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Instruction Manual

Active Gauge Controller
RS232 Option

This is supplementary to the Active Gauge Controller Instructions D386-55-880

Description	*Item Number*
AGC-SINGLE DISP, RS232, 3 HEAD	*D386-52-000*
AGC-SINGLE DISP, RS232, 6 HEAD	*D386-51-000*
AGC-SINGLE DISP, RS232, CM VER	*D386-50-000*
AGC-TRIPLE DISP, RS232, 3 HEAD	*D386-62-000*
AGC-TRIPLE DISP, RS232, 6 HEAD	*D386-61-000*
AGC-TRIPLE DISP, RS232, CM VER	*D386-60-000*

BOC EDWARDS

Manor Royal, Crawley, West Sussex, RH10 2LW, UK
Telephone: +44 (0) 1293 528844 Fax: +44 (0) 1293 533453
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1 INTRODUCTION

1.1 Scope of this man ual

This manual provides installation and operation instructions for the Edwards Active Gauge Controller RS232 option. It is important that these instructions are read in conjunction with the Active Gauge Controller general operating instructions D386-55-880.

1.2 General

The Edwards Active Gauge Controller (AGC) RS232 option allows the AGC to be interfaced to a micro-computer or data acquisition system via a serial RS232 communications link.

The RS232 communications protocol is set up (and monitored) via a menu tree structure. You move through the menu with simple keystroke combinations entered from the front panel. Security of the settings is achieved via a password system which restricts access to the menu tree.

2 TECHNICAL DATA

The technical data is available in Section 2 of D386-55-880.

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3 INSTALLATION

3.1 General

The RS232 option is factory fitted and cannot be retrofitted by the user.

The installation instructions are listed in Section 3 of D386-55-880.

The electrical supply and all other connections to the active gauge controller are through the rear panel shown in Figure 1. The RS232 option serial port, internal relay expansion board and gauge channel expansion board are all shown.

