INNOVA
AirTech Instruments

Technical Documentation

1314 Photoacoustic Multi-Gas Monitor and Monitor Photoacoustic Field Gas-Monitor

Interface Manual

Interface Manual
for
1314 Photoacoustic Multi-Gas Monitor
and
1412 Photoacoustic Field Gas-Monitor

From:
1314 Serial number: 002-001 – 033-002
1314 Serial number: 700-001
1412 Serial number: 710-001

March 2006

About this Interface Manual

This manual describes the programming and operation of the serial and parallel interfaces of the 1314 Photoacoustic Multi-gas Monitor and the 1412 Photoacoustic Field Gas-Monitor.

Although the physical aspect of cabling is touched on in this manual, it is assumed that users are familiar with the manual operation of the Gas Monitor, as described in the Instruction Manual.

Safety Considerations.

The 1314 Photoacoustic Multi-Gas Monitor and the 1412 Photoacoustic Field Gas-Monitor complies with:

- EN/IEC 61010-1, 2nd (2001): Safety requirements for electrical equipment for measurement, control and laboratory use.
- UL61010A-1 first edition (2002): Electrical Equipment For Laboratory Use; Part 1. General Requirements.
- CAN/CSA – C22.2 No.1010.1-92: Safety requirements for equipment for measurement, control laboratory use.

To ensure safe operation and retain the Monitor in safe condition, note the following:

EXPLOSION HAZARD!

TO AVOID THE POSSIBILITY OF AN EXPLOSION; MONITORING OF FLAMMABLE GASES IN EXPLOSIVE CONCENTRATIONS MUST NEVER BE ATTEMPTED.

Never operate the 1314 Photoacoustic Multi-Gas Monitor or the 1412 Photoacoustic Field Gas-Monitor in potentially explosive environments.

When Monitoring potentially flammable or toxic gases it is essential that:

- The instrument itself is placed in a well-ventilated area outside the potentially hazardous zone.

- A sufficiently long tube is connected to the air-outlet on the back panel so that the sampled gas is carried away to the open air or to an extraction and/or filtration unit.

Warnings!

- Avoid water condensation in the instrument.
- Switch off all equipment before connecting or disconnecting their digital interface. Failure to do so could damage the equipment.
- Whenever it is likely that correct function or operating safety of the apparatus has been impaired, the apparatus must be made inoperative and secured against unintended operation.
- Any adjustment, maintenance and repair of the open apparatus under voltage must be avoided as far as possible and, if unavoidable, must be carried out only by trained personnel.
- If a fault is reported by the Monitor that indicates correct function of the instrument may be impaired, consult your local Innova AirTech representative. Under no circumstances should repair be attempted by persons not qualified in service of electronic instrumentation.

Applying Power

Before using the 1314 or the 1412 check that the available mains voltage match the specified voltage and frequency for the instrument.

SAFETY SYMBOLS

⚠

The apparatus will be marked with this symbol when it is important that the user refers to the associated warning statement given in the User Guide.

 Frame or Chassis  Protective earth  Dangerous voltage

Chapter 1

Physical Level of the Interface

March, 2006

1.1 The Monitor's Interface Ports

Both interface ports, the IEEE–488 and the RS–232, are located on the rear panel of the Monitor, see Fig. 1.1.

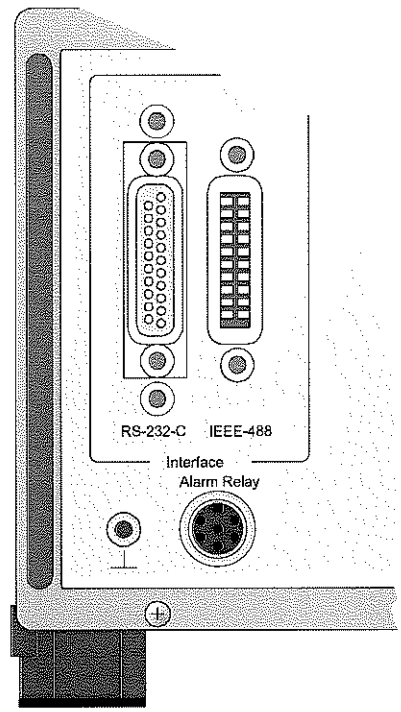


Fig. 1.1 The interface connections on the rear panel of the Monitor

WARNING! Before connecting any cables to the Monitor, ensure that the power to the Monitor is turned off. Cabling to the Monitor is covered in more detail in the Monitor Instruction Manual.

1.2 The IEEE–488 Interface

The digital interface of the Monitor is designed according to ANSI/IEEE Std 488–1978, "IEEE Standard Digital Interface for Programmable Instrumentation". Since the only significant difference between this and IEC Publication 625–1 is in the type of connector specified, compatibility with these standards is only a question of which connecting cable is used.

The Monitor is connected to other instruments with IEEE/IEC interfaces using the following cables and connectors.

- Cable AO0265, length 2m, which has an IEEE–488 standard connector at each end, connects the Monitor to other instruments equipped with the IEEE–488 connector.

- Cable WL0845, length 1m, which has an IEEE–488 standard connector at each end, connects the Monitor to other instruments equipped with the IEEE–488 connector.

Data Conventions

The codes and formats used by the Monitor in sending and receiving data and/or messages via the IEEE/IEC interface have been designed according to the recommendations of IEEE Std 728–1982, "IEEE Recommended Practice for Code and Format Conventions (For Use with ANSI/IEEE Std 488–1978)". This standard is identified by the IEEE as a recommended practice rather than an absolute standard. It seeks to define standard forms for the transfer of various types of data on the IEEE–488 interface, and so to improve the level of communication between instruments equipped with the interface. In particular, IEEE 728 recommends that all messages use ASCII/ISO 7-bit coding and it defines standard header messages, data formats and message separators and terminators.

It is important to note that although the Monitor interface is designed according to IEEE Std 488 and follows the recommendations of IEEE Std 728, absolute compatibility with IEC or IEEE/ANSI interfaces designed by other manufacturers cannot be unconditionally guaranteed, since differences can occur within the limits of the specifications. Any problems encountered, however, will be of a software rather than a hardware nature. Where compatibility is in doubt, contact Innova Service Support for further information.

1.2.1 IEEE–488 Functions Implemented

The interface of the Monitor implements the following functions as specified by the IEEE–488 standard. The Sections referred to are the relevant sections of the IEEE Std 488–1978 which specify the functions. The equivalent Clauses of IEC 625–1 are given in parentheses.

Section 2,3	Source Handshake (SH) Interface Function, (Clause 6): SH 1 — complete capability
Section 2,4	Acceptor Handshake (AH) Interface Function, (Clause 7): AH 1 — complete capability
Section 2,5	Talker (T) Interface Function, (Clause 8): T 5 — complete capability
Section 2,6	Listener (L) Interface Function, (Clause 9): L 3 — complete capability
Section 2,7	Service Request (SR) Interface Function, (Clause 10): SR 1 — complete capability
Section 2,8	Remote Local (RL) Interface Function, (Clause 11): T 5 — complete capability
Section 2,9	Parallel Poll (PP) Interface Function, (Clause 12): PP 1 — remote configuration
Section 2,10	Device Clear (DC) Interface Function, (Clause 13): DC 1 — complete capability
Section 2,12	Controller (C) Interface Function, (Clause 15): C 1,2,3,4,5 — complete capability
	All other functions — no capability

For further details of the above functions, refer to the relevant sections of the IEEE or IEC standards.

1.2.2 Addressing the Monitor

Each device in an IEEE–488 interface bus system has at least one listener and/or talker address depending on its function. When an interface controller contacts a device over the IEEE–488 interface, it sends a device address that will contain the appropriate talker or listener address. This address is in ISO 7-bit code (or equivalent ASCII), bit 8 being unused for addressing and therefore remaining at logic 0. Table1.1 gives a list of the possible addresses with the corresponding ASCII characters for the different address modes. All values in Table 1.1 are acceptable as addresses for the Monitor. The default value is 14.

Setting the Address

The listen and talk addresses, over which the Monitor can be contacted via their IEEE–488 interface, are selected through the Monitor's Set-Up tree. The selections are:
SET-UP — CONFIGURATION — SYSTEM — COMMUNICATION — IEEE–488.

WARNING! You must partially reset the Monitor if the address is changed.

Address Code (decimal)	Address Code (Binary)					ASCII Address Characters	
	A5	A4	A3	A2	A1	Listen	Talk
0	0	0	0	0	0	SP	@
1	0	0	0	0	1	!	A
2	0	0	0	1	0	"	B
3	0	0	0	1	1	#	C
4	0	0	1	0	0	$	D
5	0	0	1	0	1	%	E
6	0	0	1	1	0	&	F
7	0	0	1	1	1	'	G
8	0	1	0	0	0	(	H
9	0	1	0	0	1	)	I
10	0	1	0	1	0	*	J
11	0	1	0	1	1	+	K
12	0	1	1	0	0	,	L
13	0	1	1	0	1	-	M
14	0	1	1	1	0	.	N
15	0	1	1	1	1	/	O
16	1	0	1	0	0	0	P
17	1	0	1	0	1	1	Q
18	1	0	1	1	0	2	R
19	1	0	1	1	1	3	S
20	1	0	1	0	0	4	T
21	1	0	1	0	1	5	U
22	1	0	1	1	0	6	V
23	1	0	1	1	1	7	W
24	1	1	0	0	0	8	X
25	1	1	0	0	1	9	Y
26	1	1	0	1	0	:	Z
27	1	1	0	1	1	;	[
28	1	1	1	0	0	<	\
29	1	1	1	0	1	=	]
30	1	1	1	1	0	>	^

Table 1.1 Listener/Talker addresses (default values shaded)

1.3 The RS–232 Interface

The interface of the Monitor conforms with the EIA standard RS–232, which is equivalent to the CCITT V.24 recommendation.

The interface is coupled as "Data Terminal Equipment" (DTE), and it operates in full duplex mode, which means that the interface is capable of operating in both directions simultaneously.

Interface Connector

The interface connector is a 25-pin D-range male connector. It is located on the rear panel of the Monitor as shown in Fig. 1.1. Fig. 1.2 shows the numbering of the pins. Pin definitions are given in Table 1.2.

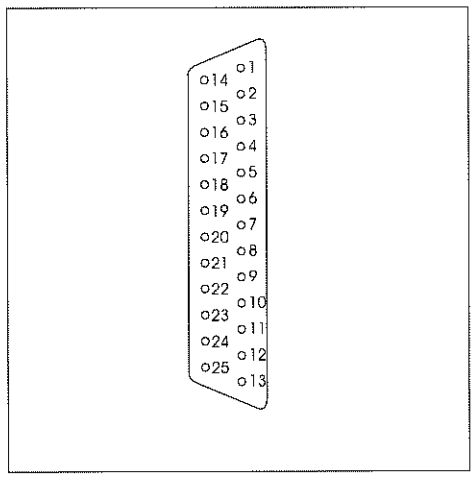


Fig. 1.2 The interface connector of the Monitor

Pin No.	RS–232	CCITT V.24	Description	Mnemonic	Direction
1	AA	101	Protected Ground	P GND	—
2	BA	103	Transmitted Data	TxD	From Monitor
3	BB	104	Received Data	RxD	To Monitor
4	CA	105	Request to send	RTS	From Monitor
5	CB	106	Clear to send	CTS	To Monitor
6	CC	107	Data Set ready	DSR	To Monitor
7	AB	102	Signal Ground	S GND	—
8	CF	109	Data Carrier Detect	DCD	To Monitor
20	CD	108.2	Data terminal Ready	DTR	From Monitor

Table 1.2 Pin definitions of the RS – 232 interface

Data Lines

Pins 2 and 3, Transmitted Data and Received Data, are data lines. For data lines, RS–232 specifies that:

- A voltage below –3V signifies a binary 1
- A voltage above +3V signifies a binary 0
- When a data line is passive, it is held in the binary 1 condition.

Data transmission is asynchronous as shown in Fig. 1.3.

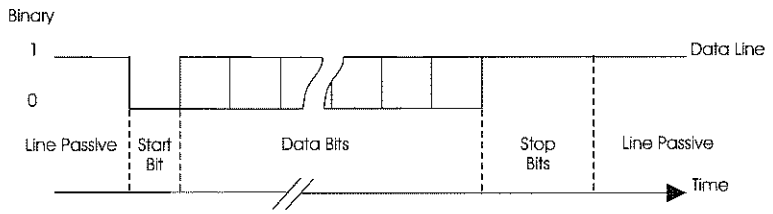


Fig. 1.3 Asynchronous transmission of character data

Most of the data is transmitted in the form of ASCII codes. All ASCII codes given in the following text are decimal numbers.

Control Lines

Pins 4, 5, 6, 8 and 20 are control lines. For control lines, RS–232 specifies that:

- A voltage above +3V signifies the "on" state.
- A voltage below –3V signifies the "off" state.

The use of the control lines is described in section 1.3.2.

1.3.1 Interconnection

A null-modem cable must be used to interface the Monitor to another DTE-coupled device (computer or printer), so that the DTEs appear to each other to behave like modems. Examples of null-modem cross connections which may be used with the Monitor are given in Fig. 1.4 and Fig. 1.5.

