block 16

Block 16 Byte		Parameter	Variable type	Mne	Comments
	4		8-bit US		Block length
1	16		8-bit US		Block identification
2	0 ... 63	Copy ch	8-bit US	ACO	Source channel for parameters
3	0 ... 63	Copy to	8-bit US	ACO	Target channel for parameters
4	0 ... 2	Copy art	8-bit US	ACO	0 = to all channels 1 = to one channel 2 = swap
	Check sum LSB		16-bit US		Check sum
	MSB				

6.5.1.6 *output* frame

Read parameters
Transmit: Block 17
Receive: Block 18

Transmit parameters
Transmit: Block 18

Block 17 Byte		Block 18 Byte		Parameter	Variable type	Mne	Comments
	2		7		8-bit US		Block length
1	17	1	18		8-bit US		Block identification
2	0 ... 63	2	0 ... 63	channel	8-bit US	SPC	Selected parameter channel
		3	0 ... 12	AO-CH	8-bit US	OAC	0 = no channel 1 ... 12 = Channel 1...12
		4	0 ... 1	AO-MODE	8-bit US	OMO	0 = lin; 1 = log
		5	0 ... 1	MONITOR	8-bit US	OAM	0 = lin; 1 = log; 2 = RNG code
		6	0 ... 1	LOG-DEC	8-bit US	ODC	Only for ion counting operation 0 = 3 decades; 1 = 10 decades
		7	-12 ... +8	O-RNG	8-bit US	ORA	Exponent for the display range
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.1.7 *trip* frame

Read parameters
Transmit: Block 19
Receive: Block 20

Transmit parameters
Transmit: Block 20

Block 19 Byte		Block 20 Byte		Parameter	Variable type	Mne	Comments
	2		13		8-bit US		Block length
1	19	1	20		8-bit US		Block identification
2	0 ... 63	2	0 ... 63	channel	8-bit US	SPC	Selected parameter channel
		3	0 ... 2	TYPE	8-bit US	TTY	0 = off; 1 = absolute 2 = hysteresis
		4	according to IEEE 754	LEVEL-A	FLOAT	TLA	Switching function A / lower threshold value for the switching function 1.00 E-24 ... 9.99 E+24
		5		"			
		6		"			
		7		"			
		8	according to IEEE 754	LEVEL-B	FLOAT	TLB	Switching function B / upper threshold value for the switching function 1.00 E-24 ... 9.99 E+24
		9		"			
		10		"			
		11		"			
		12	0 ... 95 (99)	DO-A	8-bit US	TDA	DO bit for switching function A (99 = off)
		13	0 ... 95 (99)	DO-B	8-bit US	TDB	DO bit for switching function B (99 = off)
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.2 *general* group

6.5.2.1 *di/do* frame

DI statuses (block operation)

Read parameters
Transmit: Block 23
Receive: Block 24

Block 23 Byte		Block 24 Byte		Parameter	Variable type	Mne	Comments
	1		9		8-bit US		Block length
1	23	1	24		8-bit US		Block identification
		2	0 ... 255	DIG-IN	8-bit US	-	Bit 0.. 7: 0 = low; 1 = high
		3	0 ... 255	"	8-bit US		Bit 8..15: 0 = low; 1 = high
		4	0 ... 255	"	8-bit US		Bit 16..23: 0 = low; 1 = high
		5	0 ... 255	"	8-bit US		Bit 24..31: 0 = low; 1 = high
		6	0 ... 255	"	8-bit US		Bit 32..39: 0 = low; 1 = high
		7	0 ... 255	"	8-bit US		Bit 40..47: 0 = low; 1 = high
		8	0 ... 255	"	8-bit US		Bit 48..55: 0 = low; 1 = high
		9	0 ... 255	"	8-bit US		Bit 56..63: 0 = low; 1 = high
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

DI statuses (single bit operation)

Read parameters
Transmit: Block 25
Receive: Block 26

Block 25 Byte		Block 26 Byte		Parameter	Variable type	Mne	Comments
	2		3		8-bit US		Block length
1	25	1	26		8-bit US		Block identification
2	0 ... 63	2	0 ... 63		8-bit US		Selected DI bit
		3	0 ... 1	DIG-IN	8-bit US	DIS	0 = low; 1 = high
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

DO statuses (block operation)

Read parameters		Transmit parameters	
Transmit:	Block 27	Transmit:	Block 28
Receive:	Block 28		

Block 27 Byte		Block 28 Byte		Parameter	Variable type	Mne	Comments
	1		13		8-bit US		Block length
1	27	1	28		8-bit US		Block identification
		2	0 ... 255	DIG-OUT	8-bit US	DOC	Bit 0.. 7: 0 = clear; 1 = set
		3	0 ... 255	"	8-bit US		Bit 8..15: 0 = clear; 1 = set
		4	0 ... 255	"	8-bit US		Bit 16..23: 0 = clear; 1 = set
		5	0 ... 255	"	8-bit US		Bit 24..31: 0 = clear; 1 = set
		6	0 ... 255	"	8-bit US		Bit 32..39: 0 = clear; 1 = set
		7	0 ... 255	"	8-bit US		Bit 40..47: 0 = clear; 1 = set
		8	0 ... 255	"	8-bit US		Bit 48..55: 0 = clear; 1 = set
		9	0 ... 255	"	8-bit US		Bit 56..63: 0 = clear; 1 = set
		10	0 ... 255	"	8-bit US		Bit 64..71: 0 = clear; 1 = set
		11	0 ... 255	"	8-bit US		Bit 72..79: 0 = clear; 1 = set
		12	0 ... 255	"	8-bit US		Bit 80..87: 0 = clear; 1 = set
		13	0 ... 255	"	8-bit US		Bit 88..95: 0 = clear; 1 = set
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

DO statuses (single bit operation)

Read parameters		Transmit parameters	
Transmit:	Block 29	Transmit:	Block 30
Receive:	Block 30		

Block 29 Byte		Block 30 Byte		Parameter	Variable type	Mne	Comments
	2		3		8-bit US		Block length
1	29	1	30		8-bit US		Block identification
2	0 ... 63	2	0 ... 95		8-bit US		Selected DO bit
		3	0 ... 1	DIG-OUT	8-bit US	DOC	0 = clear; 1 = set
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.2.2 *config* SYSTEM frame

Read parameters
Transmit: Block 31
Receive: Block 32

Transmit parameters
Transmit: Block 32

Block 31 Byte		Block 32 Byte		Parameter	Variable type	Mne	Comments
	1		6		8-bit US		Block length
1	31	1	32		8-bit US		Block identification
		2	0 ... 3	QMA	8-bit US	SQA	0 = QMA 125; 1 = QMA 400 2 = QMA 410; 3 = QMA 430 4 = QMA 200 (only for information)
		3	0 ... 7	MASS-R	8-bit US	SMR	0 = 100 1 = 200 2 = 128 3 = 512 4 = 1024 5 = 2048 6 = 340 7 = 300
		4	0 ... 4	DETECT	8-bit US	SDT	0 = Farad; 1 = SEM 2 = CD-SEM; 3 = H-SEM 4 = Channeltron
		5	0 ... 5	IS-TYP	8-bit US	SIT	400: 0 = Axial; 1 = CB 2 = Grid; 3 = SPM 4 = Spec+; 5 = Spec– 125: 0 = Axial; 1 = CB 2 = Grid; 3 = SPM
		6	0 ... 3	OPTION	8-bit US	SOP	0 = none; 3 = CP
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

6.5.2.3 *config* QMS-HW frame

Read parameters
Transmit: Block 33
Receive: Block 34

Block 33 Byte		Block 34 Byte		Parameter	Variable type	Mne	Comments
	1		11		8-bit US		Block length
1	33	1	34		8-bit US		Block identification
		2	0 ... 1	QMS-HW	8-bit US	QHW	0 = none; 1 = HV 420
		3	0 ... 1	"	8-bit US		0 = none; 1 = HV 421
		4	0 ... 1	"	8-bit US		0 = none; 1 = IS 420
		5	0 ... 1	"	8-bit US		0 = none; 1 = AO 422
		6	0 ... 1	"	8-bit US		0 = none; 1 = IC 422
		7	0 ... 3	"	8-bit US		0 = none; 1..3 = DI 420 (Bit 0: DI 420 Nr. 0 0 ... 31 Bit 1: DI 420 Nr. 1 32 ... 63)
		8	0 ... 7	"	8-bit US		0 = none; 1..7 = DO 420 (Bit 0: DO 420 Nr. 0 0 ... 31 Bit 1: DO 420 Nr. 1 32 ... 63 Bit 2: DO 420 Nr. 2 64 ... 95)
		9	0 ... 1	"	8-bit US		0 = none; 1 = AI 421
		10	0 ... 1	"	8-bit US		0 = none; 1 = PI 420
		11	0 ... 1	"	8-bit US		0 = none; 1 = PE 420
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

6.5.2.4 *config* INIT frame

Transmit parameters
Transmit: Block 36

Block 36 Byte		Parameter	Variable type	Mne	Comments
	2		8-bit US		Block length
1	36		8-bit US		Block identification
2	0 ... 1	RESET	8-bit US	IRE	0 = no action 1 = default parameters (Factory)
	Check sum LSB		16-bit US		Check sum
	MSB				

6.5.2.5 *config* CTRL frame

Read parameters
Transmit: Block 37
Receive: Block 38

Transmit parameters
Transmit: Block 38

Block 37 Byte		Block 38 Byte		Parameter	Variable type	Mne	Comments
	1		6		8-bit US		Block length
1	37	1	38		8-bit US		Block identification
		2	0 ... 4	MODE	8-bit US	CMO	0 = CS 422 1 = RS-232 ASCII 2 = RS-232 binary 3 = MODEM 4 = LAN
		3	0 ... 5	BAUD	8-bit US	CBR	0 = 300; 1 = 1200 Bit/s 2 = 2400; 3 = 4800 Bit/s 4 = 9600; 5 = 19200 Bit/s
		4	0 ... 255	NODE	8-bit US	CNA	Node address
		5	0 ... 2	SEM+FIL	8-bit US	CSF	0 = internal; 1 = external 2 = Ext prot
		6	0		8-bit US		GAP (empty byte)
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.2.6 *config* SIMUL frame

Read parameters
Transmit: Block 71
Receive: Block 72

Transmit parameters
Transmit: Block 72

Block 71 Byte		Block 72 Byte		Parameter	Variable type	Mne	Comments
	1		2		8-bit US		Block length
1	71	1	72		8-bit US		Block identification
		2	0 ... 2	SIMUL	8-bit US	TSI	0 = no simulation 1 = internal simulation 2 = external simulation
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.2.7 *config* TEST frame

Read parameters
Transmit: Block 39
Receive: Block 40

Block 39 Byte		Block 40 Byte		Parameter	Variable type	Mne	Comments
	2		15		8-bit US		Block length
1	39	1	40		8-bit US		Block identification
2	0 ... 3; 8 ... 10	2	0 ... 3; 8 ... 10		8-bit US		0 = no test
				QMS		TQM	1 = Ram test 2 = Eprom test 3 = Program number
				DSP		TDS	8 = Ram test 9 = Eprom test 10 = Program number
		3	0		8-bit US		GAP (empty byte)
		4	65 ... 90		8-bit ASCII	TPN	Program number (66=B)
		5	65 ... 90		8-bit ASCII		Program number (71=G)
		6	48 ... 57		8-bit ASCII		Program number (0...9)
		:	:				:
		11	48 ... 57		8-bit ASCII		Program number (0...9)
		12	45. 65 ... 90		8-bit ASCII		Program index (45= -)
		13	45. 65 ... 90		8-bit ASCII		Program index (45= -)
		14	0 ... LSB		16-bit US	TCH	Check sum for EPROM test
		15	... 65,535 MSB				
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

Note

Depending on the test, there may be a 2 to 3 second delay between trans mission (Block 39) and reception (Block 40)..