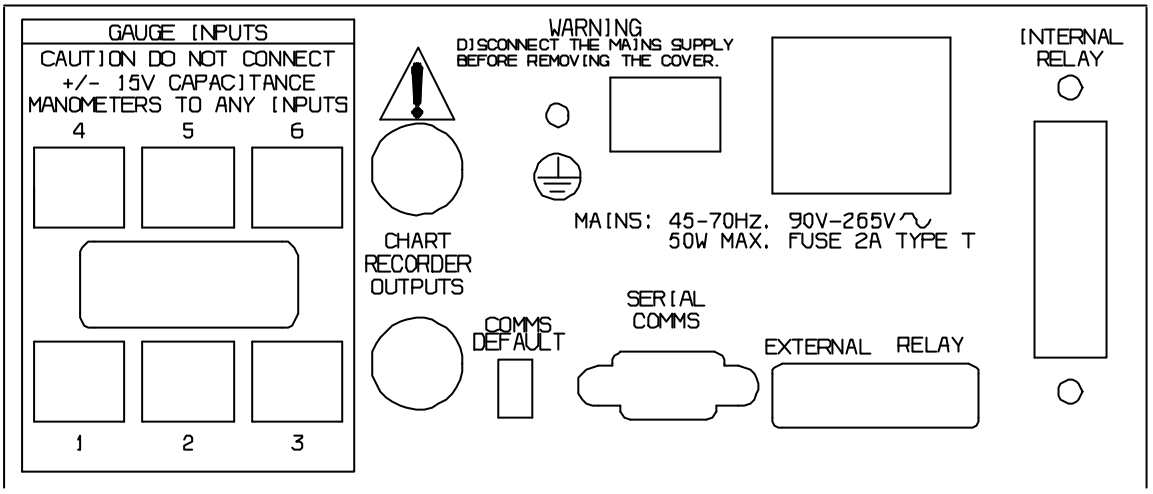

Figure 1a - Rear panel of the AGC

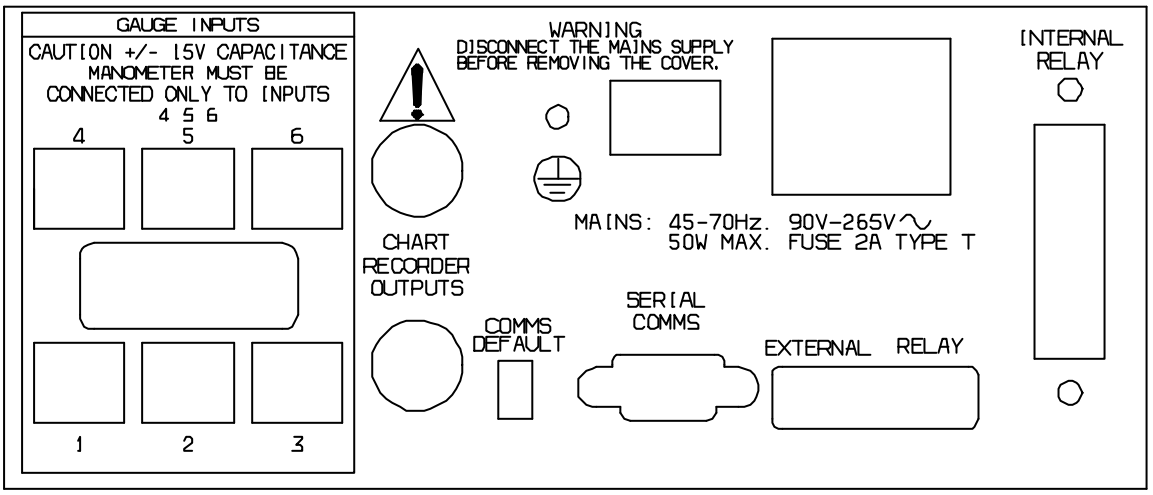

Figure 1b - Rear panel of the AGC (Capacitance Manometer version)

Note: The caution label on Figure 1b has been modified to incorporate the Capacitance Manometer version only.

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3.2 RS232 Connections

Connection to the RS232 port is through a 9-way female D-type socket fitted on the rear panel of the AGC. If an IBM compatible computer is to be used then an Edwards RS232 cable may be used to connect the AGC to the computer (refer to section 7.1).

If a custom built cable is to be used, it should be noted that the maximum length of cable for RS232 communications is approximately 10 metres. Use line drivers with cables longer than 10 metres. Refer to Appendix A for pin connections and sections 3.3 and 3.4 for typical connections.

3.3 Three-wire connection

Figure 2 shows how to connect the AGC using a simple 3-wire TX/RX/GND connecting lead. The lead should be direct for connection to a modem (DCE) or crossed-over for connection to computer equipment (DTE). Fit a 9-way male D-type connector at the AGC end of the lead, and the appropriate connector for the communicating equipment at the other end.

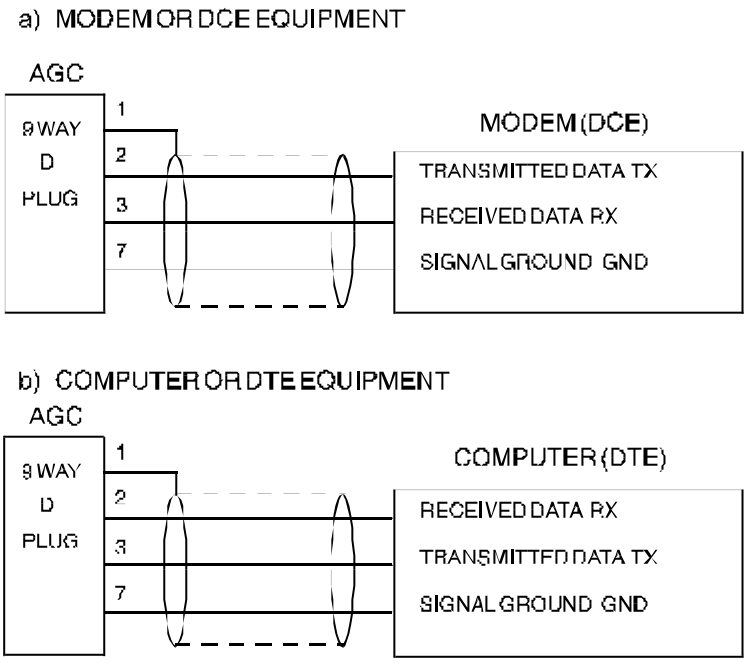

Figure 2 - Modem and DTE connections

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3.4 Connection to an IBM compatible computer

Figure 3 shows how to connect the active gauge controller to an IBM compatible computer.