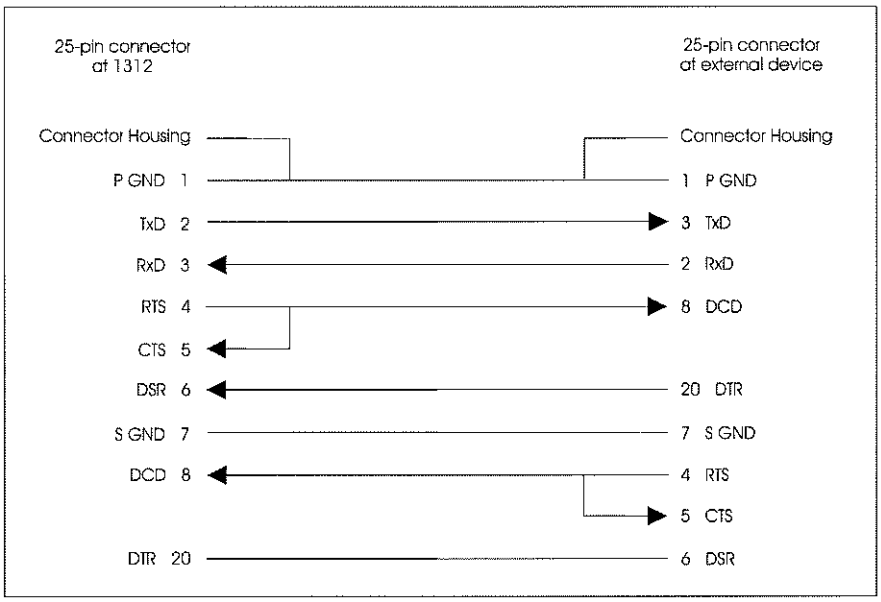


Fig. 1.4 Null-modem cable details (25-pin to 25-pin connectors)

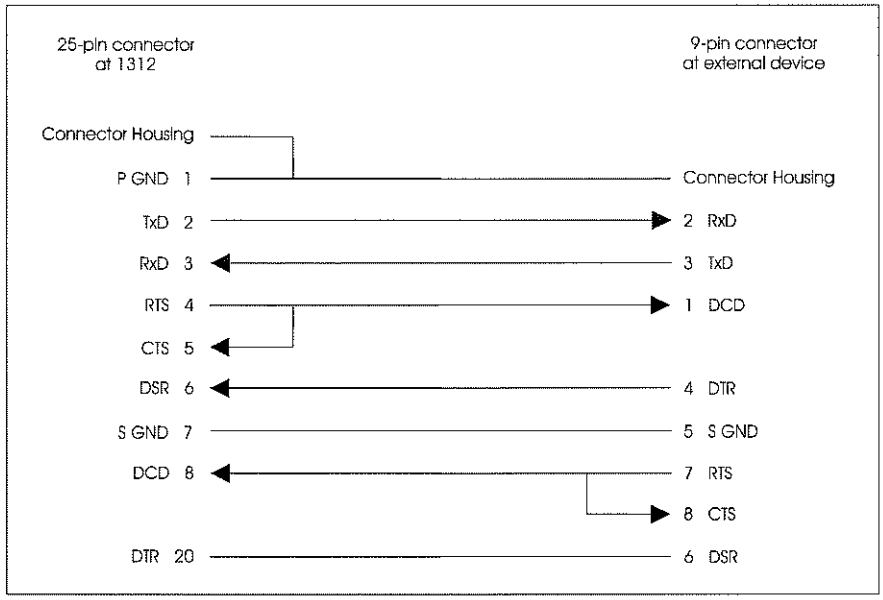


Fig. 1.5 Null-modem cable details (25-pin to 9-pin connectors)

1.3.2 Interface Set-up

The Set-Up tree enables you to specify the interface set-up of the Monitor. The selections are: SET-UP — CONFIGURATION — SYSTEM — COMMUNICATION — RS–232–C.

WARNING! You must partially reset the Monitor if the RS–232 configuration is changed, for example, if the baud rate is changed. See the Monitor Instruction Manual for details.

Baud Rate

The baud rate is the speed of data transmission. Possible baud rates are 300, 600, 1200, 2400, 4800 and 9600 bits/sec.

Parity

Checking the parity of a transmitted byte is a way of detecting transmission errors. Possible set-ups are:

- Even
- Odd
- None

Even (odd) parity means that a transmitted byte must contain an even (odd) number of binary 1's. To achieve this, one extra bit — the parity bit — is added to each byte transmitted. When "None" is selected, no parity check is performed.

Stop Bit

The stop bit is used to terminate a transmitted character (see Fig. 1.3). Together with the start bit, the stop bit frames the data bits and is used to synchronise data transmission. The Monitor can use either one or two stop bits.

Data Bit

The number of data bits determines how many bits are transmitted for every byte of data. Possible set-ups are 7 or 8 data bits to a byte.

Handshake Method

The handshake method is the method used by the Monitor and the external device to synchronize their transmissions. Three possible set-ups exist:

- X-On/X-Off handshake
- Hardwired handshake
- None

When X-On/X-Off handshake is used, the Monitor transmits the X-Off character (ASCII 19) when it can handle no more input data. When the Monitor is once again ready to receive data, it transmits the X-On character (ASCII 17) over the interface. Similarly, when the Monitor receives an X-Off character during a transmission, it stops transmitting until it receives the X-On character. If the X-On character does not arrive within 30 seconds, the Monitor regards the transmission as aborted and issues a time-out warning.

In hardwired-handshake mode, the Monitor sets the DTR control line (pin 20) off when it will accept no more data. When it is ready to receive more data, the DTR line is set on. When the external device sets the DSR control line (pin 6) off, the Monitor stops transmitting until DSR goes back on. If the DSR line remains off for more than 30 seconds, the Monitor issues a time-out warning.

If "None" is selected, handshaking is disabled.

If either "Hardwired" or "None" is selected and the external device attempts to use X-On/X-Off handshaking, the Monitor displays a warning. Similarly, if "X-On/X-Off" or "None" is selected and DSR is set off by the external device, a warning will appear.

Hardwire Mode

This parameter determines how the Monitor uses the control lines of the interface. Three set-ups exist:

- 3–Wire mode
- Switched–Line mode
- Leased–Line mode

In 3–wire mode, only the data lines are used. All control lines are ignored.

This means that X-On/X-Off handshake is the only handshake method available.

In switched–line mode, the CTS and DSR control lines are monitored. If one of the two control lines is set off, data transmission from the Monitor is blocked. It is recommended that the external device uses the DSR line for handshaking.

In leased–line mode, the CTS, DSR and DCD control lines are monitored. CTS and DSR have the same effect as in switched line mode. If the DCD input control line goes off, the Monitor ignores all incoming data.

1.3.3 Transmission Interrupt

If the Monitor receives a Ctrl-C (ASCII 3) character over the interface during transmission of data, the transmission will be aborted.

1.3.4 Service Requests

To get the attention of the controller, the Monitor issues a Service Request. This is an unsolicited message sent over the interface by the Monitor. The Service Request consists of a single SYN character (ASCII 22). Before the Monitor can transmit Service Requests, the controller must enable it to do so.

Chapter 2

The Interface Messages

March 2006

2.1 List of Interface Messages

For remote control of the Monitor over the IEEE–488 or RS–232 interface bus, various interface messages can be specified, a list of which is given in Table 2.1.

Alphabetical list of interface messages					
	Minimum code	**Input Job**	**Output Job**	**RS232**	**IEEE 488**
ACCEPT_CALIBRATION	A_C	I			
ALARM_LIMIT: Alarm_Limit number 1 and 2 are NR1 data to the calibration parameter command. Filter A to E: C_P F_x, b, A_L, y, 1 sets setup alarm limit 1, in bank b, for filter x to y. C_P F_x, b, A_L, y, 2 sets setup alarm limit 2, in bank b, for filter x to y. C_P? F_x, b, A_L, 1 returns setup alarm limit 1, in bank b, for filter x. C_P? F_x, b, A_L, 2 returns setup alarm limit 2, in bank b, for filter x. Filter W: C_P F_W, A_L, y, 1 sets setup alarm limit 1, for filter W to y. C_P F_W, A_L, y, 2 sets setup alarm limit 2, for filter W to y. C_P? F_W, A_L, 1 returns setup alarm limit 1 for filter W. C_P? F_W, A_L, 2 returns setup alarm limit 2 for filter W.					
ACCEPT_MESSAGE	A_M	I	O	R	I
ALARM_START	A_STA	I		R	I
ALARM_STOP	A_STO	I		R	I
BEEP	B	I		R	I
BINARY_NUMERIC_ORDER	B_N_O	I		R	I
CALIBRATION_DATA_BINARY	C_D_B	I	O	R	I
CALIBRATION_PARAMETER	C_P	I	O	R	I
CHANNEL_LOCKOUT	C_L	I	O	R	I
CLICK	C	I		R	I
CONTROL_SRQ	CO_SRQ	I	O	R	I
CURRENT_FILTER	C_F	I	O	R	I
CURRENT_SETUP	CU_SE	I	O	R	I
DEFINE_TERMINATOR	D_T	I			I
DELETE_MEASUREMENT	D_M	I		R	I
DISPLAY_AVERAGE	D_A	I	O	R	I
DISPLAY_STATE	D_S	I	O	R	I
ERROR_STOP	ER_S	I		R	I
EXECUTE_STATE?	EX_S?		O	R	I
EXTENDED_CONTROL	E_C	I		R	I
EXTERNAL_PUMP	E_P	I	O	R	I
FILTER CONSTANTS?	F_C		O	R	I
INDENTIFICATION?	*IDN?		O	R	I
IDENTIFY?	ID?		O	R	I
IEEE_ATTENTION	I_A	I		R	
IEEE_CLEAR	I_C	I		R	
IEEE_ENTER?	I_E?		O	R	
IEEE_INTERFACE_CLEAR	I_I_F_C	I		R	
IEEE_LOCAL	I_L	I		R	
IEEE_LOCAL_LOCKOUT	I_L_L_O	I		R	

Table 2.1 List of interface messages

IEEE_OUTPUT	I_O	I		R	
IEEE_PARALLEL_POLL?	I_P_P?		O	R	
IEEE_PPC	I_P_P_C	I		R	
IEEE_PPU	I_P_P_U	I		R	
IEEE_REMOTE	I_R	I		R	
IEEE_SERIAL_POLL	I_S_P		O	R	
KEYBOARD_LOCKOUT	K_L	I	O	R	I
MEASURED_AIR_PRESSURE	M_A_P	I			
MEASURED_AIR_PRESSURE?	M_A_P?		O		
MEASUREMENT_STATE	M_S		O	R	I
OUTPUT_CALIBRATION_DATA?	O_C_D?		O	R	I
OUTPUT_ERROR_DUMP?	O_E_D?		O	R	I
OUTPUT_HEADER	O_H	I		R	I
OUTPUT_MEASUREMENT?	O_M?		O	R	I
OUTPUT_SETUP_DATA?	O_SE_D?		O	R	I
OUTPUT_SPECIAL_COMPILATION?	O_SP_C?		O	R	I
PASS_CONTROL_BACK	*PCB	I		R	I
PAUSE_MEASUREMENT	PAUSE_M	I			
PAUSE_MEASUREMENT?	PAUSE_M?		O		
POP_UP_DISPLAY_BUFFER?	P_U_D_B?		O	R	I
PRINT_CALIBRATION_DATA	P_C_D	I		R	I
PRINT_ERROR_DUMP	P_E_D	I		R	I
PRINT_MEASUREMENT	PR_M	I		R	I
PRINT_SETUP_DATA	P_SE_D	I		R	I
PRINT_SPECIAL_COMPILE	P_SP_C	I		R	I
PUSH_KEY	P_K	I	O	R	I
RECALL_MEASUREMENT	R_M	I		R	I
RELAY	R	I	O	R	I
REMOTE_DISPLAY_BUFFER	R_D_B	I	O	R	I
RESET_COMMAND	*RST	I		R	I
RESET_STATUS_BYTE	R_S_B	I		R	I
RESET_SYSTEM	RESET_SY	I		R	I
SELF_TEST?	TST?		O	R	I
SERVICE_REQUEST_ENABLE	S_R_E	I	O	R	I
SETUP	SE	I	O	R	I
SOFTWARE_IDENTIFICATION?	S_I?		O	R	I
START_CALIBRATION_MEASURE	STA_C_M	I		R	I
START_DELAYED_MEASUREMENT	S_D_M "dhh:mm"	I		R	I
START_DELAYED_MEASUREMENT	S_D_M "ddhh:mm"	I			
START_MEASUREMENT	STA_M	I		R	I
STATUS_BYTE?	*STB?		O	R	I
STOP_MEASUREMENT	STOP_M	I		R	I
STORE_DEFAULT	STO_DEF	I			
STORE_MEASUREMENT	STOR_M	I		R	I
SYNCHRONIZE	SY?	I	O	R	I
SYSTEM_DISPLAY_BUFFER?	SY_D_B?		O	R	I
TIME_SINCE_RESET?	T_S_R		O	R	I

Table 2.1 List of interface messages

2.2 Message Format

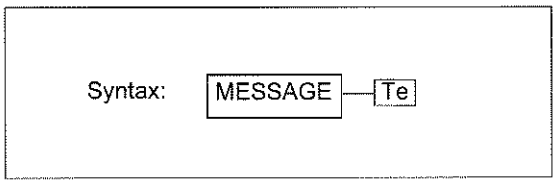
The same message format is used for programming both the IEEE and RS–232 interfaces. Differences in individual messages are described in the relevant section for that message, e.g. Channel_Lockout (section 2.3.8).