6.5.2.8 *error* / STATUS frame

Read parameters
Transmit: Block 41
Receive: Block 42

Transmit parameters
Transmit: Block 42

Block 41 Byte		Block 42 Byte		Parameter	Variable type	Mne	Comments
	1		11		8-bit US		Block length
1	41	1	42		8-bit US		Block identification
		2	0 ... LSB	ERROR	32-bit US	ERR	Bit Error / Bit Error 0: No. 17 / 4: No. 21 1: No. 18 / 5: No. 22 2: No. 19 / 6: No. 23 3: No. 20 / 7: No. 24
		3		"			8: No. 25 / 12: No. 29 9: No. 26 10: No. 27 11: No. 28
		4		"			16: No. 33 / 20: No. 37 17: No. 34 / 21: No. 38 18: No. 35 / 22: No. 39 19: No. 36 / 23: No. 40
		5	... 2^{32} -1 MSB	"			24: No. 41 / 28: No. 45 25: No. 42 / 29: No. 46 26: No. 43 / 30: No. 47 27: No. 44
		6	0 ... LSB	Warning	16-bit US	EWN	Bit Warning / Bit Warning 0: No. 17 / 4: No. 21 1: No. 18 / 5: No. 22 2: No. 19 3: No. 20
		7	... 2^{16} -1 MSB	"			
		8	0 ... LSB	State-QMS	16-bit US	ESQ	Bit Status 0 / 1 0: Cycle halt / run 1: Mono / multi 2: Emission off / on 3: SEM-Supply off / on 4: Wait for external trigger 5: Settling halt / run 6: Integrator background halt / run 7: Electrometer measured value / emission current display
		9	... 2^{16} -1 MSB	"			8: Degas off / on 9: Adjust off / on 10: Adjust run 11: 12: 13: 14: Ring buffer empty 15: Ring buffer overflow
		10	0		8-bit US		GAP (empty byte)
		11	0		8-bit US		GAP (empty byte)
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

Note

The 'ERROR' and 'Warning' messages are automatically cleared after any query about them has been answered.

When transmitting parameters the 'ERROR' and 'Warning' messages are erased.

Note

The »Ring buffer overflow« status (bit 15) is not cleared until the next measure - ment cycle is started (»run«).

6.5.3 *ion source* group

6.5.3.1 *emiss* frame

Read parameters		Transmit parameters	
Transmit:	Block 43	Transmit:	Block 44
Receive:	Block 44		

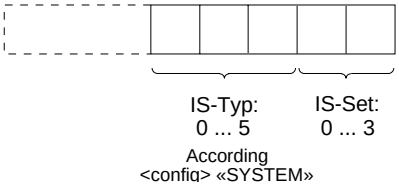
Block 43 Byte		Block 44 Byte		Parameter	Variable type	Mne	Comments
	2		6		8-bit US		Block length
1	43	1	44		8-bit US		Block identification
2	0 ... 3	2	0 ... 23	IS-Set	8-bit US		Ion source set *)
		3	0 ... 200	EMISS	8-bit US	EMI	0 = off; 0.01 ... 2.00 mA
		4	0 ... LSB	E-PROT	16-bit US	EPR	0.00 ... 5.00 A
		5	... 500 MSB	"			
		6	0		8-bit US		GAP (empty byte)
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.3.2 *v1...v6 / v7...* frame

Read parameters		Transmit parameters	
Transmit:	Block 45	Transmit:	Block 46
Receive:	Block 46		

Block 45 Byte		Block 46 Byte		Parameter	Variable type	Mne	Comments
	2		11		8-bit US		Block length
1	45	1	46		8-bit US		Block identification
2	0 ... 3	2	0 ... 23	IS-Set	8-bit US		ion source set *)
		3	0 ... 150	V1	8-bit US	V01	400 0 ... 150 V In steps of 1 V
		4	0 ... 250	V2	8-bit US	V02	400 0.0 ... 125.0 V In steps of 0.5 V
		5	8 ... 128 ... 248	V3	8-bit US	V03	400 +30.0 ... 0.0 ... -30.0 V In steps of 0.25 V
		6	0 ... 240	V4	8-bit US	V04	400 00 ... 60 V In steps of 0.25 V
		7	0 ... 225	V5	8-bit US	V05	400 ... 450 V In steps of 2 V
		8	0 ... 225	V6	8-bit US	V06	400 0 ... 450 V In steps of 2 V
		9	0 ... 250	V7	8-bit US	V07	400 0 ... 250 V In steps of 1 V
		10	3 ... 128 ... 253	V8	8-bit US	V08	400 +125 ... 0 ... -125 V In steps of 1 V
		11	0 ... 240	V9	8-bit US	V09	400 0 ... 60 V In steps of 0.25 V
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

*) The ion source set comprises two parts:



6.5.4 *operation* group

6.5.4.1 *sem hv* / *sem* frame

Read parameters
Transmit: Block 49
Receive: Block 50

Transmit parameters
Transmit: Block 50

Block 49 Byte		Block 50 Byte		Parameter	Variable type	Mne	Comments
	1		4		8-bit US		Block length
1	49	1	50		8-bit US		Block identification
		2	0 ... LSB	SEM-VOLTAGE	16-bit US	SHV	0 ... 3500 V
		3	... 3500 MSB	"			
		4	0 ... 1	Control	8-bit US	SEM	0 = off; 1 = on
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.4.2 *ion src* frame

Ion source parameters

Read parameters
Transmit: Block 51
Receive: Block 52

Transmit parameters
Transmit: Block 52

Block 51 Byte		Block 52 Byte		Parameter	Variable type	Mne	Comments
	1		7		8-bit US		Block length
1	51	1	52		8-bit US		Block identification
		2	0 ... 1	MODE	8-bit US	ISM	0 = standard; 1 = Degas
		3	0 ... 2	TYPE	8-bit US	ITY	400: 0 = According to configurat. 1 = Spec+ 2 = Spec–
		4	0 ... 2	FILAM	8-bit US	IFI	400: 0 = Filament 1 1 = Filament 2 2 = Filament 1+2 125: 0 = Filament 1 1 = Filament 2
		5	0 ... 3	FIL1	8-bit US	IS1	400: Set 0 ... Set 3
		6	0 ... 3	FIL2	8-bit US	IS2	400: Set 0 ... Set 3
		7	0 ... 1	Emi-Disp	8-bit US	IED	125: 0 = Emission current display off (standard operation) 1 = Emission current display on
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Note

The emission current is output from a separate frame (see section 6.5.5.4).

Set copy parameter

Read parameters		Transmit parameters	
Transmit:	Block 53	Transmit:	Block 54
Receive:	Block 54		

Block 53 Byte		Block 54 Byte		Parameter	Variable type	Mne	Comments
	1		3		8-bit US		Block length
1	53	1	54		8-bit US		Block identification
		2	0 ... 3	IS-Set	8-bit US		400 Source set
		3	0 ... 3	COPY	8-bit US	ICS	400 Destination set
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Degas parameter

Read parameters		Transmit parameters	
Transmit:	Block 55	Transmit:	Block 56
Receive:	Block 56		

Block 55 Byte		Block 56 Byte		Parameter	Variable type	Mne	Comments
	1		6		8-bit US		Block length
1	55	1	56		8-bit US		Block identification
		2	0 ... 99	D-TIME	8-bit US	IDT	0 = Manual; 1 ... 99 minutes
		3	0 ... 200	D-EMIS	8-bit US	IDE	400 0.0 ... 20.0 mA
		4	... 0 LSB	D-PROT	16-bit US	IDP	400 0.00 ... 5.00 A
		5	... 500 MSB	"			
		6	0		8-bit US		GAP (empty byte)
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Degas control parameter

Read parameters		Transmit parameters	
Transmit:	Block 57	Transmit:	Block 58
Receive:	Block 58		

Block 57 Byte		Block 58 Byte		Parameter	Variable type	Mne	Comments
	1		2		8-bit US		Block length
1	57	1	58		8-bit US		Block identification
		2	0 ... 1	CTRL	8-bit US	ISC	0 = stop; 1 = start / run
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.4.3 *cycle* frame

Read parameters
Transmit: Block 59
Receive: Block 60

Transmit parameters
Transmit: Block 60

Block 59 Byte		Block 60 Byte		Parameter	Variable type	Mne	Comments
	1		8		8-bit US		Block length
1	59	1	60		8-bit US		Block identification
		2	0 ... 3	FUNCT	8-bit US	CFU	0 = Cycle; 1 = Adjust 4 = Offset measure
		3	0 ... 1	MODE	8-bit US	CYM	0 = Mono; 1 = Multi
		4	0 ... LSB	CYCLES	16-bit US	CYS	0 = Repeat 1 ... 10,000 cycles
		5	... 10,000 MSB	"			
		6	0 ... 63	BEGIN	8-bit US	CBE	
		7	0 ... 63	END	8-bit US	CEN	
		8	0 ... 3	TRIG	8-bit US	CTR	0 = Internal; 1 = Ext-Auto 2 = Ext-standard; 3 = Ext-Sngl
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

Run Time (watch)

Read parameters
Transmit: Block 61
Receive: Block 62

Block 61 Byte		Block 62 Byte		Parameter	Variable type	Mne	Comments
	1		6		8-bit US		Block length
1	61	1	62		8-bit US		Block identification
		2	0 ... LSB	Watch	32-bit US	CWA	Cycle run time in ms
		3	"	"			
		4	"	"			
		5	... 2^{32} -1 MSB	"			
		6	0 ... 1		8-bit US		0 = LAP off; 1 = LAP on automatically Run Time transmission
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

Adjust parameter

Read parameters
Transmit: Block 63
Receive: Block 64

Transmit parameters
Transmit: Block 64

Block 63 Byte		Block 64 Byte		Parameter	Variable type	Mne	Comments
	1		2		8-bit US		Block length
1	63	1	64		8-bit US		Block identification
		2	0 ... 1	ADJ-TYP	8-bit US	CCF	0 = coarse adjustment 1 = fine adjustment
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

Cycle control parameters (operation state)

Read parameters Transmit: Block 65 Receive: Block 66	**Transmit parameters** Transmit: Block 66			
Block 65	**Block 66**	**Parameter**	**Variable type**	**Mne**	**Comments**
Byte	**Byte**				
1	2		8-bit US		Block length
1 65	1 66		8-bit US		Block identification
	2 0 ... 2	RUN / HALT	8-bit US	CRU	0 = stop; 1 = start 2 = job start (auto status)
Check sum LSB MSB	Check sum LSB MSB		16-bit US		Check sum

Job-Start: The measurement cycle is started. When the cyc le (measurement job) has been completed, the QC 422 Quadrupole Controller replies to the interface with *error* / STATUS Frame (see section 6.5.2.8).