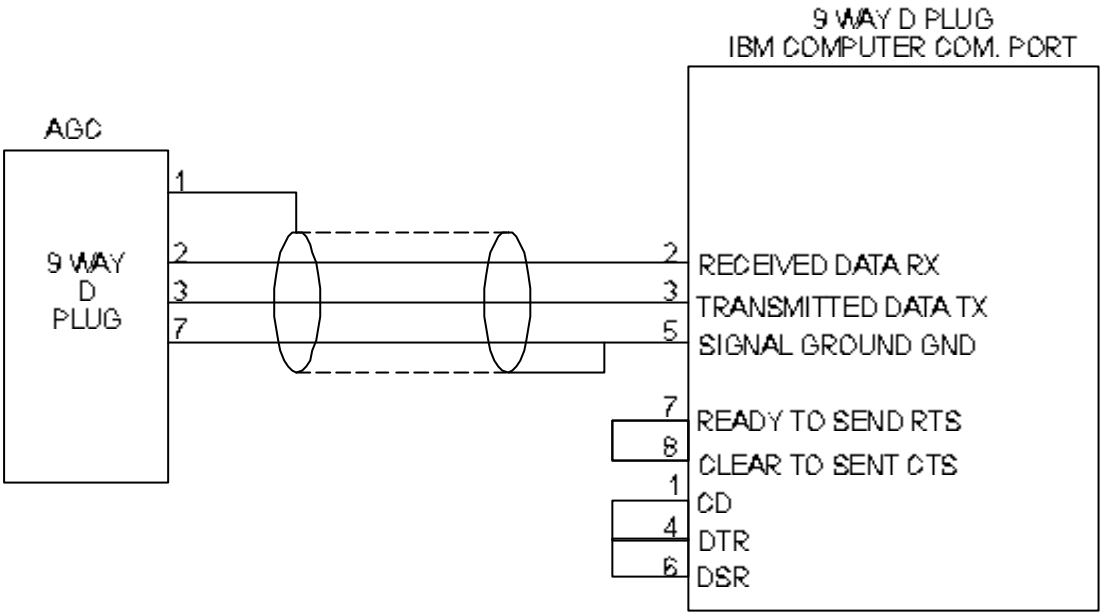

Figure 3 - AGC/IBM computer interface

3.5 Hardware control signals

If speed of transmission or slow response time for the external equipment cause communication problems, use the two hardware control signals CTS and DTR in addition to the three wire system described above.

Note: If CTS and DTR are connected and are not in the correct state, then communications between the external equipment and the AGC may stop
Check that the states of CTS and DTR are correct for the remote equipment..
For the AGC:

DTR (output) is always HIGH to signal the AGC is online
CTS (input) has no function if the CTS control line is not connected.

If CTS is connected, then the AGC will transmit data only when the CTS input signal is HIGH. As soon as CTS goes LOW , the AGC will stop transmitting, and will resume only when CTS goes HIGH again.

Alternatively, the equipment can be loopback connected, e.g. connect the external equipment RTS to CTS and DTR to DSR.

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4 OPERATION

4.1 General

It is important that you read these instructions in conjunction with the active gauge controller general instructions D386-55-880.

4.2 RS232 serial communications

The active gauge controller RS232 option is supplied with an RS232 serial communications port to allow interfacing with other equipment.

There are two modes of operation using the serial port: printer and query-command mode.

When in printer mode, logging information can be automatically transmitted at a fixed interval which is user programmable. This information may be printed out on a serial printer, or logged directly onto a computer for storage and analysis.

When in query-command mode all information normally displayed on the AGC can be read over the serial link, and all operations normally actioned using the AGC can be controlled remotely. This feature may be used, for example, to provide an interface to a supervisory control and data acquisition (SCADA) program running on a personal computer (PC).

4.3 Selecting the default serial setting

A comms default switch is fitted on the back panel of the controller (see Figure 1). This is used to switch the serial baud rate between the factory default and User setting. Move the switch up for factory serial settings or down for User selection. If the settings need to be changed from the default user value, move the switch to the down position, then alter the settings from the default values via the menu tree. The default values are 300 baud (Factory) and 9600 baud (User).

Note: If display is showing Baud 2 and the default switch is moved down, Baud 2 will be assigned as user value.