Four types of interface messages are possible: Command Messages, Command Messages with one or more parameters, Request Messages and Request Messages with one or more parameters. The syntax for these messages are very similar, each is illustrated below together with an example:

	Description
MESSAGE	This is the interface message
HS	This is the "Header Separator". A <SPACE> is always used, and must be inserted between the header the first parameter field.
PARAMETER	Some message and request commands require some parameters to be sent with them.
Te	This is the "MessageTerminator". The default terminator for this Monitor is <LF> (i.e. <CTRL>+<J>). It can be changed via the IEEE interface but not via the RS–232 interface. The change is made using Define_Terminator, see section 2.3.12. **Note:** when programming the Monitor via the interface, it sends data as a series of one or more text lines. Each of these lines is terminated by a "text line terminator". This can be changed using the Setup command. There are three possibilities: <LF>, <CR> or <CR><LF>. When the Monitor has finished sending data (all the text lines) the final terminator is sent. This is the same as the "Message Terminator".
BLOCK DATA	This defines the way in which block data is transferred to the Monitor. The block data fields conform to the general block data format as defined by ANSI/EEE Standard 488.2. It takes the form: #C n..n [n..n data bytes] C gives the number of characters in the following block length, and is an integer between 1 and 9 inclusive. e.g. #4 1200 [1200 data bytes]
NRX	These are numbers according to the IEEE–488 standards, where x can be 1, 2, or 3. NR1 is always an integer. NR2 is real without exponential. NR3 is real with an exponential.
Protected xx	Some messages are protected. This means the message will only be recognised by the Monitor if it is "unlocked". Unlocking the Monitor is done using the Extended_Control message, see section 2.3.18. **Note:** you must unlock the message each time it is sent.

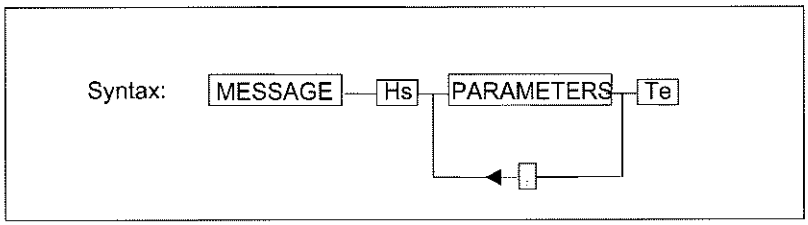
Table 2.2 Key to Syntax Messages

Command Messages:



Example: A_M

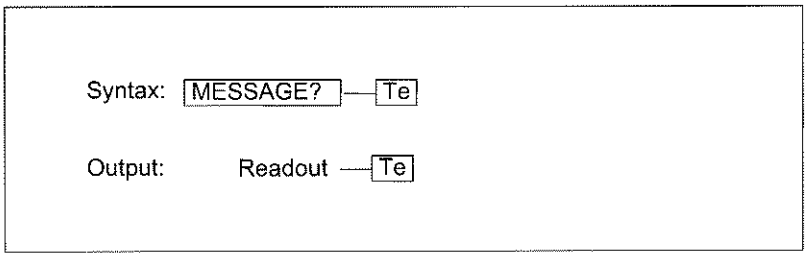
Command Messages with Parameters:



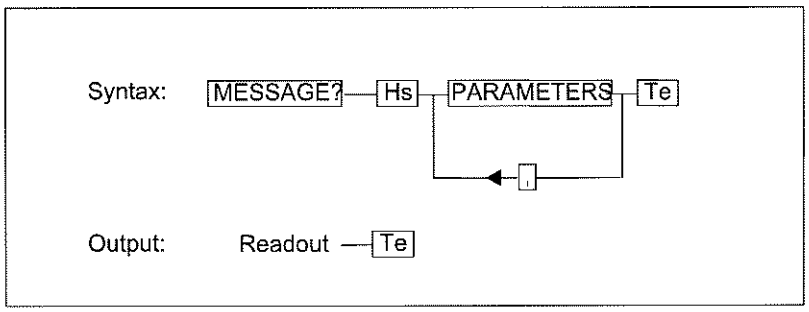
Example: C_L Y

Note: if several parameters need to be set, these are separated by a comma.

Request Messages:



Request Messages with Parameters:



Example: CO_SRQ? 8
or C_D_B? AL

These standards will be used in the description of messages.

Message Note

The Monitor makes no distinction between the type of characters input. Messages can be input using upper- or lower-case characters.

2.3 The Individual Messages

2.3.1 ACCEPT_CALIBRATION

The command has minimum code **A_C** and excist only as input command. **A_C** has a similar function to pressing the Enter button on the front panel.

2.3.2 ACCEPT_MESSAGE

A_M? indicates if there is a message to acknowledge.
A_M acknowledges the message. Corresponds to pressing "INFO" if there is a message.

2.3.3 ALARM_START

A_STA starts the Monitor's acoustic alarm.

2.3.4 ALARM_STOP

A_STO stops the Monitor's acoustic alarm.

2.3.5 BEEP

B causes the Monitor to emit a tone.

2.3.6 BINARY_NUMERIC_ORDER

Some interface messages cause the Monitor to give output in binary form. The order in which the bytes are given can be determined using **B_N_O**. Typing **STAN** or **REV** as the Parameters, will result in the following byte order:

STANdard	Most significant byte first
REVerse	Least significant byte first

For example, the number 300 read out as a 16 bit word in STAN order will be:

0000000100101100

The least significant byte will be 44 and most significant byte will be 1 (corresponding to 256 when the bytes are taken as a 16 bit word).

The number 300 read out in REV order will be:

0010110000000001

2.3.7 CALIBRATION_DATA_BINARY

C_D_B? reads out calibration data from the Monitor in binary form. This is used primarily as a backup of calibration data. When issuing the interface message, the parameter command can be one of the following:

ALl	Data for all filters
Filter_**A**	Data for filter A
Filter_**B**	Data for filter B
Filter_**C**	Data for filter C
Filter_**D**	Data for filter D
Filter_**E**	Data for filter E
Filter_**W**	Data for filter W

/***** PROTECTED 15 *****/

C_B_D enables input of calibration data. This may also be used for back-up of the calibration.

2.3.8 CHANNEL_LOCKOUT

If **C_L** comes via IEEE, the output will tell if the RS–232 interface is blocked against messages. If the message comes from RS–232, output will tell if the IEEE interface is blocked against messages.

Message From:	Output	Description
IEEE	Yes	RS–232 interface is locked out
	No	RS–232 interface is open
RS–232	Yes	IEEE interface is locked out
	No	IEEE interface is open

2.3.9 CLICK

The Monitor emits a clicking sound.

2.3.10 CONTROL_SRQ

CO_SRQ? reads out the event number, NR_1 (0..255), for the events that have been registered in the Event Register specified, NR_1 (1..8). **CO_SRQ?** can be followed by the character data parameter **MEM**ory.

CO_SRQ? NR1 provides a read out acknowledged by the SRQ register, while **CO_SRQ?** NR1, **MEM** provides a read out without acknowledging any changes to the register.

Examples using **CO_SRQ?**:
If the AVERAGE button has been activated on the Monitor.

CO_SRQ? 8 requests the number stored in register 8. Output: **1**

This is because the bit number is set as a result of the event "key pressed". See Table 2.3 to Table 2.7.

CO_SRQ sets the specified Event Enable Register. The first number, NR_1 (1..8), is the register number. The second number, NR_1 (0..255), is a bit-mask that tells which occurrence can generate SRQ.
For example: **CO_SRQ 8,12**

The number 12 is written into Register 8 (Special Event Enable Register), setting bits 3 and 4, so that whenever the air pump is started and stopped a Service Request is generated. See Table 2.3 to Table 2.7 for a description of the registers.

Note: Register 5, Register 6 and Register 7 are not used.

Register 1 (Data Ready Register)		
Bit no.	Decimal no.	Bit name
1	1	Sample Data Ready
2	2	Measurement Task Data Ready
3	4	Calibration Data Ready
4..8		Not used

Table 2.3 The contents of Register 1

Register 2 (Reset Activated Register)		
Bit no.	Decimal no.	Bit name
1..8		Not used

Table 2.4 The contents of Register 2

Register 3 (Command Completed Register)		
Bit no.	Decimal no.	Bit name
1	1	Input/Output Command Finished
2	2	Measurement Task Finished
3	4	Calibration Finished
4	8	Setup Operation Finished
5	16	Memory Operation Finished
6	32	Print Finished
7..8		Not used

Table 2.5 The contents of Register 3

Register 4 (Error Register)		
Bit no.	Decimal no.	Bit name
1	1	Error in Self-test Detected
2..6		Not used
7	64	HW Error Detected
8	128	SW Error Detected

Table 2.6 The contents of Register 4

Register 8 (Special Event Register)		
Bit no.	Decimal no.	Bit name
1	1	Key Pressed
2	2	Synchronize Required
3	4	Pump Started
4	8	Pump Stopped
5	16	Sample Measurement in Progress
6	32	Bus Control Requested
7	64	SRQ Button Activated
8	128	Self-test Running

Table 2.7 The contents of Register 8

2.3.11 CURRENT_FILTER

C_F? reads out the "filter id". This indicates which filter (gas) is currently in use.
For example: If the Monitor is using the water filter, **C_F?** will cause the Monitor to output F_W.

C_F determines which filter (gas) is displayed.
For example: **C_F F_A** causes filter (gas) A to be displayed.

2.3.12 CURRENT_SETUP

CU_SE? reads out the number of the active "Measurement Task" on the display. The output from the Monitor will be an integer, NR_1 (1..10).

CU_SE defines which "Measurement Task" will be active.
For example: **CU_SE 5** defines that measurement task 5 is active.

2.3.13 DEFINE_TERMINATOR

D_T defines the character that is used as the message terminator (Te). This message can only be used on the IEEE–488 interface. The message terminator for the RS–232 interface cannot be changed and is fixed as the default character; line feed <LF>. This terminator may be redefined to any ASCII character decimal value between 1 and 31, with the exception of 13. For example, the given message might be "D_T 1", which defines the terminator as <SOH> because the <SOH> ASCII character has a decimal value of 1.

2.3.14 DELETE_MEASUREMENT

D_M erases the contents of the defined Memory Location, NR_1 (1..10), from the background memory.

2.3.15 DISPLAY_AVERAGE

D_A? indicates the state of the average function. The output from the Monitor can be **Y**es (average function is active) or **N**o (average function is inactive).

D_A followed by a **Y**es or a **N**o defines the state of the average function.

2.3.15 DISPLAY_STATE

D_S? indicates which display buffer is being displayed on the Monitor. The output (display id) from the Monitor is one of the following:

POp_Up	Used for error/status/reset messages.
REMote	The content is chosen via interface.
SYstem	Default display.

/***** PROTECTED 1 *****/

D_S selects the display buffer to be read out on the display.

For example, when:
D_S SY is typed, the Monitor will read out "SY" to the controller during normal system, display.

2.3.17 ERROR_STOP

ER_S is used to determine what information is displayed on the Monitor screen when there is an error in the interface message sent by the user. The parameter following the **ER_S** command can be **Y**es or **N**o, determining whether or not the **ER**ror_**S**top function is active.

Yes	Indicates error location.
No	Does not include error location.

Example:
If the **ER**ror_**S**top function is set to **Y**es, and you were to type:

***IDN? 9**

then the Monitor screen would read:

TOO MUCH DATA*IDN?

This is because no data is expected after this interface message. The message is returned up to and including the character that caused the error, or start of the error.

Note: only minimum code is returned even when you send messages in full.

If the **ER**ror_**S**top is set to **N**o, the error message TOO MUCH DATA would be read out on the screen together with the identification query.

Note: any error in the interface message sent to the Monitor will cause it to ignore all subsequent data. You must send an IFC (Interface Clear) bus command to reset, and the interface message must be sent again. IFC is an interface bus command and is defined in the interface standards.

2.3.18 **EX**ECUTE_**S**TATE?

EX_S? requests a status of the Monitor. The output from the Monitor can come as one NR_1 or two NR_1s. The first NR_1 gives a general description of the current status of the Monitor.

Output no. (NR_1)	Name	Description
0	Display_Run	Normal idle state
5	Meas_Clean_Up	Just after stop measurement
6	Meas_Count_Down	Waiting for time to run out
7	Meas_Init_Mode	Measurement mode selected
8	Meas_Run	Measurement running
9	Calib_Run	Calibration running
10	Memory_Run	Memory mode related
11	Print_Clean_Up	Just after end of print
12	Print_Menu	Print selected but not started
14	Print_Run	Print in progress
15	Setup_Run	Setup mode selected
16	Test_Run	Test mode

Table 2.8 The meaning of the output from EXecute_State?