6.5.4.4 *filam* frame

Filament control parameter

Read parameters Transmit: Block 67 Receive: Block 68	**Transmit parameters** Transmit: Block 68			
Block 67	**Block 68**	**Parameter**	**Variable type**	**Mne**	**Comments**
Byte	**Byte**				
1	2		8-bit US		Block length
1 67	1 68		8-bit US		Block identification
	2 0 ... 1	Fila-Emi	8-bit US	FIE	0 = off; 1 = on
Check sum LSB MSB	Check sum LSB MSB		16-bit US		Check sum

6.5.5 Group of measured values not defined in measurement channels

6.5.5.1 TOTAL frame

Pirani data (measured values)

Read parameters
Transmit: Block 101
Receive: Block 102

Block 101 Byte		Block 102 Byte		Para-meter	Variable type	Mne	Comments
	1		11		8-bit US		Block length
1	101	1	102		8-bit US		Block identification
		2	0 ... 3	Pirani	8-bit US	TPI	Status of Pirani meas. circuit 1: 0 = measured data ok 1 = outrange situation (too high) 2 = outrange situation (too low) 3 = sensor failure
		3	0 ... 3	"	8-bit US		Status of Pirani meas. circuit 2: 0 = measured data ok 1 = outrange situation (too high) 2 = outrange situation (too low) 3 = sensor failure
		4	according to IEEE 754	"	FLOAT		Measured value Pirani 1 [mbar]
		5		"			(Total pressure)
		6		"			
		7		"			
		8	according to IEEE 754	"	FLOAT		Measured value Pirani 2 [mbar
		9		"			(Total pressure)
		10		"			
		11		"			
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Cold cathode data (measured values)

Read parameters
Transmit: Block 103
Receive: Block 104

Block 103 Byte		Block 104 Byte		Para-meter	Variable type	Mne	Comments
	1		7		8-bit US		Block length
1	103	1	104		8-bit US		Block identification
		2	0 ... 1	Penning	8-bit US	TPE	0 = Circuit disabled 1 = Circuit enabled
		3	0 ... 4	"	8-bit US		Status cold cathode circuit: 0 = Measured data ok 1 = outrange situation (too high) 2 = outrange situation (too low) 3 = sensor failure 4 = sensor off
		4	according to IEEE 754	"	FLOAT		Cold cathode measured value
		5		"			[mbar] (Total pressure)
		6		"			
		7		"			
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.5.2 ANALOG frame

Analog input measured data (single channel)

Read parameters
Transmit: Block 105
Receive: Block 106

Block 105 Byte		Block 106 Byte		Parameter	Variable type	Mne	Comments
	2		6		8-bit US		Block length
1	105	1	106		8-bit US		Block identification
2	0 ... 15	2	0 ... 15	A-Input	8-bit US	AIN	AI channel number
		3	0	"	8-bit US		GAP (empty byte)
		4	-2048 ... LSB	"	16-bit S		Voltage: 0 ... ±10.24 V Resolution = 5 mV/LSB
		5	... +2047 MSB	"			
		6	0		8-bit US		GAP (empty byte)
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Analog output data (single channel)

Read parameters
Transmit: Block 107
Receive: Block 108

Transmit parameters
Transmit: Block 108

Block 107 Byte		Block 108 Byte		Parameter	Variable type	Mne	Comments
	2		6		8-bit US		Block length
1	107	1	108		8-bit US		Block identification
2	1 ... 12	2	1 ... 12	A-Output	8-bit US	AOU	AO channel number
		3	0		8-bit US		GAP (empty byte)
		4	-2048 ... LSB	"	16-bit S		Voltage: 0 ... ±10.24 V Resolution = 5 mV/LSB
		5	... +2047 MSB	"			
		6	0		8-bit US		GAP (empty byte)
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Note

AO channel number 0 is not used to prevent confusion with the sequential out - put on the QMS 420 and because of the lettering on the AO connector (CHANNEL 1...12).

6.5.5.3 *trip* STATUS frame

Switch function statuses (block operation)

Read parameters
Transmit: Block 109
Receive: Block 110

Block 109 Byte		Block 110 Byte		Para-meter	Variable type	Mne	Comments
	1		17		8-bit US		Block length
1	109	1	110		8-bit US		Block identification
		2	0 ... 255	T-State	8-bit US	-	Switching function A: Bit 0.. 7: 0 = passive 1 = active
		3	0 ... 255	"	8-bit US		Bit 8..15: 0 = passive 1 = active
		4	0 ... 255	"	8-bit US		Bit 16..23: 0 = passive 1 = active
		5	0 ... 255	"	8-bit US		Bit 24..31: 0 = passive 1 = active
		6	0 ... 255	"	8-bit US		Bit 32..39: 0 = passive 1 = active
		7	0 ... 255	"	8-bit US		Bit 40..47: 0 = passive 1 = active
		8	0 ... 255	"	8-bit US		Bit 48..55: 0 = passive 1 = active
		9	0 ... 255	"	8-bit US		Bit 56..63: 0 = passive 1 = active
		10	0 ... 255	"	8-bit US		Switching function B: Bit 0.. 7: 0 = passive 1 = active
		11	0 ... 255	"	8-bit US		Bit 8..15: 0 = passive 1 = active
		12	0 ... 255	"	8-bit US		Bit 16..23: 0 = passive 1 = active
		13	0 ... 255	"	8-bit US		Bit 24..31: 0 = passive 1 = active
		14	0 ... 255	"	8-bit US		Bit 32..39: 0 = passive 1 = active
		15	0 ... 255	"	8-bit US		Bit 40..47: 0 = passive 1 = active
		16	0 ... 255	"	8-bit US		Bit 48..55: 0 = passive 1 = active
		17	0 ... 255	"	8-bit US		Bit 56..63: 0 = passive 1 = active
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

Switching function statuses (single bit operation)

Read parameters
Transmit: Block 111
Receive: Block 112

Block 111 Byte		Block 112 Byte		Para-meter	Variable type	Mne	Comments
	2		4		8-bit US		Block length
1	111	1	112		8-bit US		Block identification
2	0 ... 63	2	0 ... 63	channel	8-bit US	SPC	Selected parameter channel
		3	0 ... 1	T-State	8-bit US	TST	Switching function A: 0 = passive 1 = active
		4	0 ... 1	"	8-bit US		Switching function B: 0 = passive 1 = active
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

6.5.5.4 EMIS frame

Read parameters
Transmit: Block 113
Receive: Block 114

Block 113 Byte		Block 114 Byte		Parameter	Variable type	Mne	Comments
	1		3		8-bit US		Block length
1	113	1	114		8-bit US		Block identification
		2	0 ... LSB	EMI-CUR	16-bit US	ECU	125 Emission current display 0 ... 20,000 µA
		3	... 20,000 MSB	"			
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Note

To be able to output the emission current value, the unit must be switched to emission current display (see section 6.5.4.2)

6.5.5.5 Offset-Value frame

Read parameters
Transmit: Block 119
Receive: Block 120

Transmit parameters
Transmit: Block 120

Block 119 Byte		Block 120 Byte		Parameter	Variable type	Mne	Comments
	1		47		8-bit US		Block length
1	119	1	120		8-bit US		Block identification
		2	-32,768 ... LSB	OSET-F1	16-bit S	AOF	Offset Faraday E-05
		3	... 32,767 MSB	"			
		4	-32,768 ... LSB	OSET-F2	16-bit S	AOF	Offset Faraday E-06
		5	... 32,767 MSB	"			
		6	-32,768 ... LSB	OSET-F3	16-bit S	AOF	Offset Faraday E-07
		7	... 32,767 MSB	"			
		:	:				:
		16	-32,768 ... LSB	OSET-F8	16-bit S	AOF	Offset Faraday E-12
		17	... 32,767 MSB	"			
		18	-32,768 ... LSB	OSET-N1	16-bit S	AOF	Offset SEM E-05
		19	... 32,767 MSB	"			
		20	-32,768 ... LSB	OSET-N2	16-bit S	AOF	Offset SEM E-06
		21	... 32,767 MSB	"			
		22	-32,768 ... LSB	OSET-N3	16-bit S	AOF	Offset SEM E-07
		23	... 32,767 MSB	"			
		:	:				:
		32	-32,768 ... LSB	OSET-N8	16-bit S	AOF	Offset SEM E-12
		33	... 32,767 MSB	"			
		34	0		16-bit S		GAP (empty byte)
		35	0				
		36	0		16-bit S		GAP (empty byte)
		37	0				
		:	:				:
		46	0		16-bit S		GAP (empty byte)
		47	0				
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Note

Transmission of block 120 sets all offset values to (Clear).

Signal range: -10.240 V ... +10.240 V
Resolution: 312.5 µV / LSB

Conversion: $$I_{Offset} = \frac{Value\ OSET - xx}{32000} \times Range$$

6.5.6 Group of measured data defined in channels (cycle data)

No measured data are output when the cycle is not running (»halt«).

6.5.6.1 MEASURED DATA frame

Measured data buffer contents counter

Read parameters
Transmit: Block 131
Receive: Block 132

Block 131 Byte		Block 132 Byte		Para-meter	Variable type	Mne	Comments
	1		11		8-bBit US		Block length
1	131	1	132		8-bit US		Block identification
		2	0 ... LSB	B-Counter	32-bit US	MBC	Contents counter for measured data buffer = 0 ... 128 k
		3	"	"			
		4	"	"			
		5	... 131,071 MSB	"			
		6	0 ... LSB	M-Counter	32-bit US		Number of measured values for the type of data defined = 0 ... 128 k
		7	"	"			
		8	"	"			
		9	... 131,071 MSB	"			
		10	0 ... 1	M-State	8-bit US		0 = Measurement in progress 1 = Measurement finished
		11	0 ... 16	M-Data Type	8-bit US		0 = No available block 1 = Data type SCAN, STAIR-Integer 2 = Data type PEAK-Integer 7 = Data type SCAN-Float 8 = Data type PEAK-Float 9 = Data type SAMPLE-Float 10 = Data type ADJUST-Float 13 = Data type PIRANI 14 = Data type PENNING 15 = Datatype A-INPUT 16 = Data type Run Time
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

Note

Data type Integer:
For Fix range in the SCAN, STAIR, and PEAK modes and for the detector types FARAD, SEM, and EXTERN.

Data type Float:
For Auto range in all operating modes and for the detector types FARAD, SEM, and IONCOUNT.