4.4 Serial communications settings

The serial communications settings can be viewed or adjusted from the COMMS menu within SYSTEM. Password 2 needs to be entered (if set) to gain access to the SYSTEM menu. Appendix B shows the COMMS menu tree. The COMMS menu contains the following items:

☐ COMMS
PROTCL MODE RATE

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Selecting PROTCL allows access sequentially to the BAUD, PAR and STOP sub menus. Note that the number of data bits is fixed at 8. Select PROTCL and press ENTER, the display reads □BAUD X where X is a number 1-8 corresponding to the current baud rate setting as follows:

X	1	2	3	4	5	6	7	8
Baud Rate	110	300	600	1200	2400	4800	9600	19200

Press ENTER, to retain the setting, this moves to the second sub menu □ PAR. Use the UP/DOWN buttons to change the setting and select a new value from the list. Press ENTER. The display will now read□PAR X where X is 0, 1 or 2 corresponding to the current parity setting:

X	0	1	2
Parity	None	Odd	Even

Having selected the required value, press ENTER. The display will now read□STOP X where X is 1 or 2 corresponding directly to the number of stop bits. Select value as before. On making this final selection the serial port is set to the revised protocol and the display returns to the PROTCL item in the COMMS menu.

Note: Adjustment of the settings is only possible if the COMMS DEFAULT switch is in the DOWN position (refer to Section 4.3).

The MODE item is used to select either printer or query-command mode. Press ENTER and use the UP/DOWN or CYCLE keys to cycle between MODE O (printer mode) and MODE 1 (query-command mode), press ENTER. The RATE item is used to select the printer cycle rate when using the printer mode (MODE 0). Press ENTER, the display reads□RATE X where X is a number 0-9 corresponding to a printer cycle rate which can be selected from the following:

X	0	1	2	3	4	5	6	7	8	9
Cycle Rate	OFF	CONTIN	10 SEC	30 SEC	1 MIN	5 MIN	10 MIN	30 MIN	1 HOUR	2 HOUR

4.5 Printer mode

Automatic printout of gauge information on the serial port can be obtained when the active gauge controller printer mode (MODE 0) has been set. All queries and commands sent to the AGC will be ignored when in printer mode except for the commands !MO 0 and !MO 1 which are used to switch the AGC remotely between printer and query-command mode.

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When in printer mode, gauge information is automatically transmitted at an interval set in the RATE menu. This information may be be printed out on a serial printer, or logged directly onto a computer for storage and analysis. The information consists of a block of data divided into lines (one for each gauge channel in use). Each line of data contains the gauge channel number, the gauge type, the pressure reading, pressure units, print rate, carriage return (CR) and line feed (LF). If the pressure is in error, then an error message is printed instead of the pressure reading. Refer to Appendix C for a list of possible errors. The data is arranged as follows:

Normal pressure reading: c = tttttt rm.mmmEsee uu RATE = rrrrrr
Error: c= tttttt XXXXXX RATE = rrrrrr

Where :

c	Channel 1-6
tttttt	Gauge Identification. Section 4.3 in D386-55-880
rm.mmmEsee	Pressure Reading r : mantissa sign (blank or -) m : mantissa s : exponent sign (+ or -) ee : exponent
uu	Pressure units MB : millibar PA : Pascal TR : Torr % : % turbo full speed
XXXXXX	Error message. Refer to Appendix C.
rrrrrr	Printer cycle rate. If rrrrrr reads NOSET then the system is in error.

Each line is terminated by carriage return (ASCII Char 13), line feed (ASCII Char 10), and a blank line separates successive blocks of data. Below is an example of the printout obtained from the AGC for three connected active gauges. The example shows three consecutive RATE intervals only.

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Printer mode example:

```
1  =  APG M   1.2E-3 MB     RATE  =  CONTIN
2  =  ASG     1.015E+3 MB   RATE  =  CONTIN
3  =  TURBO   5.00E+1  %    RATE  =  CONTIN

1  =  APG M   1.2E-3 MB     RATE  =  CONTIN
2  =  ASG     1.015E+3 MB   RATE  =  CONTIN
3  =  TURBO   5.00E+1  %    RATE  =  CONTIN

1  =  APG M   1.2E-3 MB     RATE  =  CONTIN
2  =  ASG     1.015E+3 MB   RATE  =  CONTIN
3  =  TURBO   5.00E+1  %    RATE  =  CONTIN
```

4.6 Query - command control mode

The AGC includes a special mode of operation which allows a remote terminal device or supervisory computer to control and interrogate the system directly, by-passing the AGC front panel. This feature, called query-command, allows all information normally displayed on the AGC front panel to be read over the serial link, and all operations normally actioned using the AGC keys to be controlled remotely.

Queries: Return values from the AGC without interfering with any other function of the AGC.

Commands: Act directly on the AGC and return an error message indicating whether the operation was successful or not.

Query-command only operates when the AGC has been put into MODE 1 (query-command control mode) using COMMS menu option: MODE. If a query or command is sent to the AGC when in MODE 0 (printer mode), it will be ignored, except for !MO 0 and !MO 1 which are used to remotely switch the AGC between the two modes.