The second NR_1 is used only if the first NR_1 indicates that the Monitor is calibrating. It describes the calibration procedure. The key to the first integer, NR_1, is shown in Table 2.8. The second integer, given when the Monitor is calibrating, indicates one of the following:

0 No error occurred
1 Warning(s) detected
2 Errors detected

2.3.19 **E**XTENDED_**C**ONTROL

E_C is used to gain access to the protected messages. For example, you must type:

```
/xxxx protected 59xxxx/
E_C 59
```

to gain control.

This would allow you to use the **E**xternal_**P**ump message to configure the Monitor to work with an external pump. Without giving this message first, the Monitor would not recognise the **E_P** message.

Note: you must send the **E**xtended_**C**ontrol message prior to and every time a protected message is sent.

2.3.20 EXTERNAL_PUMP

E_P? indicates whether the Monitor is configured to work with an external pump, e.g. the pump in the 1303.
/***** PROTECTED 59 *****/
E_P configures the Monitor to take an external pump into consideration when the sampling tube/analysis cell is to be flushed. If an external pump is connected, the tube is flushed independently of the Monitor. There are two parameters to choose from:

Yes	External pump connected.
No	External pump not connected.

When a measurement ends/stops, the Monitor will set "External Pump" to No.

2.3.21 IDENTIFICATION?

***IDN** gives the identification of the instrument in the following format:

Innova,1412,ssss,VPxxxx.
or
Innova,1314,ssss,VPxxxx.

where:

ssss string of max 10 characters containing the serial number.

xxxx software revision number.

2.3.22 IDENTIFY?

ID? gives the identification of the instrument in this format:

Innova 1412
or
Innova 1314

2.3.23 KEYBOARD_LOCKOUT

K_L? indicates whether the front panel push-buttons of the Monitor are locked.

K_L followed by a parameter **Y** locks or **N** unlocks the front panel push-buttons of the Monitor.

2.3.24MEASUREMENT_AIR_PRESSURE

The atmospetrical air pressure is measured during reset, measurement calibration or by the command **M**easure_**A**ir_**P**ressure.

M_A_P starts an atmospherical air pressure measurement.

M_A_P? reads out the atmospherical air pressure.

2.3.25MEASUREMENT_STATE?

M_S? indicates whether the Monitor is measuring. The Monitor's output can be Y, it is measuring, or N, it is not measuring.

2.3.26OUTPUT_CALIBRATION_DATA?

O_C_D? provides a readout of calibration data from the Monitor in ASCII form. When issuing the interface message, the command parameter can be one of the following:

ALl	Data for all filters
Filter_**A**	Data for filter A
Filter_**B**	Data for filter B
Filter_**C**	Data for filter C
Filter_**D**	Data for filter D
Filter_**E**	Data for filter E
Filter_**W**	Data for filter W

For example, to get a read out of the calibration data for all the filters, type:

O_C_D? AL

2.3.27OUTPUT_ERROR_DUMP?

O_E_D? provides a readout of memory data etc. from the Monitor in ASCII form. It is used when a fatal error, which causes automatic restart (partial reset), occurs in the Monitor.

2.3.28 OUTPUT_HEADER

Allows the user to define whether the Monitor includes a message header with the readout messages. The default setting is without message header. The command parameter can be:

INclusive	Readout with message header
EXclusive	Readout without message header

For example, if you typed the message:

SE? 2, C_S

This asks the Monitor to indicate whether Monitoring task 2 is set up for continuous sampling. If it is, there are two possible outputs depending on whether **O**utput_**H**eader is inclusive or exclusive. The output would be either (a) or (b) as given below:

(a) With **O**utput_**H**eader inclusive:

SE? 2, C_S, Y

This is reusable as input.

(b) With **O**utput_**H**eader exclusive

Y

2.3.29 OUTPUT_MEASUREMENT?

O_M? provides a readout of measurement data from the Monitor in ASCII form. The **O_M?** command is followed by none or one of the following character data:

Alphabetical list if interface character data		
Data fields	Minimum code	Output Values
ALARM_LIMIT[1] NUMBER 1	A_L, 1	NR1
ALARM_LIMIT[1] NUMBER 2	A_L, 2	NR1
AIR_PRESSURE	A_P	NR2
BANK1	B	NR1
CHAMBER_FLUSH_TIME	C_F_T	NR1
CONTINUOUS_SAMPLING	C_S	Y or N
CROSS_COMPENSATION	C_C	Y or N
DATE	DA	"string"
EVENT_MARK	E_M	NR1
FIXED_TIME_FLUSH	F_T_F	Y or N
GAS_NAME1	G_N	"string"
MEMORY	MEM	NR1
MONITORING_MODE	M_M	Y or N
MONITORING_PERIOD	M_P	"string"
NORMALIZATION_TEMPERATURE	N_T	NR2
SAMPLE_INTERVAL	S_I	"string"
SIGNAL_INTEGRATION_TIME1	S_I_T,	NR1
TUBE_FLUSH_TIME	T_F_T	NR1
TUBE_LENGTH	T_L	NR2
USE_FILTER	US_F	Y or N
USE_MEASURED_AIR_PRESSURE	US_M_A_P	
WATER_COMPENSATION	W_C	Y or N

Table 2.9 List of interface character data for use with O_M?

When no character data follows, then **O_M?** reads out measurement data in ASCII form to the screen of the controller.

In some cases, the data character command must be clarified. For example, to obtain the Sample Integration Time for a specific filter (e.g. A) the command must be written as: O_M? S_I_T,F_A

O_M? A_L,F_X,1	returns measurement alarm limit 1 for filter x.
O_M? A_L,F_X,2	returns measurement alarm limit 2 for filter x.
O_M? US_M_A_P	returns measurement printout including air pressure table.
O_M? X,Y,US_M_A_P	returns measurement samples including air pressure from number X to Y.

[1]. This character command should be followed by a specified filter, e.g. F_A

2.3.30 OUTPUT_SETUP_DATA?

O_SE_D? reads out setup data from the Monitor in ASCII form. The parameter block, which defines what is readout can be one of the following:

ALl

COMmunication

CONfiguration

ENvironment

FIlters

FOrmat

General

MEAsurement

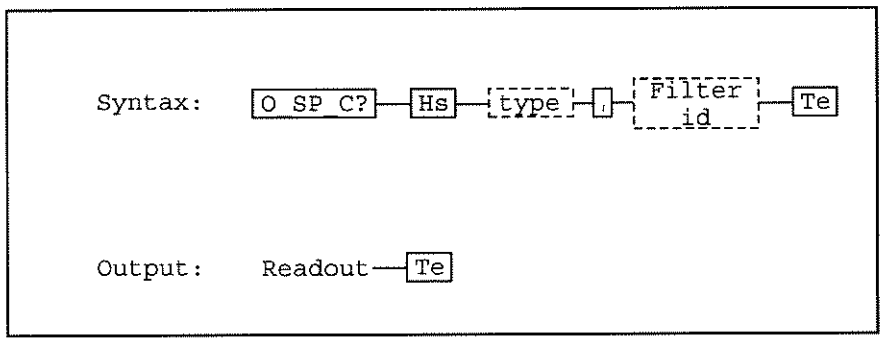
SYstem

Units

These names refer to the headings in the "setup tree". All data below these headings will be printed.

2.3.31 OUTPUT_SPECIAL_COMPILATION?

O_SP_C? reads out specially compiled data from the Monitor in ASCII form. This command requires two parameters. The syntax is shown below.



Where type is one of the following:

APplication	Data for 7620 Application Software.
SAmple_**DA**ta	Reads out data for all filters or a specified filter
O_SP_C?<type><filterid>,ALL	Returns measurement data including chamber temperature and air pressure.

The filter id is the same parameter used for section 2.3.24 OUTPUT_CALIBRATION_DATA?

The **SA**mple_**DA**ta output "readout" format for each sample consists of the following:

[Filter Error, Alarm][10 characters per gas][3 error and warning bits][Event no.][Time stamp]

An example of a read out for all filters is shown below:
FA 309.57E-06,_____,.....,.....,.....,.....,000,R0,X0,E____,3 13:56:40

The 10 characters for each gas consist of the concentrations of each in the internal units, which are mg/m^3. This may or may not be the same units as the current units manually selected in the set-up tree of the Monitor.

To interpret the read out use the following key:

F	Filter alignment error
A	Alarm
000	Air Flag, Error Flag, Warning Flag
R	Power down: 0=no, 1=yes
X	Operational error or warning: 0=no, 1=yes
E____	User event, where ___ is the event number (0001)
.....	Gas is not read out
_____	Bad result
3 13:56:40	Time stamp (DD HH:MM:SS)

Dot marks (...) mean that the gas was not measured. A straight line (_) means that the Monitor was unable to calculate the concentration of the gas. Of the error/warning bits, the first bit corresponds to gas feed errors/warnings, the second bit corresponds to any errors, and the third bit corresponds to any warnings. The time stamp gives hours, minutes, seconds, in addition to the date.

2.3.32 PASS_CONTROL_BACK

***P_C_B** determines the address to which control is passed back. NR_1 (0..30) is the bus address of the next controller. If two NR_1 numbers are used, the first will be the primary and the second the secondary address of the next controller.

2.3.33 POP_UP_DISPLAY_BUFFER?

P_U_D_B? reads out the contents of the Pop-up display.

For example the output string might be:
"UNKNOWN HEADER OR CHARACTER DATA"

2.3.34 PRINT_CALIBRATION_DATA

P_C_D enables the Monitor to send calibration data to a printer. The parameter is one of the following:

ALl	Data for all filters
Filter_**A**	Data for filter A
Filter_**B**	Data for filter B
Filter_**C**	Data for filter C
Filter_**D**	Data for filter D
Filter_**E**	Data for filter E
Filter_**W**	Data for filter W

2.3.35 PRINT_ERROR_DUMP

P_E_D enables the Monitor to send memory data etc. to a printer. This message can be used to dump memory data after a fatal error has occurred in the Monitor. The error can be generated from either the hardware or the software and causes an automatic restart (partial reset) of the Monitor.

2.3.36 PRINT_MEASUREMENT

PR_M sends Monitoring task data to a printer.

2.3.37 PRINT_SETUP_DATA

P_SE_D sends setup data to a printer. The parameter, which determines the setup data that is printed out, can be one of the following:

ALl

COMmunication

CONfiguration

ENvironment

FIlters

FOrmat

General

MEAsurement

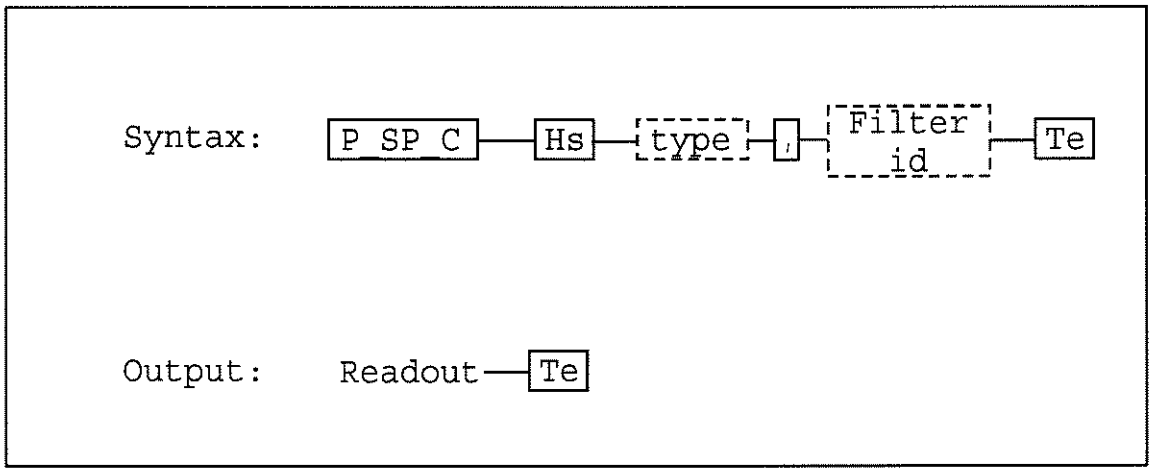
SYstem

Units

These names refer to the headings in the setup "tree". All data below these headings will be read out.

2.3.38 PRINT_SPECIAL_COMPILATION

P_SP_C sends a printout of specially compiled data to a printer. This command requires two parameters. The syntax is shown below.



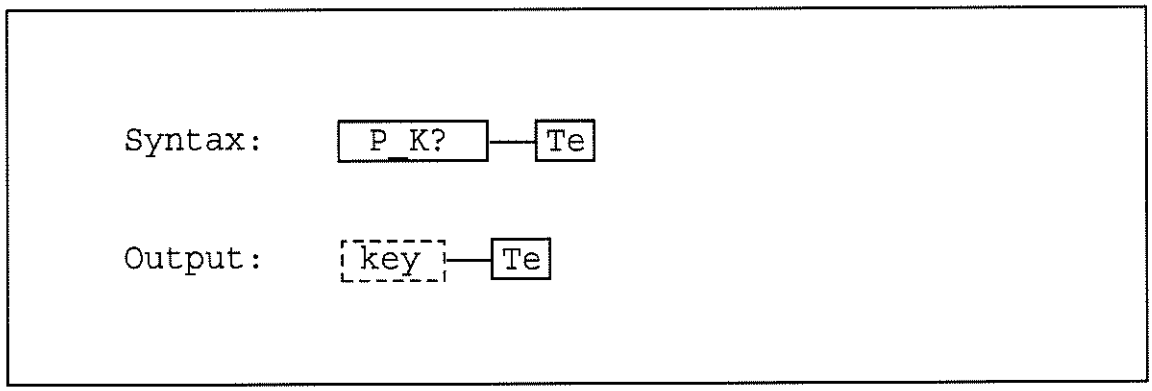
Where type command is one of the following:

APplication — Data for 7620 Application Software.