Measured data when no block is available

Read parameters
Transmit: Block 133
Receive: Block 134

Block 133 Byte		Block 134 Byte		Parameter	Variable type	Mne	Comments
	1		6		8-bit US		Block length
1	133	1	134		8-bit US		Block identification
		2	0 LSB	Header	16-bit US	MDB	Block counter
		3	MSB	"			
		4	0 ... 63	"	8-bit US		Measurement channel number
		5	0	"	8-bit US		No block available
		6	0		8-bit US		GAP (empty byte)
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.6.2 Data type Integer

SCAN, STAIR Integer measurement data

Read parameters
Transmit: Block 133
Receive: Block 134

Block 133 Byte		Block 134 Byte		Parameter	Variable type	Mne	Comments
	1		7 ... max. 245		8-bit US		Block length
1	133	1	134		8-bit US		Block identification
		2	0 ... LSB	Header	16-bit US	MDB	Block counter
		3	... 1023 MSB	"			
		4	0 ... 63	"	8-bit US		Measurement channel number
		5	1	"	8-bit US		Data type SCAN, STAIR Integer
		6	0 ... LSB	Data	16-bit S		Intensity: 0 ... 10.24 V Resolution = 312.5 µV/LSB
		7	... 32,767 MSB	"			
		8	0 ... LSB	"	16-bit S		Intensity: 0 ... 10.24 V Resolution = 312.5 µV/LSB
		9	... 32,767 MSB	"			
		:	:				:
		max 244	0 ... LSB	"	16-bit S		Intensity: 0 ... 10.24 V Resolution = 312.5 µV/LSB
		245	... 32,767 MSB	"			
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

Note

The number of measurement values per mass is defined in the Steps parameter in the *mass* frame (see section 6.5.1.3)

PEAK Integer measurement data

Read parameters
Transmit: Block 133
Receive: Block 134

Block 133 Byte		Block 134 Byte		Para-meter	Variable type	Mne	Comments
	1		9 ... max. 245		8-bit US		Block length
1	133	1	134		8-bit US		Block identification
		2	0 ... LSB	Header	16-bit US	MDB	Block counter
		3	... 1023 MSB	"			
		4	0 ... 63	"	8-bit US		Measurement channel number
		5	2	"	8-bit US		Data type for electrometer operation PEAK
		6	0 ... LSB	Data	16-bit US		Mass number: 0 ... 1023 (2048) Resolution = $^{1}/_{64}$ ($^{1}/_{32}$) amu/Bit
		7	... 65,535 MSB	"			
		8	0 ... LSB	"	16-bit S		Intensity: 0 ... 10.24 V Resolution = 312.5 µV/LSB
		9	... 32,767 MSB	"			
		10	0 ... LSB	"	16-bit US		Mass number: 0 ... 1023 (2048) Resolution = $^{1}/_{64}$ ($^{1}/_{32}$) amu/Bit
		11	... 65,535 MSB	"			
		12	0 ... LSB	"	16-bit S		Intensity: 0 ... 10.24 V Resolution = 312.5 µV/LSB
		13	... 32,767 MSB	"			
		:	:				:
		max 242	0 ... LSB	"	16-bit US		Mass number: 0 ... 1023 (2048) Resolution = $^{1}/_{64}$ ($^{1}/_{32}$) amu/Bit
		243	... 65,535 MSB	"			
		244	0 ... LSB	"	16-bit S		Intensity: 0 ... 10.24 V Resolution = 312.5 µV/LSB
		245	... 32,767 MSB	"			
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.6.3 Data type Floating point

for Auto range or ion counter

SCAN, STAIR Float measuement data

Read parameters
Transmit: Block 133
Receive: Block 134

Block 133 Byte		Block 134 Byte		Para-meter	Variable type	Mne	Comments
	1		9 ... max. 245		8-bit US		Block length
1	133	1	134		8-bit US		Block identification
		2	0 ... LSB	Header	16-bit US	MDB	Block counter
		3	... 1023 MSB	"			
		4	0 ... 63	"	8-bit US		Measurement channel number
		5	7	"	8-bit US		Data type SCAN, STAIR-Float
		6	gemäss IEEE 754	Data	FLOAT		Intensity
		7		"			
		8		"			
		9		"			
		10	according to IEEE 754	"	FLOAT		Intensity
		11		"			
		12		"			
		13		"			
		:	:				:
		max 242	according to IEEE 754	"	FLOAT		Intensity
		243		"			
		244		"			
		245		"			
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

Note

The number of measurement values per mass is defined in the Steps parameter in the *mass* frame (see section 6.5.1.3)

PEAK Float measurement data

Read parameters
Transmit: Block 133
Receive: Block 134

Block 133 Byte		Block 134 Byte		Para-meter	Variable type	Mne	Comments
	1		11 ... max. 245		8-bit US		Block length
1	133	1	134		8-bit US		Block identification
		2	0 ... LSB	Header	16-bit US	MDB	Block counter
		3	... 1023 MSB	"			
		4	0 ... 63	"	8-bit US		Measurement channel number
		5	8	"	8-bit US		Data type PEAK-Float
		6	0 ... LSB	Data	16-bit US		Mass number: 0 ... 1023 (2048) Resolution = $^1/_{64}$ ($^1/_{32}$) amu/Bit
		7	... 65,535 MSB	"			
		8	according to IEEE 754	"	FLOAT		Intensity
		9		"			
		10		"			
		11		"			
		12	0 ... LSB	"	16-bit US		Mass number: 0 ... 1023 (2048) Resolution = $^1/_{64}$ ($^1/_{32}$) amu/Bit
		13	... 65,535 MSB	"			
		14	according to IEEE 754	"	FLOAT		Intensity
		15		"			
		16		"			
		17		"			
		:	:				:
		max 240	0 ... LSB	"	16-bit US		Mass number: 0 ... 1023 (2048) Resolution = $^1/_{64}$ ($^1/_{32}$) amu/Bit
		241	... 65,535 MSB	"			
		242	according to IEEE 754	"	FLOAT		Intensity
		243		"			
		244		"			
		245		"			
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

SAMPLE Float measurement data

Read parameters
Transmit: Block 133
Receive: Block 134

Block 133 Byte		Block 134 Byte		Para-meter	Variable type	Mne	Comments
	1		9 ... max. 245		8-bit US		Block length
1	133	1	134		8-bit US		Block identification
		2	0 ... LSB	Header	16-bit US	MDB	Block counter
		3	... 1023 MSB	"			
		4	0 ... 63	"	8-bit US		Start channel number (Begin)
		5	9	"	8-bit US		Data type SAMPLE-Float
		6	according to IEEE 754	Data	FLOAT		Intensity
		7		"			
		8		"			
		9		"			
		10	according to IEEE 754	"	FLOAT		Intensity
		11		"			
		12		"			
		13		"			
		:	:				:
		max 242	according to IEEE 754	"	FLOAT		Intensity
		243		"			
		244		"			
		245		"			
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

ADJUST Float measurement data

Read parameters
Transmit: Block 133
Receive: Block 134

Block 133 Byte		Block 134 Byte		Para-meter	Variable type	Mne	Comments
	1		13 ... max. 245		8-bit US		Block length
1	133	1	134		8-bit US		Block identification
		2	0 ... LSB	Header	16-bit US	MDB	Block counter
		3	... 1023 MSB	"			
		4	0 ... 63	"	8-bit US		Start channel number (Begin)
		5	10	"	8-bit US		Data type ADJUST-Float
		6	0 ... 31	Data	16-bit US		Status report Bit 0: 0 = good 1 = mass too low (coarse adjust) 1 = no peak found (fine adjust) Bit 1: 0 = good 1 = Mass too high Bit 2: 0 = good 1 = Intensity didn't drop to 66% Bit 3: 0 = good 1 = intensity out-range Bit 4: 0 = good 1 = intensity lower than Threshold
		7		"			
		8	0 ... LSB	"	16-bit US		Mass number: 0 ... 1023 (2048) Resolution = $^1/_{64}$ ($^1/_{32}$) amu/Bit
		9	... 65,535 MSB	"			
		10	according to IEEE 754	"	FLOAT		Intensity
		11		"			
		12		"			
		13		"			
		14	0 ... 31	Data	16-bit US		Status report
		15		"			
		16	0 ... LSB	"	16-bit US		Mass number: 0 ... 1023 (2048) Resolution = $^1/_{64}$ ($^1/_{32}$) amu/Bit
		17	... 65,535 MSB	"			
		18	according to IEEE 754	"	FLOAT		Intensity
		19		"			
		20		"			
		21		"			
		:	:				:
		max 238	0 ... 31	Data	16-bit US		Status report
		239		"			
		240	0 ... LSB	"	16-bit US		Mass number: 0 ... 1023 (2048) Resolution = $^1/_{64}$ ($^1/_{32}$) amu/Bit
		241	... 65,535 MSB	"			
		242	according to IEEE 754	"	FLOAT		Intensity
		243		"			
		244		"			
		245		"			
	Check sum LSB MSB		Check sum LSB MSB		16-bit US		Check sum

6.5.6.4 Total pressure measured data from Pirani measurement

Also refer to section 6.5.5.1

Read parameters
Transmit: Block 133
Receive: Block 134

Block 133 Byte		Block 134 Byte		Parameter	Variable type	Mne	Comments
	1		15		8-bit US		Block length
1	133	1	134		8-bit US		Block identification
		2	0 ... LSB	Header	16-bit US	MDB	Block counter
		3	... 1023 MSB	"			
		4	0 ... 63	"	8-bit US		Measurement channel number
		5	13	"	8-bit US		Data type PIRANI
		6	0 ... 3	Data	8-bit US		Status of Pirani meas. circuit 1: 0 = measured data ok 1 = outrange situation (too high) 2 = outrange situation (too low) 3 = sensor failure
		7	0 ... 3	"	8-bit US		Status of Pirani meas. circuit 2: 0 = measured data ok 1 = outrange situation (too high) 2 = outrange situation (too low) 3 = sensor failure
		8	according to IEEE 754	"	FLOAT		Measured value Pirani 1 [mbar]
		9		"			(Total pressure)
		10		"			
		11		"			
		12	according to IEEE 754	"	FLOAT		Measured value Pirani 2 [mbar]
		13		"			(Total pressure)
		14		"			
		15		"			
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.6.5 Total pressure measured data from cold cathode measurement

Also refer to section 6.5.5.1

Read parameters
Transmit: Block 133
Receive: Block 134

Block 133 Byte		Block 134 Byte		Parameter	Variable type	Mne	Comments
	1		11		8-bit US		Block length
1	133	1	134		8-bit US		Block identification
		2	0 ... LSB	Header	8-bit US	MDB	Block counter
		3	... 1023 MSB	"			
		4	0 ... 63	"	8-bit US		Measurement channel number
		5	14	"	8-bit US		Data type PENNING
		6	0 ... 4	Data	16-bit US		Status Kaltkatoden-Messkreis: 0 = measured data ok 1 = outrange situation (too high) 2 = outrange situation (too low) 3 = sensor failure 4 = sensor off
		7		"			
		8	according to IEEE 754	"	FLOAT		Cold cathode measured value
		9		"			[mbar] (Total pressure)
		10		"			
		11		"			
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.6.6 Measured data from analog input

Also refer to section 6.5.5.2

Read parameters
Transmit: Block 133
Receive: Block 134

Block 133 Byte		Block 134 Byte		Parameter	Variable type	Mne	Comments
	1		9		8-bit US		Block length
1	133	1	134		8-bit US		Block identification
		2	0 ... LSB	Header	8-bit US	MDB	Block counter
		3	... 1023 MSB	"			
		4	0 ... 63	"	8-bit US		Measurement channel number
		5	15	"	8-bit US		Data type A-INPUT
		6	0 ... 15	Data	16-bit US		AI channel number
		7		"			
		8	0 ... LSB	"	16-bit S		Voltage: 0 ... ±10.24 V Resolution = 5 mV/LSB
		9	2^{12}-1 MSB	"			
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

6.5.6.7 Run Time measured data

Read parameters
Transmit: Block 133
Receive: Block 134

Block 133 Byte		Block 134 Byte		Parameter	Variable type	Mne	Comments
	1		9		8-bit US		Block length
1	133	1	134		8-bit US		Block identification
		2	0 ... LSB	Header	8-bit US	MDB	Block counter
		3	... 1023 MSB	"			
		4	0 ... 63	"	8-bit US		Measurement channel number
		5	16	"	8-bit US		Data type Run Time
		6	0 ... LSB	Data	32-bit US		Measurement cycle time
		7	"	"			
		8	"	"			
		9	... 2^{32} -1 MSB	"			
	Check sum LSB		Check sum LSB		16-bit US		Check sum
	MSB		MSB				

7 LAN interface

7.1 ARCNET® network

ARCNET® is a 'Local area network' with 'Token passing protocol' (Token Bus).