SAmple_**DA**ta — Reads out data for all filters or a specified filter

The filter id is the same parameters used for section 2.3.24 OUTPUT_CALIBRATION_DATA?

2.3.39 PUSH_KEY



P_K? indicates which front panel key has been the last activated. The output Key is one of those in Table 2.10:

Code	Key
AVerage	Average (1412 only)
Down_**D**irection	Arrow Down
Enter_**E**xecute	Enter/Execute
Event_**M**ark	Event (1412 only)
LEft_**D**irection	Arrow Left
LoCK	Lock
MEAsurement	Measure
MEMory	Memory
PRint	Print
RESet	Reset
Right_**D**irection	Arrow Right
Select_**1**	S1
Select_**2**	S2
Select_**3**	S3
SEtup	Setup
STATUs	Info
UP_Direction	Arrow Up

Table 2.10 The codes for Key

Use **P_K** to activate keys. Input of one or more front keys is possible. For example:

P_K AV,STATU,S_1

Note: LCK also works on instrument which do not have a lock button.

2.3.40 RECALL_MEASUREMENT

R_M transfers measurement data from the Memory Location specified, **NR_1** (1..10), in the background memory into the display memory.

2.3.41 RELAY

R? indicates the condition of/control over the relays. If the relay number is included, for example, R? 1, then condition of Relay 1 will be readout. Two outputs are possible:

Yes active
No inactive
/***** PROTECTED 59 *****/

The relay(s) condition can be set using **R**. If the relay number is specified, for example:

R 1,Y

Then the relay specified can be set as shown below:

Yes active
No passive

If the number is left out:

Yes the relays will be controlled via the interface
No the relays will be controlled by the Monitor.

2.3.42 REMOTE_DISPLAY_BUFFER

R_D_B? reads out the contents of Remote display. The output from the Monitor will be whatever has been written into the buffer via the interface by the user.

R_D_B reads new contents into Remote display buffer. The data string is 80 characters long and must be enclosed by double quotes(“”).

2.3.43 RESET_COMMAND

***RST** partially resets the Monitor. For details about resetting the Monitor, see the Instruction Manual.

2.3.44 RESET_STATUS_BYTE

R_S_B clears the Status byte, i.e. it is set to 00000000.

2.3.45 RESET_SYSTEM

Warning! during a full reset of the Monitor, all data in the Display Memory and Background Memory will be lost.

RESET_SY is followed by a parameter, which should be one of the following:

PARTial The Type Monitor is partially reset.

FULl The Type Monitor is fully reset.

If the parameter is omitted, the Monitor is partially reset.

/***** PROTECTED 71 *****/

Warning! during a factory reset of the Monitor, all data in the Source Memory will be lost.

FActory The Monitor makes a total E2PROM reset.

See the Instruction Manual for information on resetting the Monitor.

2.3.46 SELF_TEST?

***TST** causes the Monitor to carry out a self-test. The output (NR_1) gives the result of this test.

The output has one of these values:

–2 The Monitor is not in idle mode (display mode). Therefore the test can not be carried out.

–1 Operational Error Flags have been set after the test.

0 No flag has been set after the test.

1 Warning Flags have been set after the test.

For more details about self tests and Warning and Error messages, refer to the Instruction Manual.

2.3.47 SERVICE_REQUEST_ENABLE

The Service Request Enable Register is a mask for the Status Byte (see section 2.3.50) i.e. a bit that is set in the Status Byte will only cause a Service Request if the corresponding bit in the Service Request Enable Register is also set. This register is, therefore, used by the controller to enable and disable Service Requests.

S_R_E? will read out the decimal value of the SRQ enable register. The output (NR_1) is in the range 0..255. For example, if the register contained the binary number 0000 1000 and you typed:

S_R_E?

The Monitor would read out the decimal number 8, indicating that bit 4 is set and that an error has occurred.

S_R_E sets the Service Request Enable Register. The number in the register lies in the range 0..255. For example, if you typed:

S_R_E 8

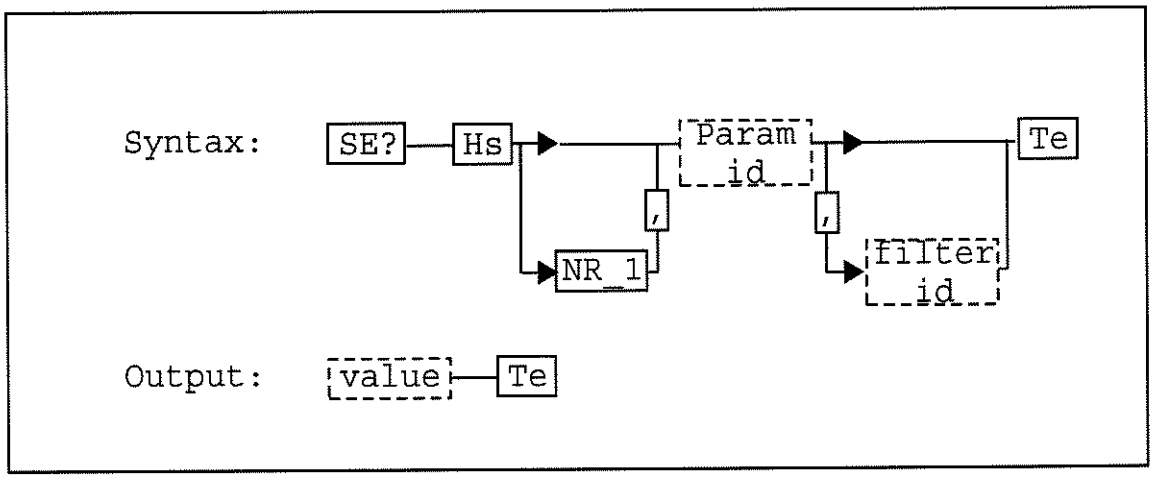
The Monitor would set bit 4 of the register to binary 1, so that whenever bit 4 of the Status Byte is set (the Error bit) an SRQ is generated.

The contents of the Service Request Enable Register is given in Table 2.11.

Service Request Enable Register		
Bit no.	Bit value	Bit name
1	1	Data Ready
2	2	Reset Activated
3	4	Command Completed
4	8	Error
5	16	(Not user definable)
6	32	Abnormal
7	64	(Not user definable)
8	128	Special event

Table 2.11 The contents of the Service Request Enable Register

2.3.48 SETUP



SE? reads out a specified parameter from the "setup" of the Monitor.

NR_1	(1..10)is Setup Number
Param id	is the parameter identification.
Filter id	is the filter identification. e.g. F_A...F_W
Value	is numeric data (types NR1..3), character data or string data.

SE defines the specified parameter of the setup of the Monitor.

NR_1 (1..10)	is Setup Number
Param id	is the parameter identification.

Filter id	is the filter identification. e.g. F_A...F_W
Value	is numeric data (types NR1..3), character data or string data.

The following examples show the use of the SE message with the parameter value different in each case:

SE T_L,10.5	in this case value is numeric and the length of the sampling tube is set to 10.5 in the current length units.
SE S_H,X_O	in this case value is character data.
SEG_N,F_A,"carbon dioxide"	in this case value is a text string and the gas name for filter A is set to carbon dioxide
SE 2,M_P,"2 12:00"	in this case value is a time string. Monitoring task No. 2 is set up for a period of 2 days and 12 hours.
SE F_T_F,Y	in this case, the Fixed Time Flushing is activated. The times for the chamber and the tube need to be set. Acceptable values for these parameters are given in the Instruction Manual. To set the times to 10s for the chamber and 20s for the tube, send: SE C_F_T,10 and SE T_F_T,20.
SE? C_W_S	returns Y og N.
SE C_W_S	takes character data Y or N as parameter. Y states that the measurement system is heated in idle mode. Heated means that the infrared source is heated, the chopper is running and the filters are positioned in a cyclic sequence. The heating is started after reset, finished measurement and finished calibration. If measurement or calibration is not started after 30 minutes the heating is stopped. N states that the measurement system is only kept warm during measurement and calibration. Changes in heating mode are updated after reset, finished measurement and finished calibration. Default after EEPROM reset is N.
SE? US_M_A_P	returns Y or N
SE US_M_A_P	takes character data Y or N as parameter. Y states that the measured atmospherical pressure is used for calculations. N states that the entered actual air pressure in setup is used for calculations.
SE? USER_L	returns 1,2 or 3.
SE USER_L	takes NR1 data 1,2 or 3. The number is the user level associated with the lock function. Default after EEPROM reset is 3.

SE? PASSWORD	returns a string of length 0 to 5.
SE PASSWORD	takes a string of length 0 to 5. The string is the password associated with the lock function. When comparing the password string with the password entered from the front panel (always 5 characters) the string is considered to be right padded with spaces. Default after EEPROM reset is "*****".
SE A_L, F_x,y, 1	sets setup alarm limit 1 for filter x to y.
SE A_L, F_x,y, 2	sets setup alarm limit 2 for filter x to y.
SE? A_L, F_x, 1	returns setup alarm limit 1 for filter x.
SE? A_L, F_x, 2	returns setup alarm limit 2 for filter x.
SE? MEM	returns Y or N.
SE MEM	takes character data Y or N as parameter. Y states that measurement history is stored, i.e. all available memory is used for storing measurement results. N states that only the results of the latest gas sample are stored. This enables a faster start up of the analyzer. Default after EEPROM reset is Y.
SE? PR,A_P	returns Y or N.
SE PR,A_P	takes character data Y or N as parameter. Y states that an air pressure table is printed when the measured concentrations are printed. N states that no air pressure table i sprinted when the measured concentrations are printed. Default after EEPROM reset is N.

All allowable parameter ids and values for SEtup are given in Table 2.12 and Table 2.13.

Setup parameter id	Minimum code
ALARM_LIMIT	A_L
AIR_PRESSURE	A_P
AVERAGE_TIME	A_T
BANK (Filter)	B
BAUD_RATE	B_R
CHAMBER_FLUSH_TIME	C_F_T
CLOCK	CL
CROSS_COMPENSATION	C_C
CONTINUOUS_SAMPLING	C_S
CONTINUOUS_WARM_SYSTEM	C_W_S
CONCENTRATION_UNIT	C_U
DATE	DA
DATA_BIT	D_B
DATA_LOG	D_L
ERROR_LOGGING	E_L
FIXED_TIME_FLUSH	F_T_F
GAS_NAME	G_N
GAS_WEIGHT	G_W
HARD_WIRE	H_W
HUMIDITY_UNIT	H_U
IEEE_Monitor_ADDRESS	I_1_A
IEEE_Monitor_CONTROLLER	I_1_C
IEEE_PRINTER_ADDRESS	I_PR_A
LENGTH_UNIT	L_U
MEMORY	MEM
MONITORING_MODE (preset period)	M_M
MONITORING_PERIOD	M_P
NORMALIZATION_TEMPERATURE	N_T
PARITY	PARI
PASSWORD	PASSWORD
PRESSURE_UNIT	PR_U
PRINTER_LINK	PR_L
PRINT,AIR_PRESSURE	PR and A_P
PRINT_ALL	P_P_A
PRINT_FILTER	P_P_F
POWER_UP_TEST (+ regular self-test)	P_U_T
SAMPLE_INTERVAL	S_I
SAMPLE_INTEGRATION_TIME	S_I_T
SOFT_HANDSHAKE (Handshake mode)	S_H
SOUND_VOLUME	S_V
STOP_BIT	S_B
TEMPERATURE_UNIT	T_U
TUBE_FLUSH_TIME	T_F_T
TUBE_LENGTH	T_L
UA_NUMBER	UA_N
USE_FILTER	US_F
USE_MEASURED_AIR_PRESSURE	US_M_A_P
USER_LEVEL	USER_L
WATER_COMPENSATION	W_C

Table 2.12 The setup parameter ids

Setup parameter id	Minimum code
EVEN	EV
HARD_WIRE	H_W
IEEE_488	IE
LEASED_LINE	L_L
NO (none)	N
ODD	O
RS_232	RS
SWITCHED_LINE	S_L
THREE_WIRE	T_W
UNIT_C	U_CE
UNIT_F	U_FA
UNIT_ft	U_FEET
UNIT_K	U_KE
UNIT_kPa	U_KPA
UNIT_mbar	U_MBAR
UNIT_m	U_METER
UNIT_mg/m^3	U_MG_M
UNIT_mmHg	U_MM_HG
UNIT_ppm	U_PPM
UNIT_Tdew	U_TDEW
X-ON/X-OFF	X_O
YES	Y

Table 2.13 Setup parameter values

2.3.49 SOFTWARE_IDENTIFICATION?

S_I? reads out the software identification string, for example the output might be "SOFTWARE ID VPxxxx 05-10-21 08.10".