Star topology with fibre optics connections (LWL) is used in the QMS 422 and QMI 422 quadrupole mass spectrometer control units. This topology allows for simple point-to-point connections. If an optical hub is used (e.g. OH 421 optical hub), it is additionally possible to set up networks with up to a maximum of 255 stations (nodes).

Each station has its own identification address (ID) which can be allocated in the network without hierarchical assignment or arrangement. A node address may only be used once.

7.1.1 Token Passing Protocol

Network access is controlled by a "Token" which is passed from one station to another in the network. The station with the "Token" can dispatch a data packet to any other station. After dispatching the data packet, the station must pass on the "Token" to the station with the next highest ID (→ Logical ring organisation).

7.1.2 Reconfiguring the network

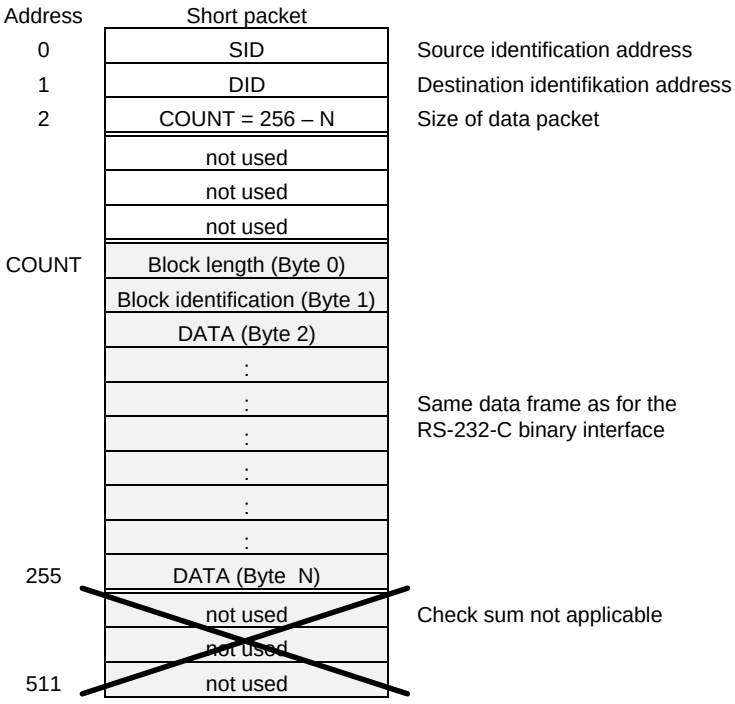
The ARCNET is reconfigured automatically every time the network is started or when a station is added or removed during operation.

7.2 Data transmission

Format of data packet

When the QMS 422 is used, data is passed only in 'Short packet' format (255 bytes). The same data frames as for the RS–232–C binary interface are used as data packets (see section). The entire data packet is incorporated in the ARCNET data packet with the exception of the check sum which is annexed to the frame.

ARCNET data packet



7.3 PC interface

BALZERS offers the OPA 200 ARCNET® Network Controller Board as pc interface for the AT/ISA bus (see [2] and [1]).

Appendix

A Program examples

SCAN measurement with the RS-232-C interface (ASCII format)

```
10 REM ************************************************************************
20 REM  AVMQMSE.BAS       Measured value query QMS 422        18.05.1997 soro
30 REM
40 REM  Creation Date : 2.November 1996
50 REM  Author        : R. Sonderegger  Abt. KARE
60 REM  Version       : V00.01
70 REM  Modification  :
80 REM  Contents      :
90 REM ************************************************************************
100 CLS : ACK$ = CHR$(6): ENQ$ = CHR$(5): LF$ = CHR$(10): ETX$ = CHR$(3)
110 REM ***<general>**<config>**<CTRL>*************************************
120 OPEN "COM1:19200,N,8,,CS,DS,CD" FOR RANDOM AS #1
130 REM opens COM1: with 19200 bps, no parity and eight data bits.
140 REM CTS, DSR and CD are not checked.
150 COM(1) ON: REM Aktiviert Ereignisverfolgung
160 ON COM(1) GOSUB 400
170 CBR% = 5: CMOACK% = 0: GOTO 230
180 OPEN "COM1:9600,N,8,,CS,DS,CD" FOR RANDOM AS #1: GOTO 230
190 OPEN "COM1:4800,N,8,,CS,DS,CD" FOR RANDOM AS #1: GOTO 230
200 OPEN "COM1:2400,N,8,,CS,DS,CD" FOR RANDOM AS #1: GOTO 230
210 OPEN "COM1:1200,N,8,,CS,DS,CD" FOR RANDOM AS #1: GOTO 230
220 OPEN "COM1:300,N,8,,CS,DS,CD" FOR RANDOM AS #1
230 PRINT #1, ETX$; : REM clearing the input buffer of the QMS422
240 PRINT #1, "CMO,1": REM send measurement data or parameters in ASCII strings
250 FOR J = 1 TO 4000: NEXT J' delay four seconds
260 IF CMOACK% = 128 THEN GOTO 370
270 CLOSE
280 IF CBR% = 0 THEN CBR% = 6
290 CBR% = CBR% - 1
300 IF CBR% = 4 THEN PRINT "check 9600 BAUD": GOTO 180
310 IF CBR% = 3 THEN PRINT "check 4800 BAUD": GOTO 190
320 IF CBR% = 2 THEN PRINT "check 2400 BAUD": GOTO 200
330 IF CBR% = 1 THEN PRINT "check 1200 BAUD": GOTO 210
340 IF CBR% = 0 THEN PRINT "check  300 BAUD": GOTO 220
350 CBR% = 5: PRINT "check 19200 BAUD"
360 GOTO 120
370 IF CBR% = 5 THEN GOTO 410
380 PRINT #1, "CBR,5": PRINT "send baud rates 19200 BAUD"
390 CLOSE : GOTO 120
400 CMOACK% = 128: RETURN
410 COM(1) OFF
420 C$ = INPUT$(LOC(1), #1): REM clearing the input buffer of the PC
430 PRINT "19200 BAUD"
440 REM ***<general>**<config>**<SYSTEM>**********************************
450 INPUT "defines the system configuration ? (Y/N)"; IN$
460 IF IN$ = "n" OR IN$ = "N" THEN GOTO 670
470 IF IN$ = "y" OR IN$ = "Y" THEN GOTO 490
480 GOTO 450
490 PRINT #1, "SQA": REM query for type of analyzer
500 GOSUB 1380: IF RETRY% > 0 THEN GOTO 490' communications protocol
510 PRINT #1, ENQ$; : REM request for data transmission
520 LINE INPUT #1, SQA$: REM reading the type of analyzer
530 IF SQA$ = "0" THEN GOTO 620
540 PRINT #1, "SQA,0": PRINT "SQA,0   type of analyzer QMA 125"
550 GOSUB 1380: IF RETRY% > 0 THEN GOTO 540' communications protocol
560 INPUT "mass range 200 (Y/N)"; IN$
570 SMR$ = "0": REM mass range 100
580 IF IN$ = "y" OR IN$ = "Y" THEN SMR$ = "1"
590 PRINT #1, "SMR," + SMR$
600 PRINT "SMR,"; SMR$; "QMA125 mass range 100 or 200"
610 GOSUB 1380: IF RETRY% > 0 THEN GOTO 590' communications protocol
620 INPUT "type of ion detection SEM (Y/N)"; IN$
630 SDT$ = "0": REM ion detection FARADAY
640 IF IN$ = "y" OR IN$ = "Y" THEN SDT$ = "1"
650 PRINT #1, "SDT," + SDT$: PRINT "SDT,"; SDT$; " ion detection SEM or FARADAY"
660 GOSUB 1380: IF RETRY% > 0 THEN GOTO 650' communications protocol
670 INPUT "vacuum <=10^4 mbar (Y/N)"; IN$
680 IF IN$ = "n" OR IN$ = "N" THEN GOTO 790
690 IF IN$ = "y" OR IN$ = "Y" THEN GOTO 710
700 GOTO 670
710 PRINT #1, "SEM,1": PRINT "SEM,1   enable the SEM high voltage"
720 GOSUB 1380: IF RETRY% > 0 THEN GOTO 710' communications protocol
730 PRINT #1, "FIE,1": PRINT "FIE,1   enable the emission"
```

```
740 GOSUB 1380: IF RETRY% > 0 THEN GOTO 730' communications protocol
750 PRINT #1, "TSI,0": PRINT "TSI,0   simulated test spectrum OFF"
760 GOSUB 1380: IF RETRY% > 0 THEN GOTO 750' communications protocol
770 TIMERTEXT$ = " SCAN-FIR mass spectrum mass 0-100          "
780 GOTO 820
790 PRINT #1, "TSI,1": PRINT "TSI,1   simulated test spectrum INTERN"
800 GOSUB 1380: IF RETRY% > 0 THEN GOTO 790' communications protocol
810 TIMERTEXT$ = " SCAN !! simulated test spectrum INTERN !!  "
820 REM ***<operation>**<cycle>*********************************************
830 PRINT #1, "CFU,0": PRINT "CFU,0   measurement operation CYCLE"
840 GOSUB 1380: IF RETRY% > 0 THEN GOTO 830' communications protocol
850 PRINT #1, "CYM,0": PRINT "CYM,0   single channel cycle MONO"
860 GOSUB 1380: IF RETRY% > 0 THEN GOTO 850' communications protocol
870 PRINT #1, "CYS,1": PRINT "CYS,1   number of measurement cycles"
880 GOSUB 1380: IF RETRY% > 0 THEN GOTO 870' communications protocol
890 REM ***<channels>******************************************************
900 PRINT #1, "SPC,6": PRINT "SPC,6   selected parameter channel"
910 GOSUB 1380: IF RETRY% > 0 THEN GOTO 900' communications protocol
920 PRINT #1, "SDT": REM ion detection SEM or FARADAY
930 GOSUB 1380: IF RETRY% > 0 THEN GOTO 920' communications protocol
940 PRINT #1, ENQ$; : INPUT #1, SDT$' request for data transmission
950 PRINT #1, "DTY,"; SDT$: PRINT "DTY,"; SDT$; " ion detection SEM or FARADAY"
960 GOSUB 1380: IF RETRY% > 0 THEN GOTO 950' communications protocol
970 PRINT #1, "MMO,1": PRINT "MMO,1   scan with FIR filter"
980 GOSUB 1380: IF RETRY% > 0 THEN GOTO 970' communications protocol
990 PRINT #1, "MSD,6": PRINT "MSD,6   measurement speed per amu 50 ms"
1000 GOSUB 1380: IF RETRY% > 0 THEN GOTO 990' communications protocol
1010 PRINT #1, "ARA,-9": PRINT "ARA,-9  electrometer range"
1020 GOSUB 1380: IF RETRY% > 0 THEN GOTO 1010' communications protocol
1030 PRINT #1, "MST,0": PRINT "MST,0   points per mass 1/16"
1040 GOSUB 1380: IF RETRY% > 0 THEN GOTO 1030' communications protocol
1050 PRINT #1, "MFM,0": PRINT "MFM,0   first mass"
1060 GOSUB 1380: IF RETRY% > 0 THEN GOTO 1050' communications protocol
1070 PRINT #1, "MWI,100": PRINT "MWI,100 width of a scan"
1080 GOSUB 1380: IF RETRY% > 0 THEN GOTO 1070' communications protocol
1090 REM *** START SCAN ****************************************************
1100 PRINT #1, "CRU,2": PRINT "CRU,2 JOB-RUN the measurement cycle is started!"
1110 GOSUB 1380: IF RETRY% > 0 THEN GOTO 1100' communications protocol
1120 GOSUB 1600: IF LOC(1) = 0 THEN GOTO 1120: REM time display
1130 LINE INPUT #1, ESQ$: REM waiting for measurement job completed
1140 PRINT #1, "MBH": REM query for measured data header
1150 GOSUB 1380: IF RETRY% > 0 THEN GOTO 1140' communications protocol
1160 PRINT #1, ENQ$; : REM request for data transmission
1170 INPUT #1, S%, C%, B%, M%, Z%: REM reading the measured data header
1180 PRINT #1, "MDB": REM query for measured data in scan operation
1190 GOSUB 1380: IF RETRY% > 0 THEN GOTO 1180' communications protocol
1200 REM *** reading the QMS422 measured values ****************************
1210 FOR I% = 1 TO M%' number of peak intensity
1220 GOSUB 1500: REM measured values transmission
1230 SCANDATA = VAL(mdata$): REM peak intensity
1240 REM *** display of measured values *************************************
1250 PRINT USING " MASS:###.##  ######"; I% / 16; SCANDATA;
1260 PRINT STRING$(ABS(SCANDATA) / 200, 219)
1270 GOSUB 1600: REM time display
1280 FOR J = 0 TO 100: NEXT J' display delay 1/10 second
1290 REM *** press any key to stop the screen from scrolling ***************
1300 T$ = INKEY$: IF T$ = "" THEN GOTO 1360
1310 TEMPTEXT$ = TIMERTEXT$
1320 TIMERTEXT$ = " hit the space bar to continue !          "
1330 GOSUB 1600: REM time display
1340 T$ = INKEY$: IF T$ = "" THEN GOTO 1330
1350 TIMERTEXT$ = TEMPTEXT$
1360 NEXT I%
1370 GOTO 1090: REM START SCAN
1380 REM *** communications protocol ****************************************
1390 FOR J = 1 TO 2000: REM waiting for acknowledge
1400 IF LOC(1) >= 3 THEN GOTO 1420
1410 NEXT J
1420 A$ = INPUT$(LOC(1), #1)
1430 IF INSTR(A$, ACK$) THEN GOTO 1480
1440 RETRY% = RETRY% + 1: REM if acknowledge is negative
1450 IF RETRY% <= 8 THEN GOTO 1490
1460 PRINT J; A$; " communications ERROR "; TIME$
1470 GOTO 1690: REM END
1480 RETRY% = 0: REM if acknowledge is positive
1490 RETURN
1500 REM *** measured values transmission ***********************************
1510 mdata$ = "": C$ = INPUT$(LOC(1), #1)'clearing the input buffer of the PC
1520 PRINT #1, ENQ$; : REM request for data transmission
1530 FOR J = 1 TO 2000: REM waiting for data
1540 IF LOC(1) = 0 THEN GOTO 1570
1550 dtemp$ = INPUT$(LOC(1), #1): REM reading the characters
1560 mdata$ = mdata$ + dtemp$
```

```
1570 IF INSTR(mdata$, LF$) THEN GOTO 1590: REM message received
1580 NEXT J
1590 RETURN
1600 REM *** time display ************************************************
1610 Y = CSRLIN: REM saves cursor position
1620 X = POS(0)
1630 LOCATE 25, 1: REM moves cursor to line 25, column 1
1640 PRINT TIMERTEXT$;
1650 LOCATE 25, 47: REM moves cursor to line 25, column 47
1660 PRINT "BALZERS QMS422   "; TIME$; " soro";
1670 LOCATE Y, X: REM restores the old cursor position
1680 RETURN
1690 END
```