S_I?AL reads out one line of information for each detected slave module in the instrument.

S_I?, COM reads out one line of information including dynamic status information for each detected slave module in the instrument.

2.3.50 START_CALIBRATION

The command has minimum code STA_C and exists only as input command.

STA_C, *calibration type, calibration parameters* starts a calibration of the specified *calibration type*. The *calibration parameters* depend on the calibration type.

Calibration type	Minimum code	Calibration parameters
Calibration_Zero	C_Z	Filter ABCDE, filter W
Calibration_Hum	C_H	
Calibration_Zero_Hum	C_Z_H	Filter ABCDE, filter W
Calibration_Gas_Span	C_G_S	Filter, two point, low conc, high conc, cross
Calibration_Water_Span	C_W_S	Conc

Calibration Parameter	Value
Filter ABCDE	YES or NO to all installed filters from A to E
Filter W	YES or NO to filter W
Filter	One of FILTER A to FILTER W
Two point	YES or NO to two point calibration
Low conc.	Two point low concentration
High conc.	Two point high concentration or single point concentration
Cross	YES or NO to cross calibration
Conc.	Span concentration

Examples:
STArt_Calibration Calibration_Zero,Yes,No
Calibration of Filter A to E. Filter W not calibrated.

STArt_Calibration Calibration_Zero,Yes,Yes
Calibration of Filter A to W.

STArt_Calibration Calibration_Zero,No,Yes
Calibration of Filter W without calibration of Filter A to E is not valid.

STArt_Calibration Calibration_Zero_Hum,Yes,No
Combined zero- and humidity calibration of Filter A-E. Filter W not zero calibrated.

STArt_Calibration Calibration_Zero_Hum,Yes,Yes
Combined zero- and humidity calibration of Filter A-E. Filter W is zero calibrated. (First time calibration of instrument!).

STArt_Calibration Calibration_Gas_Span, Filter_A,No,0.0,345.34,Yes
Single Point calibration of filter A with 345.34 ppm gas and with cross calibration.

STArt_Calibration Calibration_Water_Span,18000
Calibration of water filter with 18000mg/m^3 water.

2.3.51 START_DELAYED_MEASUREMENT

S_D_M "d hh:mm" or **S_D_M "dd hh:mm"** starts a Monitoring task at the specified time. d ~ day, h ~ hour, m ~ minute.

2.3.52 START_MEASUREMENT

STA_M starts a monitoring task immediately.

2.3.53 STATUS_BYTE?

***STB?** reads out the contents of the Status-Byte, see Fig. 6.1. The number (NR_1) is in the range 0..255.

For example, if the Status Byte contained the binary number 00000001 and you typed *STB? , the Monitor would return the decimal number 1, indicating that the Data Ready bit was set. The contents of the Status Byte is shown in Table 2.14.

Bit no.	Bit name
1	Data ready
2	Reset activated
3	Command completed
4	Error
5	Busy
6	Abnormal
7	SRQ_line
8	Special event

Table 2.14 Contents of Status Byte

2.3.54 STOP_MEASUREMENT

STOP_M stops the current measurement task.

2.3.55 STORE_DEFALUT

STO_DEF stores the current setup in non volatile memory. A full reset will recall the saved setup as the current setup. Exists only as input command.

2.3.56 STORE_MEASUREMENT

STOR_M stores the contents of the display memory in the background memory at a specified (NR_1) (1..10) location.

2.3.57 SYNCHRONIZE

SY? reads out the pump synchronization condition. This message is for use when an external pump (e.g. a pump in the 1303) is connected to the Monitor.

There are two possible outputs:

Yes	indicates that the Monitor pump will start only when a synchronization command is received from the controller. This is the required condition when an external pump is connected to the Monitor. If the synchronization condition is not set to Yes, and an external pump is connected, then airway errors can occur.
No	indicates that the Monitor pump is controlled by the Monitor.

/***** PROTECTED 59 *****/

SY sets the pump synchronization condition:

Yes	the Monitor pump will start only when a synchronization command is received from the controller.
No	the pump will be controlled by the Monitor.

If a **Y**es or **N**o parameter is not given, then the Monitor pump starts if the Monitor is waiting for the **SY**nchronize command.

2.3.58 SYSTEM_DISPLAY_BUFFER?

SY_D_B? reads out the contents of the Monitor default display. For example, the output might be:

SELECT SETUP BRANCH MEASUREMENT FORMAT CONFIGURATION

2.3.59 TIME_SINCE_RESET?

T_S_R? reads out the number of seconds since the last reset/power-up of the Monitor. The output (NR1) is in the range 0..4294967295 (about 136 years).

2.3.60 USE_MEASURED_AIR_PRESSURE

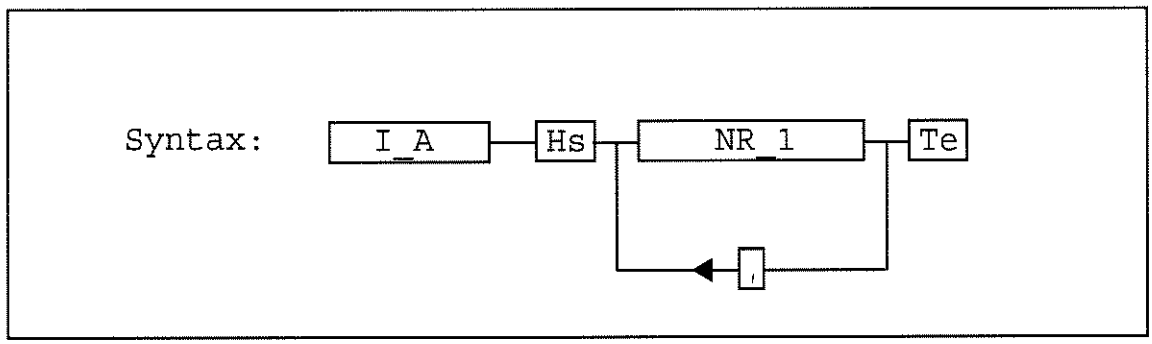
In order to use the measured air pressure for calculation the use measured air pressure code has to be selected by the command **SE US_M_A_P,y**

2.4 The IEEE–488 Bus Messages

The IEEE–488 bus messages (IEEE_xxxx) can only be sent to the Monitor via the RS–232 interface. They enable the user to send commands to/receive information from the device(s) connected to the Monitor via the IEEE–488 interface.

Notes:
These messages can only be executed when the Monitor is set-up as system controller (refer to the Instruction Manual).
As system controller, a controller is able to send device addresses, universal and addressed commands to other devices over the interface. To do this, however, it must send the ATN message over the interface (assert the ATN-line) before sending the actual message.

2.4.1 IEEE_ATTENTION



I_A sends data on the IEEE-bus with the ATN-line asserted. The data consists of max. 10 NR_1 (0..127) parameters, i.e. BYTE values.

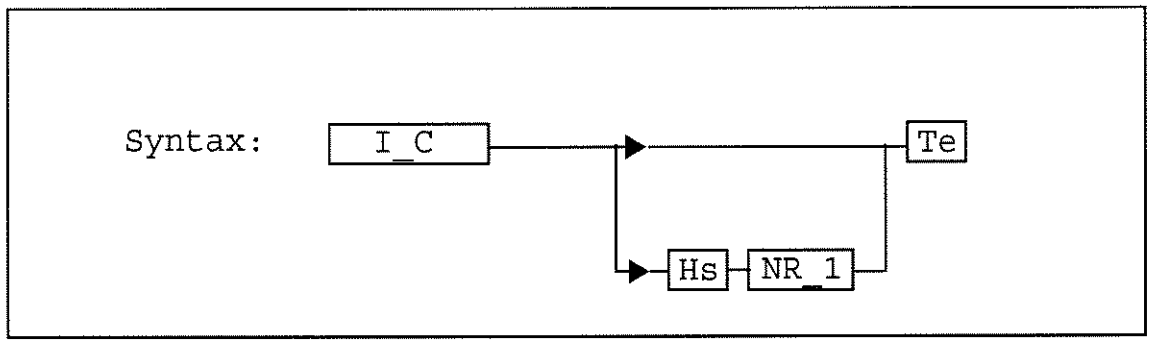
This message enables control of devices on the IEEE-bus via RS–232.

For example: I_A 63,95,49

This message will set the bus in the talker/listener idle state (UNL=63 "111111", UNT=95 "1011111") and addressed device 1 (49 "110001") as a listener.

The five least significant bits in each parameter correspond to the table of addresses in section 1.2.2.

2.4.2 IEEE_CLEAR



When **I_C** is sent, if NR_1 is omitted, the DCL (Device Clear) message is sent with ATN asserted.
If NR_1 is included (0..30), a Listener address and SDC (Selected Device Clear) are sent.

2.4.3 IEEE_ENTER?

I_E? reads in data from the IEEE bus and sends it on to the RS–232.

If NR_1 (0..30) is included, the IEEE bus is unaddressed and the specified device is addressed as a talker. UNL, UNT, Talk NR_1-parameter are sent with ATN asserted, whereupon data is read in from this device.

2.4.4 IEEE_INTERFACE_CLEAR

I_I_F_C sends IFC (Interface Clear) on the bus.

2.4.5 IEEE_LOCAL

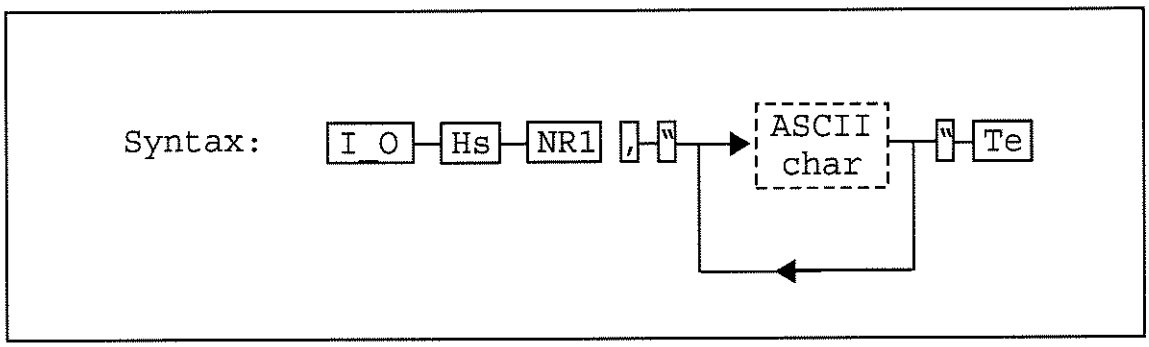
If an NR_1 (0..30) is included, UNL, the specified listener-address, and GTL (Go To Local) are sent with ATN asserted. The addressed device is set to Local State.

If an NR_1 is omitted, the REN (Remote Enable) line is unasserted (False). All devices on the bus are set to Local State.

2.4.6 IEEE_LOCAL_LOCKOUT

I_L_L_O sends the LLO (Local Lock Out) message on the IEEE bus. This command disables the return to local control (often a "Local" key) and thus prevents operation of the device via its front panel. The command is accepted regardless of whether the device is in local or remote mode.

2.4.7 IEEE_OUTPUT



I_O sends data on the IEEE bus.
If NR_1 (0..30) is included, the specified device is addressed as a listener.
The "ASCII char" is sent as normal data on the bus.

2.4.8 IEEE_PARALLEL_POLL?

I_P_P? initiates a Parallel Poll sequence on the IEEE bus. The response is returned via the RS–232 (Byte value).

2.4.9 IEEE_P_P_C (IEEE_Parallel_Poll_Configure)

I_P_P_C executes a configuration of the Parallel Poll answer from a specified device.

The command is followed by two NR_1 parameters, separated by a comma.
For example: I_PPC 3,13

First NR_1 parameter gives the address (0..30).

Second NR_1 parameter gives the configuration value (0..15). The three least significant bits indicate which bit position for the specified device the reply should be directed to. The fourth, least significant, bit indicates whether the reply should be "1" or "0" for a logical TRUE PP-status.

2.4.10 IEEE_P_P_U (IEEE_Parallel_Poll_Unconfigure)

I_P_P_U sends out PPU (Parallel Poll Unconfigure) with ATN asserted.

2.4.11 IEEE_REMOTE

I_R asserts the REN (Remote Enable) line. This places the addressed device in the Remote State, i.e. it can be controlled only via the IEEE–488 bus and not via the front panel.

2.4.12 IEEE_SERIAL_POLL?

I_S_P? carries out a Serial Poll on up to 5 connected devices. The result for each device is returned as an 8–bit binary word.