MID measurement with the RS-232-C interface (ASCII format)

```
10 REM ***************************************************************
20 REM  MIDQMSE.BAS     Multiple Ion Detecttion QMS 422        1.07.1997 soro
30 REM
40 REM  Creation Date : 2.November 1996
50 REM  Author        : R. Sonderegger  Abt. KARE
60 REM  Version       : V00.01
70 REM  Modification  :
80 REM  Contents      :
90 REM ***************************************************************
100 CLS : ACK$ = CHR$(6): ENQ$ = CHR$(5): LF$ = CHR$(10): ETX$ = CHR$(3)
110 DATA middata(7),mass$(7)
120 MASS$(0) = "H2": MASS$(1) = "He": MASS$(2) = "CH4": MASS$(3) = "H2O":
130 MASS$(4) = "N2+CO": MASS$(5) = "O2": MASS$(6) = "Ar": MASS$(7) = "CO2":
140 REM ***<general>**<config>**<CTRL>************************************
150 OPEN "COM1:19200,N,8,,CS,DS,CD" FOR RANDOM AS #1
160 REM opens COM1: with 19200 bps, no parity and eight data bits.
170 REM CTS, DSR and CD are not checked.
180 COM(1) ON: REM Aktiviert Ereignisverfolgung
190 ON COM(1) GOSUB 430
200 CBR% = 5: CMOACK% = 0: GOTO 260
210 OPEN "COM1:9600,N,8,,CS,DS,CD" FOR RANDOM AS #1: GOTO 260
220 OPEN "COM1:4800,N,8,,CS,DS,CD" FOR RANDOM AS #1: GOTO 260
230 OPEN "COM1:2400,N,8,,CS,DS,CD" FOR RANDOM AS #1: GOTO 260
240 OPEN "COM1:1200,N,8,,CS,DS,CD" FOR RANDOM AS #1: GOTO 260
250 OPEN "COM1:300,N,8,,CS,DS,CD" FOR RANDOM AS #1
260 PRINT #1, ETX$; : REM clearing the input buffer of the QMS422
270 PRINT #1, "CMO,1": REM send measurement data or parameters in ASCII strings
280 FOR J = 1 TO 4000: NEXT J' delay four seconds
290 IF CMOACK% = 128 THEN GOTO 400
300 CLOSE
310 IF CBR% = 0 THEN CBR% = 6
320 CBR% = CBR% - 1
330 IF CBR% = 4 THEN PRINT "check 9600 BAUD": GOTO 210
340 IF CBR% = 3 THEN PRINT "check 4800 BAUD": GOTO 220
350 IF CBR% = 2 THEN PRINT "check 2400 BAUD": GOTO 230
360 IF CBR% = 1 THEN PRINT "check 1200 BAUD": GOTO 240
370 IF CBR% = 0 THEN PRINT "check  300 BAUD": GOTO 250
380 CBR% = 5: PRINT "check 19200 BAUD"
390 GOTO 150
400 IF CBR% = 5 THEN GOTO 440
410 PRINT #1, "CBR,5": PRINT "send baud rates 19200 BAUD"
420 CLOSE : GOTO 150
430 CMOACK% = 128: RETURN
440 COM(1) OFF
450 C$ = INPUT$(LOC(1), #1): REM clearing the input buffer of the PC
460 PRINT "19200 BAUD"
470 REM ***<general>**<config>**<SYSTEM>**********************************
480 INPUT "defines the system configuration ? (Y/N)"; IN$
490 IF IN$ = "n" OR IN$ = "N" THEN GOTO 700
500 IF IN$ = "y" OR IN$ = "Y" THEN GOTO 520
510 GOTO 480
520 PRINT #1, "SQA": REM query for type of analyzer
530 GOSUB 1550: IF RETRY% > 0 THEN GOTO 520' communications protocol
540 PRINT #1, ENQ$; : REM request for data transmission
550 LINE INPUT #1, SQA$: REM reading the type of analyzer
560 IF SQA$ = "0" THEN GOTO 650
570 PRINT #1, "SQA,0": PRINT "SQA,0   type of analyzer QMA 125"
580 GOSUB 1550: IF RETRY% > 0 THEN GOTO 570' communications protocol
590 INPUT "mass range 200 (Y/N)"; IN$
600 SMR$ = "0": REM mass range 100
610 IF IN$ = "y" OR IN$ = "Y" THEN SMR$ = "1"
620 PRINT #1, "SMR," + SMR$
630 PRINT "SMR,"; SMR$; "QMA125 mass range 100 or 200"
```

```
640 GOSUB 1550: IF RETRY% > 0 THEN GOTO 620' communications protocol
650 INPUT "type of ion detection SEM (Y/N)"; IN$
660 SDT$ = "0": REM ion detection FARADAY
670 IF IN$ = "y" OR IN$ = "Y" THEN SDT$ = "1"
680 PRINT #1, "SDT," + SDT$: PRINT "SDT,"; SDT$; " ion detection SEM or FARADAY"
690 GOSUB 1550: IF RETRY% > 0 THEN GOTO 680' communications protocol
700 INPUT "vacuum <=10^4 mbar (Y/N)"; IN$
710 IF IN$ = "n" OR IN$ = "N" THEN GOTO 820
720 IF IN$ = "y" OR IN$ = "Y" THEN GOTO 740
730 GOTO 700
740 PRINT #1, "SEM,1": PRINT "SEM,1   enable the SEM high voltage"
750 GOSUB 1550: IF RETRY% > 0 THEN GOTO 740' communications protocol
760 PRINT #1, "FIE,1": PRINT "FIE,1   enable the emission"
770 GOSUB 1550: IF RETRY% > 0 THEN GOTO 760' communications protocol
780 PRINT #1, "TSI,0": PRINT "TSI,0   simulated test spectrum OFF"
790 GOSUB 1550: IF RETRY% > 0 THEN GOTO 780' communications protocol
800 TIMERTEXT$ = " SAMPLE display measurement data as bargraph"
810 GOTO 850
820 PRINT #1, "TSI,1": PRINT "TSI,1   simulated test spectrum INTERN"
830 GOSUB 1550: IF RETRY% > 0 THEN GOTO 820' communications protocol
840 TIMERTEXT$ = " SAMPLE !! simulated MID bargraph INTERN !!  "
850 REM ***<operation>**<cycle>*****************************************
860 PRINT #1, "CFU,0": PRINT "CFU,0   measurement operation CYCLE"
870 GOSUB 1550: IF RETRY% > 0 THEN GOTO 860' communications protocol
880 PRINT #1, "CYM,1": PRINT "CYM,1   cycle MULTI"
890 GOSUB 1550: IF RETRY% > 0 THEN GOTO 880' communications protocol
900 PRINT #1, "CYS,1": PRINT "CYS,1   number of measurement cycles"
910 GOSUB 1550: IF RETRY% > 0 THEN GOTO 900' communications protocol
920 PRINT #1, "CBE,0": PRINT "CBE,0   BEGIN "
930 GOSUB 1550: IF RETRY% > 0 THEN GOTO 930' communications protocol
940 PRINT #1, "CEN,7": PRINT "CEN,7   END"
950 GOSUB 1550: IF RETRY% > 0 THEN GOTO 940' communications protocol
960 REM ***<channels>*************************************************
970 PRINT #1, "SDT": REM ion detection SEM or FARADAY
980 GOSUB 1550: IF RETRY% > 0 THEN GOTO 970' communications protocol
990 PRINT #1, ENQ$; : INPUT #1, SDT$' request for data transmission
1000 DATA 2,4,16,18,28,32,40,44
1010 RESTORE 1000: REM mass 2 ... 28 .... 44
1020 FOR I% = 0 TO 7
1030 PRINT #1, "SPC,"; I%: PRINT "SPC,"; I%; " selected parameter channel"
1040 GOSUB 1550: IF RETRY% > 0 THEN GOTO 1030' communications protocol
1050 PRINT #1, "DTY,"; SDT$: PRINT "DTY,"; SDT$; " ion detection SEM or FARADAY"
1060 GOSUB 1550: IF RETRY% > 0 THEN GOTO 1050' communications protocol
1070 PRINT #1, "MMO,3": PRINT "MMO,3   SAMPLE"
1080 GOSUB 1550: IF RETRY% > 0 THEN GOTO 1070' communications protocol
1090 PRINT #1, "MSD,7": PRINT "MSD,7   measurement speed per amu 100 ms"
1100 GOSUB 1550: IF RETRY% > 0 THEN GOTO 1090' communications protocol
1110 PRINT #1, "ARA,-5": PRINT "ARA,-5  electrometer range"
1120 GOSUB 1550: IF RETRY% > 0 THEN GOTO 1110' communications protocol
1130 PRINT #1, "AMO,2": PRINT "AMO,2  AUTO electrometer range"
1140 GOSUB 1550: IF RETRY% > 0 THEN GOTO 1130' communications protocol
1150 READ M%
1160 PRINT #1, "MFM,"; M%: PRINT "MFM,"; M%; "mass"
1170 GOSUB 1550: IF RETRY% > 0 THEN GOTO 1160' communications protocol
1180 NEXT I%
1190 CLS : C% = 0
1200 REM *** START MID ************************************************
1210 PRINT #1, "CRU,2": LOCATE 1, 1: REM moves cursor to line 1, column 1
1220 C% = C% + 1
1230 PRINT USING "CRU,2 JOB-RUN ###### measurement cycles"; C%: PRINT
1240 GOSUB 1550: IF RETRY% > 0 THEN GOTO 1210' communications protocol
1250 GOSUB 1780: IF LOC(1) = 0 THEN GOTO 1250: REM time display
1260 LINE INPUT #1, ESQ$: REM waiting for measurement job completed
1270 PRINT #1, "MDB": REM query for measured data in scan operation
1280 GOSUB 1550: IF RETRY% > 0 THEN GOTO 1270' communications protocol
1290 REM *** reading the QMS422 measured values ***********************
1300 RESTORE 1000: REM mass 14 16 .... 44
1310 FOR I% = 0 TO 7' number of peak intensity
1320 GOSUB 1670: REM measured values transmission
1330 IF VAL(MDATA$) >= 1! OR VAL(MDATA$) = 0 THEN GOTO 1350
1340 MIDDATA(I%) = VAL(MDATA$): REM peak intensity
1350 REM *** display of measured values ********************************
1360 MIDSUM = 0
1370 FOR J% = 0 TO 7: MIDSUM = MIDSUM + MIDDATA(J%): NEXT J%
1380 INTPR = (MIDDATA(I%) * 100) / MIDSUM
1390 B$ = SPACE$(45)
1400 LSET B$ = STRING$((CINT(ABS(INTPR) / 2)), 219)
1410 READ M%
1420 PRINT USING "\     \:### ##.#####^^^^ "; MASS$(I%); M%; MIDDATA(I%);
1430 PRINT B$; : PRINT USING "###.## %"; INTPR: PRINT
1440 GOSUB 1780: REM time display
1450 REM FOR J = 0 TO 100 NEXT J display delay 1/10 second
1460 REM *** press any key to stop the screen from scrolling ***********
```

```
1470 T$ = INKEY$: IF T$ = "" THEN GOTO 1530
1480 TEMPTEXT$ = TIMERTEXT$
1490 TIMERTEXT$ = " hit the space bar to continue !          "
1500 GOSUB 1780: REM time display
1510 T$ = INKEY$: IF T$ = "" THEN GOTO 1500
1520 TIMERTEXT$ = TEMPTEXT$
1530 NEXT I%
1540 GOTO 1200: REM START SCAN
1550 REM *** communications protocol ***************************************
1560 FOR J = 1 TO 1000: REM waiting for acknowledge
1570 IF LOC(1) >= 3 THEN GOTO 1590
1580 NEXT J
1590 A$ = INPUT$(LOC(1), #1)
1600 IF INSTR(A$, ACK$) THEN GOTO 1650
1610 RETRY% = RETRY% + 1: REM if acknowledge is negative
1620 IF RETRY% <= 8 THEN GOTO 1660
1630 PRINT J; A$; " communications ERROR "; TIME$
1640 GOTO 1870: REM END
1650 RETRY% = 0: REM if acknowledge is positive
1660 RETURN
1670 REM *** measured values transmission **********************************
1680 GOSUB 1780: REM time display (wait "LF")
1690 MDATA$ = "": C$ = INPUT$(LOC(1), #1)'clearing the input buffer of the PC
1700 PRINT #1, ENQ$; : REM request for data transmission
1710 FOR J = 1 TO 2000: REM waiting for data
1720 IF LOC(1) = 0 THEN GOTO 1750
1730 DTEMP$ = INPUT$(LOC(1), #1): REM reading the characters
1740 MDATA$ = MDATA$ + DTEMP$
1750 IF INSTR(MDATA$, LF$) THEN GOTO 1770: REM message received
1760 NEXT J
1770 RETURN
1780 REM *** time display **************************************************
1790 Y = CSRLIN: REM saves cursor position
1800 X = POS(0)
1810 LOCATE 25, 1: REM moves cursor to line 25, column 1
1820 PRINT TIMERTEXT$;
1830 LOCATE 25, 47: REM moves cursor to line 25, column 47
1840 PRINT "BALZERS QMS422   "; TIME$; " soro";
1850 LOCATE Y, X: REM restores the old cursor position
1860 RETURN
1870 END
```

B Modifications with respect to the QMG 421

5.3 Mnemonics

[1] This parameter is not available for the QMG 422.
[2] This parameter of the QMG 422 has changed with respect to the QMG 421.

5.3.1 <channels> group

Function	Parameter	Mnemonics	Page	Meaning
<select>	Measure-Ch	**SMC**	11	Selected measurement channel
	Parameter-Ch	**SPC**	11	Selected parameter channel
<detect>	TYPE	**DTY**	11	Signal source selection
	SEM	**DSE**	11	SEM high voltage for a channel
	QMU-CH	[1]		
	AI-CH / PI-CH	**DAI**	11	Analog input or Pirani channel number
	PHASE	[1]		
	LOCK-IN	[1]		
	PE-CTRL	**DPC**	11	Enable / disable the cold cathode measurement circuit
<mass>	MODE	**MMO**	12	Spectrum scan operation
	FIRST / MASS	**MFM**	12	First mass for a scan / mass number
	WIDTH	**MWI**	12	Width of a scan
	SPEED / DWELL	**MSD**	12	Measurement speed / measurement time
	RESOL	**MRE**	12	Resolution
	THRESH	**MTH** [2]	13	Peak processor threshold
	AVERAGE	**MAV**	13	Number of values used for averaging
	Steps	**MST** [2]	13	Measurement channel resolution (points per mass)
<amplif>	MODE	**AMO**	14	Measurement range switching mode
	RANGE	**ARA** [2]	14	Electrometer range, display range
	RANGE-L	**ARL** [2]	14	Narrowest measurement range for Auto Down
	GAIN	**AGA**	14	Post amplification factor
	FILTER	**AFI**	14	Analog filter setting
	OFFSET	**AOF** [2]	15	Offset correction for the electrometer
	CALIB	**ACA**	15	Calibration factor for the measured value
	P-CAL	**APC**	15	"Break" factor for changing the measurement channel in multichannel operation
	CP-LEV	**ACL**	15	Response threshold for the ion counter preamplifier
	AMP	[1]		
	P-Time	**APT**		"Break" time for measurement channel switchover
<aux>	STATE	**AST**	15	Enable measurement channel
	COPY TO CH	**ACO**	15	Copy the parameter set to channel xx
<output>	AO-CH	**OAC**	16	Analog output channel number
	AO-MODE	**OMO**	16	Analog output mode
	MONITOR	**OAM** [2]	16	Analog output monitor
	LOG-DEC	**ODC**	16	Logarithmic presentation at analog output
	O-RNG	[1]		
<trip>	TYPE	**TTY**	16	Type of switching function
	LEVEL-A	**TLA**	16	Switching function A / lower threshold for switching funct.
	LEVEL-B	**TLB**	16	Switching function B / upper threshold for switching funct.
	DO-A	**TDA**	16	Digital output bit number for switching function A
	DO-B	**TDB**	17	Digital output bit number for switching function B
<integ>	I-Chan	[1]		
	SETPT	[1]		
	DO-I	[1]		
	TRIG	[1]		
	Untergr	[1]		
	INTEG	[1]		