Chapter 3

Interface Character Data

March, 2006

3.1 List of Interface Character Data

Alphabetical list of interface character data	
Data fields	Minimum code
ALL	AL
APPLICATION	AP
AVERAGE	AV
ALARM_LIMIT	A_L
AIR_PRESSURE	A_P
AVERAGE_TIME	A_T
A_D_VALUES	A_D_V
BANK	B
BAUD_RATE	B_R
CALIBRATION_DATA	C_D
CHAMBER_FLUSH_TIME	C_F_T
CLOCK	CL
COMMUNICATION	COM
CONFIGURATION	CON
CONTINUOUS_SAMPLING	C_S
CONTINUOUS_WARM_SYSTEM	C_W_S
CONCENTRATION_UNIT	C_U
CROSS_COMPENSATION	C_C
CURRENT_FILTER	C_F
DATA_BIT	D_B
DATA_LOG	D_L
DATE	DA
DOWN_DIRECTION	DO_D
ENTER_EXECUTE	E_E
ENVIRONMENT	EN
ERROR_LOGGING	E_L
ERROR_VALUES	E_V
EVEN	EV
EVENT_MARK	E_M
EXCLUSIVE	EX
FACTORY	FA
FILTERS	FI
FILTER_A	F_A
FILTER_B	F_B
FILTER_C	F_C
FILTER_D	F_D
FILTER_E	F_E
FILTER_W	F_W
FIXED_TIME_FLUSH	F_T_F
FORMAT	FO
FULL	FUL
GAS_NAME	G_N
GAS_VALUES	G_V
GAS_WEIGHT	G_W
GENERAL	G

Alphabetical list of interface character data	
Data fields	Minimum code
HARD_WIRE	H_W
HUMIDITY_UNIT	H_U
IEEE_Monitor_ADDRESS	I_1_A
IEEE_Monitor_CONTROLLER	I_1_C
IEEE488	IE
IEEE_PRINTER_ADDRESS	I_PR_A
INCLUSIVE	IN
INFO	STATU
LEASED_LINE	L_L
LEFT_DIRECTION	LE_D
LENGTH_UNIT	L_U
LINEAR	LIN
MEASUREMENT	MEA
MEASUREMENT_DONE	M_D
MEMORY	MEM
MONITORING_MODE	M_M
MONITORING_PERIOD	M_P
NO (NONE)	N
NORMALIZATION_TEMPERATURE	N_T
ODD	O
PASSWORD	PASSWORD
PARITY	PARI
PARTIAL	PART
POP_UP	PO_U
POWER_UP_TEST	P_U_T
PRESSURE_UNIT	P_U
PRINT	PR
PRINTER_LINK	PR_L
PRINT, AIR_PRESSURE	PR and A_P
PRINT_ALL	P_P_A
PRINT_FILTER	P_P_F
PROCESS_DATA	PR_D
PUMP_DONE	PU_D
PUSH_KEY	P_K
REMOTE	REM
REP_DOWN	RE_D
REP_UP	RE_U
REP_S1	R_S1
REP_S3	R_S3
RESET	RES
REVERSE	REV
RIGHT_DIRECTION	RI_D
RS232	RS
SAMPLE_DATA	SA_DA
SAMPLE_DONE	SA_DO
SAMPLE_INTEGRATION_TIME	S_I_T
SAMPLE_INTERVAL	S_I

Alphabetical list of interface character data	
Data fields	Minimum code
SELECT_1	S_1
SELECT_2	S_2
SELECT_3	S_3
SETUP	SE
SETUP_DATA	SE_D
SLUT_CALIBRATION	SL_C
SLUT_MEASUREMENT	SL_M
SOFT_HANDSHAKE	S_H
SOUND_VOLUME	S_V
STANDARD	STAN
STATISTICS	STATI
STOP_BIT	S_B
SWITCHED_LINE	S_L
SYSTEM	SY
TEMPERATURE_UNIT	T_U
THREE_WIRE	T_W
TUBE_FLUSH_TIME	T_F_T
TUBE_LENGTH	T_L
UA_NUMBER	UA_N
UNITS	U
UNIT_C	U_CE
UNIT_F	U_FA
UNIT_ft	U_FEET
UNIT_K	U_KE
UNIT_kPa	U_KPA
UNIT_mBar	U_MBAR
UNIT_m	U_METER
UNIT_mg/m	U_MG_M
UNIT_mmHg	U_MMHG
UNIT_ppm	U_PPM
UNIT_Tdew	U_TDEW
UP_DIRECTION	UP_D
USER_LEVEL	USER_L
USE_FILTER	US_F
USE_MEASURED_AIR_PRESSURE	US_M_A_P
WARNING_VALUES	W_V
WATER_COMPENSATION	W_C
X-ON/X-OFF	X_O
YES	Y

Table 3.1 List of interface character data

Chapter 4

Error Messages

March, 2006

4.1 List of Error Messages.

Error Message	Description
MONITOR IS NOT CONTROLLER IN CHARGE	The Monitor must have control of the bus, but the Monitor is not the Controller in Charge (CIC)
MONITOR IS NOT SYSTEM CONTROLLER	The Monitor must be the "System Controller" for the message to be performed. It is not sufficient if the Monitor is the CIC
AD BLOCK SPECIFICATION SYNTAX	Syntax error. Illegal specification of the block data. The correct syntax is #nc...c, where n is the length count and c is the digit. The size of the block may be wrong.
BAD CHARACTER DATA SYNTAX	Syntax error. Illegal character found in the character data types.
BAD HEADER DATA SYNTAX	Syntax error. Illegal character found in the message header.
BAD NR1 SYNTAX	Syntax error. Illegal NR1 numeric definition. Refer to "IEEE–488.2 —1987 Standard" for correct NR1 syntax.
BAD NR2 SYNTAX	Syntax error. Illegal NR1 numeric definition. Refer to "IEEE–488.2 —1987 Standard" for correct NR2 syntax.
BAD NR3 SYNTAX	Syntax error. Illegal NR3 numeric definition. Refer to "IEEE–488.2 —1987 Standard" for correct NR3 syntax.
BAD STRING DATA SYNTAX	Syntax error. The text string is not surrounded by quotes (")
BAD TERMINATOR	Syntax error. Illegal message terminator, i.e. not <LF> or one specified with DEFINE_TERMINATOR.
BAD TIME STRING SYNTAX	Syntax error. The text string to indicate date/time is not correct.
BLOCK DATA EXPECTED	Syntax error. Illegal data type received.
BLOCK DATA NOT COMPLETED	Syntax error. Block data ended/interrupted before the usual termination.
BLOCK DATA OVERRUN	Syntax error. Block data has not been ended according to the block specification.
BLOCK DATA. PARAMETER OUT OF RANGE	The data in the block is illegal
CHARACTER DATA EXPECTED	Syntax error. The wrong data type was received.
CONTROLLER JOB ABORTED	Time Out on a job where the Monitor is the controller. The usual Monitor controller functions, i.e. Print, will not cause this error. It may happen in connection with messages from the RS–232 that are sent on via the IEEE.
CONTROLLER NOT ACTIVE	The Monitor is supposed to be the controller, in connection with a certain function like Print. But the System Controller (computer) has taken back control, which it had temporarily passed to the Monitor.

Error Message	Description
HANDSHAKE ERROR	Occurs in connection with the RS–232 <–> IEEE488 conversion.
IEEE ABORTED	In the RS–232<–> IEEE488 conversion communication, communication on the IEEE488 side has stopped.
IEEE CONTROL RECEIVED/NOT REQUESTED	The Monitor wishes to send print/error-/data-log via the IEEE4888 without being the CIC. Before the Monitor gains control, output is aborted by the user. The Monitor now takes control, however, it is not necessary now for the Monitor to be the controller.
IEEE CONTROL TIMEOUT	The Monitor wishes to send print/error-/data-log via the IEEE4888 without being the CIC. If there are no other controllers on the bus, the Monitor should be the "System Controller". CIC can not hand over control to the Monitor.
IEEE CONTROL TIMEOUT/NOT REQUESTED	The Monitor wishes to send print/error-/data-log via the IEEE4888 without being the CIC. Before the Monitor gains control, output is aborted by the user. If there are no other controllers on the bus, the Monitor should be the "System Controller". CIC can not hand over control to the Monitor.
IEEE ERROR	Error in the data from the IEEE488 in connection with the RS–232<–> IEEE488 conversion.
IEEE-INTERFACE LOCKED FROM RS232	The internal communication channel of the Monitor is being used by the RS–232 interface. Communication with the Monitor via the IEEE488 is locked out by the RS–232.
ILLEGAL CHARACTER	Illegal syntax. The error can appear in many contexts.
ILLEGAL CHARACTER DATA	The character data is not correct in this context.
ILLEGAL STATE FOR OPERATION	The Monitor is currently in an operating state where the message is illegal.
ILLEGAL STRING DATA	The contents of the string is not correct.
INTERNAL BUFFER OVERFLOW	Syntax error. The header/Character data is too big. The text string is too long etc.
JOB IS CANCELLED	The current output-message is interrupted by a new input-message.
JOB NOT ALLOWED FOR INPUT OR OUTPUT	Syntax error. The user has changed an input-only message into an output message b use of a "?", or an output-only message into an input message.
MISSING CHARACTER	E.g. a "+" and <LF> are received. The "+" indicates that a numerical value (NRx) is to follow, but this numerical value does not appear.
NO CONTROL PASSBACK ADDRESS	When the Monitor has to perform the print function, and it is not the "System Controller", control has to be passed to it by the active controller (computer). Afterwards, the return address must be known (via the message *PCB). The error occurs if the return address is not known.

Error Message	Description
NOT ALLOWED	
NR1 DATA EXPECTED	Syntax error. The wrong data type is received.
NR1 OR CHARACTER DATA EXPECTED	Syntax error. The wrong data type is received.
NR2 DATA EXPECTED	Syntax error. The wrong data type is received.
NR3 DATA EXPECTED	Syntax error. The wrong data type is received. Refer to "IEEE–488—Standard" for the correct syntax.
NR3 EXPONENT OVERFLOW	Syntax error. The wrong data type is received. Refer to "IEEE–488—Standard" for the correct syntax.
NR3 OVERFLOW +/– 1.OE12	The exponent was too big. The Monitor internal limit was exceeded.
OUTPUT DATA CANCELLED	The current output-message is interrupted by a new input message.
PARAMETER EXPECTED	Syntax error. The parameter for the message is missing.
PARAMETER OUT OF RANGE	The numerical parameter is illegal.
RECEIVE ERROR	A fundamental error in receiving the message.
RELAY CONTROL NOT ENABLED	The user is trying to control the Monitor's alarm relays, but access to the relays has not been opened.
RS–232-INTERFACE LOCKED FROM IEEE	The internal communication channel of the Monitor is being used by the IEEE488 interface. Communication with the Monitor via the RS–232 is locked out by the IEEE–488.
STRING DATA EXPECTED	Syntax error. Illegal data type received.
STRING LENGTH OUT OF RANGE	The string is longer than allowed.
TIME OUT ON PCB	Control has temporarily been handed over to the Monitor, but the System Controller (computer) does not want it passed back.
TOO MUCH DATA	Syntax error. There are more parameters in the message than necessary. Otherwise, the message is correct and will usually be executed.
UNKNOWN HEADER OR CHARACTER DATA	Syntax error. Unknown message header and character data.
WARNING: CTS HANDSHAKE CONFLICT	The Monitor receives a handshake signal on the RS–232 CTS line without being setup for using CTS. There is a handshake conflict between the Monitor and the device connected to the RS–232.
WARNING: DSR HANDSHAKE CONFLICT	The Monitor receives a handshake signal on the RS–232 DSR line without being set up for using DSR. There is a handshake conflict between the Monitor and the device connected to the RS–232.
WARNING: MEMORY FULL WARNING: MEMORY LOCATION ALREADY USED WARNING: MEMORY LOCATION EMPTY	Errors in connection with the use of the Background Memory.
WARNING: NO DATA FOR PRINT	There is insufficient data in the Monitor to make a print.

Error Message	Description
WARNING: RS232 FRAMING ERROR DATA LOST	The Monitor was receiving corrupted data on the RS–232 RX line.
WARNING: RS232 OVERFLOW. DATA LOST	The Monitor receives data on the RS–232 RX line faster than it can handle. The internal buffer is full.
WARNING: RS232 OVERRUN. DATA LOST	The Monitor receives data on the RS–232 RX line faster than it can handle.
WARNING: RS232 PARTIY ERROR. DATA LOST	The Monitor receives data with illegal parity.
WARNING: SETUP AND / OR CALIBRATION CONFL	The Monitor is about to start a measurement, but the setup of the Monitor and the possibilities of the current calibration are in conflict.
WARNING: TIMEOUT. DEVICE NOT CONNECTED	The Monitor wishes to send print/error-/data-log via the IEEE–488, but there is no response from any device on the address being sent. The device may not be properly connected or it may have been given an incorrect address in the Monitor setup.
WARNING: TIMEOUT. DEVICE NOT READY	The Monitor wishes to send print/error-/data-log. The transmission starts, but the device stops reception of data for too long. The device may be off-line. The device may be too slow. The device may no longer be properly connected.
WARNING: X-ON/X-OFF HANDSHAKE CONFLICT	The Monitor receives the X-On/X-Off signal via RS–232 without being set up to use X-On/X-Off. There is a hand-shake conflict between the Monitor and the device connected to the RS–232.
WRONG DATA TYPE	

Table 4.1 List of error messages

Chapter 5

Service Requests

March, 2006

5.1 Introduction to Service Requests

Under certain circumstances, it is necessary for the Monitor to demand attention from the controller or otherwise interrupt the normal sequence of the interface communication. The Monitor does this by raising the Service Request (SRQ) line of the IEEE interface or by sending out a single SYN character (ASCII) on the RS–232 interface. Service requests can, therefore, be used for device synchronization. The SRQ function is commonly used to synchronize the operation of the Monitor with an external computer that has IEEE–488 or RS–232 controller capabilities. Typically, SRQ indicates that data is ready to be transmitted or an error condition exists. The Monitor generates a Service Request which interrupts the computer. When interrupted from the IEEE interface, the computer performs a serial poll on the Monitor Status Byte and resets the SQR line. The computer is then free to perform other tasks while waiting for a signal from the Monitor.

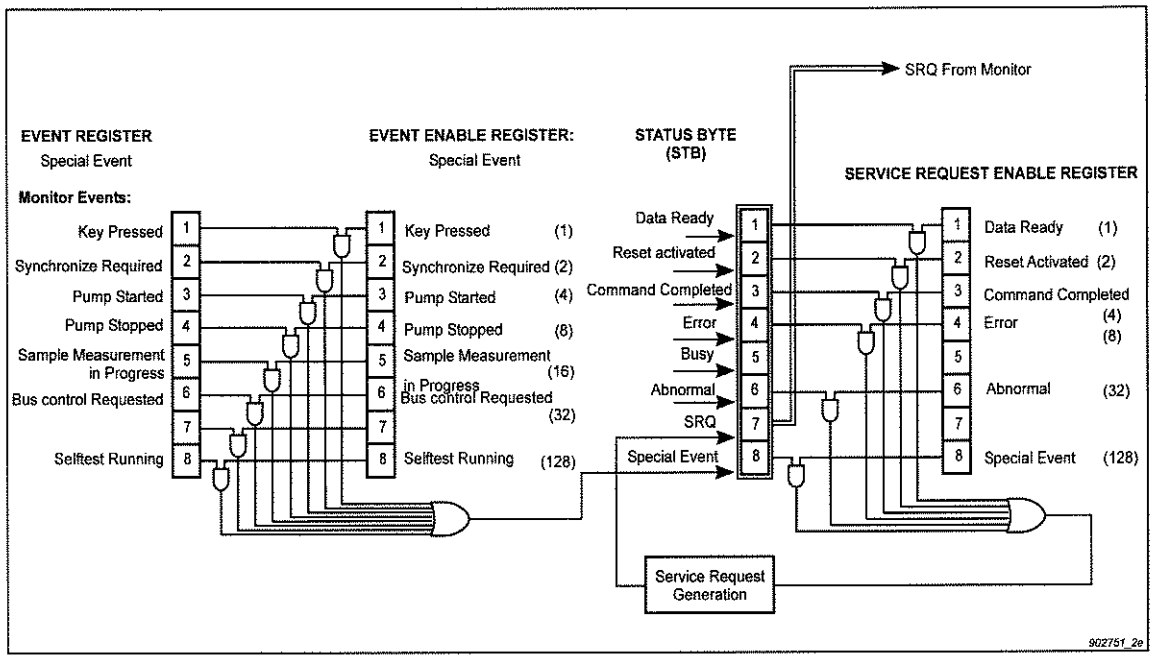


Fig. 5.1 *Logic diagram of the "Special Event" Event register, Event Enable Register, Status Byte and Service Request Enable Register.*

Fig. 5.1 shows part of the logic diagram for generating Service Requests. The input to 5 of the 8 bits of the Status Byte (bits 1 – 4 and 8) come from the 5 pairs of Event Registers and Event Enable Registers (in this case the "Special Event" Registers) is shown.

- The Event Enable Registers act as masks for the Event Registers.
- The Service Request Enable Register acts as a mask for the Status Byte.

5.2 The Status Byte

The Status Byte has 8 bits, which are by default set to 0. Seven of the bits (1..6 and 8) are only set when specific conditions occur, bit 7 is used to signal that the Monitor has sent a service request. For example, when a command has been completed, bit 3 in the Status Byte is set. The Status Byte can be read using the message ***STB?** It can also be read out as a part of a serial

poll sequence. There is no interface message enabling you to change the contents of the Status Byte.

5.3 The Service Request Enable Register

This register is a mask for the Status Byte. An event that causes a bit to be set in the Status Byte will not alone cause a service request to be sent. If, however, the corresponding bit in the Service Request Enable Register has also been set, then the Status Byte bit will cause a service request to be sent.

All bits in the Service Request Enable Register have default value 0. You can read out the contents of the register using the **S**ERVICE_**R**EQUEST_**E**NABLE**?** message, and you can define the bit pattern by using the **S**ERVICE_**R**EQUEST_**E**NABLE message. This determines which conditions cause the Monitor to send a service request.

5.4 The Event and Event Enable Register

The input to 5 of the 8 bits of the Status Byte (bits 1–4 and 8) come from 5 pairs of Event Registers and Event Enable Registers. These pairs of registers are linked together in a similar way to the Status Byte and Service Request Enable Register. 20 bits from the 5 Event Registers are used to indicate specific events. Each of these 20 bits has a corresponding bit in an Event Enable Register. As with the Status Byte, a corresponding Event Enable Register bit must be set before an event can generate an output. The contents of the 5 Event Registers are given in Table 2.3 – Table 2.7. Using the **CO**NTROL_**SRQ** message, you can define the contents of the Event Enable Register specified. Using the **CO**NTROL_**SRQ?** message, you can read the contents of the Event Enable Register specified.

A bit may be set in the Special Event Register, for example, when a key is pressed. In that case, bit 1 is set. If bit 1 is also set in the Special Event Enable Register, then the Special Event bit, which is bit 8, of the Status Byte is set.

Chapter 17

Warning and Error Messages

February, 2005

When the Monitor is switched on, and while it is being operated, the Monitor regularly performs a series of self-tests, which check that the various mechanical, electrical and electronic components of the Monitor are functioning correctly. These self-tests are described in more detail in Chapter 5. You can select to disable the **regular self-tests** if desired (see section 5.4.3). If any component is found to be functioning outside of its specifications either a "Warning" or a "Operating-error" message will appear on the gas monitor's screen.

Please note: A "Warning" and/or "Operating-error" message will only be displayed **once**. If the fault is still found to be present during the next regular self-test the message will **not** be displayed again. Messages are only displayed when a fault is first detected. If the fault corrects itself and then is later found to be faulty the message will be displayed again. It is therefore important to note the message before pressing the **INFO** button, which will cause the error message to be removed from the display.

Although the message is removed from the screen, any gas measurements performed while the fault is still present will be marked with an asterisk (*). By pressing **INFO** when such a measurement is displayed, the **Common mark "O" and/or "W"**, and in some cases, the **Gas Mark "F"** and **Gas Mark "A"** will be shown on the display.

On the following pages, all possible "Warning" messages are listed; all possible "Operating-errors" messages are listed; and all possible "Interface-error" messages are listed. There is a description of each fault as well as the possible cause(s) of each fault. The user must evaluate the significance of each message. As long as the fault is detected, all measurements will be marked by an asterisk. Some "faults" are easily corrected.

Warning and Error Messages

The following table gives most of the error and warning messages contained in the test Hierarchy of the Monitor. There is a description of each fault as well as the possible cause of each fault. The user must evaluate the significance of each message.

Error / Warning Message	Description of Fault	Possible Cause
AIR FLOW TOO LOW	The air pressure difference created by the pump in the pneumatic (airway) system (tubes and/or analysis cell) is too low. This means that the tubing and/or analysis cell cannot be properly flushed out and the sample in the analysis cell is therefore not necessarily "new"	1. The length of the sampling tube attached to the Monitor's inlet has been incorrectly entered. 2. Either the external or internal pneumatic system is not air-tight 3. The pump is defective
AIRWAY-SYSTEM BLOCKED	The air pressure difference created by the pump in the pneumatic (airway) system (tubes and/or analysis cell) is too high	1. The length of the sampling tube attached to the Monitor's inlet has been incorrectly entered. Either the external or internal pneumatic system is not air-tight
ALARM LIMIT EXCEEDED	The Monitor has measured a concentration of gas greater than the alarm limit concentration entered	
NO INDEX MARK FROM FILTER CAROUSEL	The Monitor cannot determine the position of its filter carousel	1. The motor that drives the filter carousel is not working 2. The optical detector that checks the movement of the carousel is not working 3. The filter carousel has not been properly mounted

CLOCK SET TO DEFAULT ERROR DETECTED IN CLOCK SETTINGS	The Monitor's internal clock was found to be incorrectly set so these values have been set to their default values	A new battery has been installed
FACTORS SET TO DEFAULT ERROR DETECTED IN CALIBRATION FACTORS	An error has been found in the data stored in the Calibration Factor part of the Monitor's memory, so these factors have been set to their default values	1. A defective back-up battery 2. A defective Working Memory (RAM) or Source Memory (EEPROM) 3. A Software fault
MEMORY SET TO DEFAULT ERROR DETECTED IN BACKGROUND MEMORY	An error has been detected in the Monitor's Background Memory, so the Monitor automatically deletes all data stored in this Memory	1. A defective back-up battery 2. A defective Working memory (RAM) 3. A software fault
MEMORY SET TO DEFAULT ERROR DETECTED IN DISPLAY MEMORY	An error has been detected in the Monitor's Display Memory, so the Monitor automatically delete all data stored in this memory.	1. A defective back-up battery 2. A defective Working Memory (RAM) 3. A software fault
MEMORY SET TO DEFAULT ERROR DETECTED IN INTERNAL MEMORY	An error has been found in the data stored in the Monitor's internal memory. data stored in this memory cannot be read or altered by the user, so the Monitor automatically corrects any errors found in this memory	1. A defective back-up battery 2. A defective Working Memory (RAM) 3. A software fault.
MEMORY SET TO DEFAULT ERROR DETECTED IN SOURCE MEMORY	An error has been found in the data stored in the Monitor's source memory, so the Monitor automatically give stored parameters default values.	1. A defective back-up battery 2. A defective Source Memory (EEPROM) 3. A software fault
PARAMETERS SET TO DEFAULT ERROR DETECTED IN CONFIG:/FORMAT PARAMETER	An error has been found in the value parameters stored in the Configuration and/or Format branches of the Monitor's set-up tree, and therefore the Monitor has automatically given these parameters default values	1. A defective back-up battery. 2. A defective Working Memory (RAM) 3. A software fault.
PARAMETERS SET TO DEFAULT ERROR DETECTED IN THE TASK SET_UP PARAMETER	An error has been found in the value parameter stored in the Monitoring Task branch of the Monitor's set-up tree, and has automatically given these parameters default values.	1. A defective back-up battery 2. A defective Working Memory (RAM) 3. A software fault.
A/D INTERRUPT FAILED	A/D converter was not able to collect the necessary number of signal measurements to ensure an accurate concentration measurement.	The analogue card is defective.

AIR SHUNT BLOCKED. SAMPLE ABORTED	The pressure of air in the analysis cell is too high. The microphones risk being damaged by exposed to such pressure.	The air shunt valve is either defective or blocked.
CHOPPER FAILED	The chopper wheel is not running.	1. The chopper motor is not working 2. The optical sensor which checks the chopper 's movement is not working.
INTERNAL TEMPERATURE OUT OF RANGE	The temperature in the analysis cell is either too high or too low. As the Monitor is operating outside its temperature specifications, accurate measurements can not be guaranteed.	1. The ventilation fan is defective. 2. The ambient air temperature is either too high or too low. 3. The temperature sensor is defective.
IR-SOURCE TEMPERATURE OUT OF RANGE	The temperature of the infrared light source is either too high or too low. As the IR-source is operating outside its temperature specifications accurate measurements cannot be guaranteed.	The infra-red light source is defective.
MICROPHONE TEST FAILED	The signal received from the microphone during the self-testing procedure is out of range.	1. The analogue card is defective 2. A microphone (s) is defective.
PUMP TEST FAILED	The pump cannot build up the necessary pressure during the self-testing procedure.	1. The pump is defective. 2. The internal pneumatic system is not airtight.
MODULE STATUS ERROR DETECTED	At least one of the modules is not functioning as expected.	1. Module hardware error. 2. Fault in communication cable 3. Wrong module version 4. Fault in the data configuration of the module
IEEE CONTROL TIMEOUT	The Monitor wishes to send data to a printer via IEEE interface, but the Monitor is not the system controller.	There are no other " controllers" on the IEEE bus, so the Monitor should be made the controller.
WARNING: X-ON/X-OFF HANDSHAKE CONFLICT	The Monitor receives the handshake signal from the RS232 CTS (clear to send) line, but it has not been set-up to use this CTS line	The Monitor and RS232 device (printer) do not agree about which handshake signal they should use. Perhaps the wrong interface cable has been used.

TIMEOUT. DEVICE NOT CONNECTED	Monitor wishes to send data (print , data-log or error-log) via the IEEE interface, but there is no response from the device with the address entered in the Monitor set-up	1 No device is connected to the Monitor 2 The device address has been entered incorrectly in the Monitor's set-up.
WARNING : TIMEOUT. DEVICE NOT READY	Monitor wishes to send data (print , data-log or error-log) but after the start of data transmission , the device stops receiving data.	1. The device is " off-line " (it can not receive data). 2. The device is not able to receive data fast enough. 3. The device is no longer connected to Monitor.