5.3.2 <general> group

Function	Parameter	Mnemonics	Page	Meaning
<di/do>	DIG-IN	**DIS**	17	Digital input status
	DIG-OUT	**DOC**	17	Digital output control
<config> SYSTEM	QMA	**SQA** [2]	17	Type of analyzer
	MASS-R	**SMR**	17	Type of mass range
	DETECT	**SDT**	17	Type of ion detector
	IS-TYP	**SIT**	18	Type of ion source
	OPTION	**SOP** [2]	18	System expansion information
<config> QMS-HW	QMS-HW	**QHW**	18	Pc boards in the QMS 422
<config> INIT	RESET	**IRE**	19	Parameter set (standard / user)
<config> CTRL	MODE	**CMO**	19	Select type of input
	BAUD	**CBR**	19	Transmission speed for the RS 232 C interface
	NODE	**CNA**	19	Node address for the LAN interface
	SEM+FIL	**CSF**	19	SEM and filament supply
<config> SIMUL	SIMUL	**TSI**	19	Simulated test spectrum
<config> TEST	QMS	**TQM**	20	RAM test, EPROM test, program number
	DSP	**TDS**	20	RAM test, EPROM test, program number
<error>	ERROR	**ERR**	20	Error message from QC 422
	Warning	**EWN**	20	Warning from QC 422
	State-QMS	**ESQ**	21	Control unit status (only interface)

5.3.3 <ion source> group

Function	Parameter	Mnemonics	Page	Meaning
<emiss>	EMISS	**EMI**	21	Emission current
	E-PROT	**EPR**	21	Max. filament current
<v1...v6>	V1 IONREF	**V01**	21	Ion source voltage 1
	V2 CATH	**V02**	21	Ion source voltage 2
	V3 FOCUS	**V03**	22	Ion source voltage 3
	V4 F-AXIS	**V04**	22	Ion source voltage 4
	V5 EXTRACT	**V05**	22	Ion source voltage 5
	V6 DEF-I	**V06**	22	Ion source voltage 6
<v7...>	V7	**V07**	22	Ion source voltage 7
	V8	**V08**	22	Ion source voltage 8
	V9 WEHNELT	**V09**	22	Ion source voltage 9
QMU-State	QMU 0...7	[1]		

5.3.4 <operation> group

Function	Parameter	Mnemonics	Page	Meaning
<sem hv>	SEM-VOLTAGE	**SHV**	22	Common SEM high voltage
<sem>	Control	**SEM**	23	Enable / disable the SEM high voltage
<ion src>	MODE	**ISM**	23	Type of ion source operation
	TYPE	**ITY**	23	Type of ion source
	FILAM	**IFI**	23	Filament change
	FIL1	**IS1**	23	Ion source set number for Filament 1
	FIL2	**IS2**	23	Ion source set number for Filament 2
	Emi-Disp	**IED**	23	Enable / disable the emission current display
	COPY	**ICS**	24	Copy the ion source set
	D-TIME	**IDT**	24	Duration of degas process
	D-EMIS	**IDE**	24	Emission current for degas
	D-PROT	**IDP**	24	Maximum filament current for degas
	CTRL	**ISC**	24	Enable / disable degas
<cycle>	FUNCT	**CFU** [2)]	24	Measurement cycle operation
	MODE	**CYM**	24	Measurement cycle sequence
	CYCLES	**CYS**	24	Number of measurement cycles
	BEGIN	**CBE**	25	First channel in cycle
	END	**CEN**	25	Last channel in cycle
	TRIG	**CTR**	25	Measurement cycle control
	Run-Time	**CWA**	25	Scan time
	ADJ-TYP	**CCF**	25	Measurement cycle coarse / fine peak adjustment
<run / halt>	RUN / HALT	**CRU**	25	Start / Stop the measurement cycle
<filam>	Fila-Emi	**FIE**	25	Enable / disable the emission

5.3.5 Group of measured data not defined by a channel

Function	Parameter	Mnemonics	Page	Meaning
TOTAL	Pirani	**TPI**	26	Total pressure Pirani
	Penning	**TPE**	26	Total pressure cold cathode
ANALOG	A-Input	**AIN**	26	Analog input status
	A-Output	**AOU**	26	Analog output status
<trip> STATUS	T-State	**TST**	26	Switching function status
INTEGRATOR	I-Value	[1)]		
	I-Time	[1)]		
EMIS	EMI-CUR	**ECU**	27	Emission current display on the QME 125

5.3.6 Group of measured data defined by a channel

Function	Parameter	Mnemonics	Page	Meaning
MESSDATA	B-Counter	**MBC**	27	Contents counter for measured data buffer
	M-Counter			Number of measured values for this type of data
	M-State			Measurement is running / has finished
	M-Data Type			Type of data
	B-Header	**MBH** [2)]	27	Measured data buffer header
	B-Data	**MDB**	27–30	Measured data buffer

6.4 Block identification

1) This parameter is not available for the QMG 422.
2) This parameter of the QMG 422 has changed with respect to the QMG 421.
3) This new parameter is only available for the QMG 422.

6.4.1 <channels> group

Frame	Parameter	Block identification	Page	Meaning
<select>	Measure-Ch	**01 / 02**	39	Selected measurement channel
	Parameter-Ch	**03 / 04**	39	Selected parameter channel
<detect>	TYPE	**05 / 06**	39	Signal source selection
	SEM			SEM high voltage for a channel
	QMU-CH	1)		
	AI-CH / PI-CH			Analog input or Pirani channel number
	PHASE	1)		
	LOCK-IN	1)		
	PE-CTRL	**103 / 104**	40, 56	Enable / disable the cold cathode measurement circuit
<mass>	MODE	**07 / 08**	41	Spectrum scan operation
	FIRST / MASS			First mass for a scan / mass number
	WIDTH			Width of a scan
	SPEED / DWELL			Measurement speed / measurement time
	RESOL			Resolution
	THRESH	2)		Peak processor threshold
	AVERAGE			Number of values used for averaging
	Steps	2)		Measurement channel resolution (points per mass)
<amplif>	MODE	**11 / 12** 2)	42	Measurement range switching mode
	RANGE	2)		Electrometer range
	RANGE-L	2)		Narrowest measurement range for Auto Down
	GAIN			Post amplification factor
	FILTER			Analog filter setting
	OFFSET	1)		
	CALIB			Calibration factor for the measured value
	P-CAL			"Break" factor for changing the measurement channel in multichannel operation
	CP-LEV			Response threshold for the ion counter preamplifier
	AMP	1)		
	P-Time	**69 / 70**	43	"Break" time for measurement channel switchover
<aux>	STATE	**13 / 14**	43	Enable measurement channel
	COPY TO CH	**16**	43	Copy the parameter set to channel xx
<output>	AO-CH	**17 / 18**	44	Analog output channel number
	AO-MODE			Analog output mode
	MONITOR	2)		Analog output monitor
	LOG-DEC			Logarithmic presentation at analog output
	O-RNG	2)		Display range for ion counting operation
<trip>	TYPE	**19 / 20**	44	Type of switching function
	LEVEL-A			Switching function A / lower threshold for switching funct.
	LEVEL-B			Switching function B / upper threshold for switching funct.
	DO-A			Digital output bit number for switching function A
	DO-B			Digital output bit number for switching function B
<integ>	I-Chan	1)		
	SETPT	1)		
	DO-I	1)		
	TRIG	1)		
	Untergr	1)		
	INTEG	1)		

6.4.2 <general> group

Frame	Parameter	Block identification	Page	Meaning
<di/do>	DIG-IN	**23 / 24**	45	Digital input status (block operation)
		25 / 26	45	" (single bit operation)
	DIG-OUT	**27 / 28**	46	Digital output control (block operation)
		29 / 30	46	" (single bit operation)
<config> SYSTEM	QMA	**31 / 32** [2]	47	Type of analyzer
	MASS-R			Type of RF generator
	DETECT			Type of ion detector
	IS-TYP			Type of ion source
	OPTION	[2]		System expansion information
<config> QMS-HW	QMS-HW	**33 / 34**	47	Pc boards in the QMS 422
<config> INIT	RESET	**36**	48	Parameter set (standard / user)
<config> CTRL	MODE	**37 / 38**	48	Select type of input
	BAUD			Transmission speed for the RS 232 C interface
	NODE			Node address for the LAN interface
	SEM+FIL			SEM and filament supply
<config> SIMUL	SIMUL	**71 / 72**	48	Simulated test spectrum
<config> TEST	QMS	**39 / 40**	49	RAM test, EPROM test, program number
	DSP			RAM test, EPROM test, program number
<error> STATUS	ERROR	**41 / 42**	50	Error message from QC 422
	Warning			Warning from QC 422
	State-QMS			Control unit status (only interface)
	State-QMU	[1]		

6.4.3 <ion source> group

Frame	Parameter	Block identification	Page	Meaning
<emiss>	EMISS	**43 / 44**	51	Emission current
	E-PROT			Max. filament current
<v1...v6>	V1 IONREF	**45 / 46**	51	Ion source voltage 1
	V2 CATH			Ion source voltage 2
	V3 FOCUS			Ion source voltage 3
	V4 F-AXIS			Ion source voltage 4
	V5 EXTRACT			Ion source voltage 5
	V6 DEF-I			Ion source voltage 6
<v7...>	V7			Ion source voltage 7
	V8			Ion source voltage 8
	V9 WEHNELT			Ion source voltage 9
QMU-State	QMU 0...7	[1]		

6.4.4 <operation> group

Frame	Parameter	Block identification	Page	Meaning
<sem hv> <sem>	SEM-VOLTAGE Control	**49 / 50**	52	Common SEM high voltage Enable / disable the SEM high voltage
<ion src>	MODE TYPE FILAM FIL1 FIL2	**51 / 52**	52	Type of ion source operation Type of ion source Filament change Ion source set number for Filament 1 Ion source set number for Filament 2
	Emi-Disp			Enable / disable the emission current display
	COPY	**53 / 54**	53	Copy the ion source set
	D-TIME D-EMIS D-PROT	**55 / 56**	53	Duration of degas process Emission current for degas Maximum filament current for degas
	CTRL	**57 / 58**	53	Enable / disable degas
<cycle>	FUNCT MODE CYCLES BEGIN END TRIG	**59 / 60** [2]	54	Measurement cycle operation Measurement cycle sequence Number of measurement cycles First channel in cycle Last channel in cycle Measurement cycle control
	Run-Time	**61 / 62**	54	Scan time
	ADJ-TYP	**63 / 64**	54	Measurement cycle Coarse / fine peak adjustment
<run / halt>	RUN / HALT	**65 / 66**	55	Start / Stop the measurement cycle
<filam>	Fila-Emi	**67 / 68**	55	Enable / disable the emission

6.4.5 Group of measured data not defined by a channel

Frame	Parameter	Block identification	Page	Meaning
TOTAL	Pirani Penning	**101 / 102** **103 / 104**	56 56, 40	Total pressure Pirani Total pressure cold cathode
ANALOG	A-Input A-Output	**105 / 106** **107 / 108**	57 57	Analog input status Analog output status
<trip> STATUS	T-State	**109 / 110** **111 / 112**	58 58	Switching function status (block operation) " (single bit operation)
INTEGRATOR	I-Value I-Time	[1] [1]		
EMIS	EMI-CUR	**113 / 114**	59	Emission current display on the QME 125
Offset-Value		**119 / 120** [3]	59	

6.4.6 Group of measured data defined by a channel

Frame	Parameter	Block identification	Page	Meaning
MESSDATA	B-Counter M-Counter M-State M-Data Type B-Header B-Data	**131 / 132** **133 / 134**	60 61-69	Contents counter for measured data buffer Number of measured values for this type of data Measurement is running / has finished Type of data Measured data buffer header Measured data buffer

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