4.7 Sending a query or command

Each query or command is sent to the AGC via the RS232 serial link as a text message - a sequence of ASCII coded characters. The first character of the text message is a ! for a command, or a ? for a query. The next two characters are the mnemonic representation of the particular query or command, followed by other data if required. The last character must be a carriage return CR (ASCII char 13).

The input buffer for query-command may be reset at any time by sending a / character (ASCII char 47). The system then ignores any characters previously sent. Use / to reset query-command at the beginning of a control program rather than by sending CR which resets by executing the current contents of the input buffer.

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4.8 AGC Replies to queries and commands

When a query or command is received by the AGC, a reply is always returned on the serial link. The replies sent by the AGC are text messages - sequences of ASCII coded characters terminated by two control characters CR, LF (ASCII chars 13, 10).

All the replies are printable text strings, apart from ?DP, which returns the current contents of the AGC front panel display buffer. This may contain byte values in the range 0 to 255, so the reply to ?DP should be read in as individual bytes, because CR or LF may be valid data bytes rather than the text terminators.

Each query or command must comply with its correct syntax, otherwise an error will be flagged. The reply to a query is normally the ASCII text string representing the number or result of the item queried. The reply to a faulty query will be a message of the form ERR n, where n is the error number. The reply to a command will always be a message of the form ERR n, if there is no error, the reply will be ERR 0.

Refer to Appendix C for a list of error messages and their meanings. For a detailed list of queries refer to Appendix D, Appendix E lists available commands.

4.9 Query-command error messages

Each query or command sets the error number to indicate success or the reason for failure. The error number is returned by any command and as the reply to ?SY. If a query is in error (for example a gauge is over-range) then instead of the normal reply, a message of the form ERR n is sent, where n is the error number as listed in Appendix C.

4.10 User LOCK-OUT

If !KL is used, then this will prevent the user from accessing the AGC from the front panel, thisis LOCK-OUT mode which is normally used to prevent un-authorised adjustment of the AGC settings when controlling the unit remotely. In LOCK-OUT mode the AGC keyboard is non-functional and the user cannot reset the system back to normal operation. There are two ways to recover from LOCK-OUT:

i) If the serial link is operational, send !KU and this will free the AGC keyboard.

ii) If there is no serial link operational, switch the AGC electrical supply off and then on again. The system always powers up with the AGC keyboard lock off.

4.11 Problems with serial communications

If serial communications do not appear to be working, check the following items carefully. Most problems with serial communications occur because of incorrect connections and setting up of the communications protocol. Refer to Section 3 for installation details.

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Problem: Non-functional Printer mode

Check the printer itself (on-line, paper).

Check the connecting lead.

Check the hardware control signals (if used).

Check correct programming of AGC (COMMS menu) i.e. system is in Printer mode, baud rate, parity, stop bits and cycle rate are programmed as required.

If double line spacing appears on printout, disable printer feature which adds an LF every time it gets a CR, as this is transmitted by the AGC.

Problem: non-functional query-command mode

Check the remote equipment is operational.

Check the connecting lead.

Check the hardware control signals (if used).

Check correct programming of AGC (COMMS menu) i.e. system is in query - command control mode, baud rate, parity and stop bits are programmed as required.

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5 MAINTENANCE

See Section 5 , AGC general instructions D386-55-880.

6 STORAGE AND DISPOSAL

There are no special requirements for storage or disposal of the active gauge controller RS232 option.

7 ACCESSORIES and SPARES

7.1 Cables

RS232 cable 3 m (10 feet)

D386-50-400 D Type female 25 way

D386-50-500 D Type female 9 way

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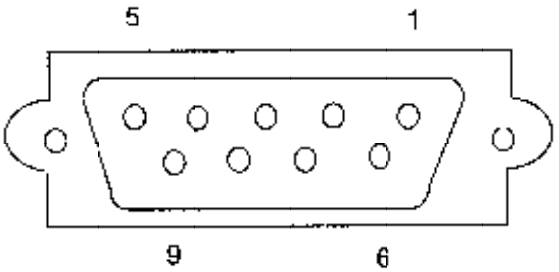
APPENDIX A

Interfaces and connections

RS 232 9 pin connector



PIN	ALLOCATION
1	Chassis
2	TXD
3	RXD
4	RTS
5	CTS
6	DTR
7	0 Volts
8	No connection
9	No connection

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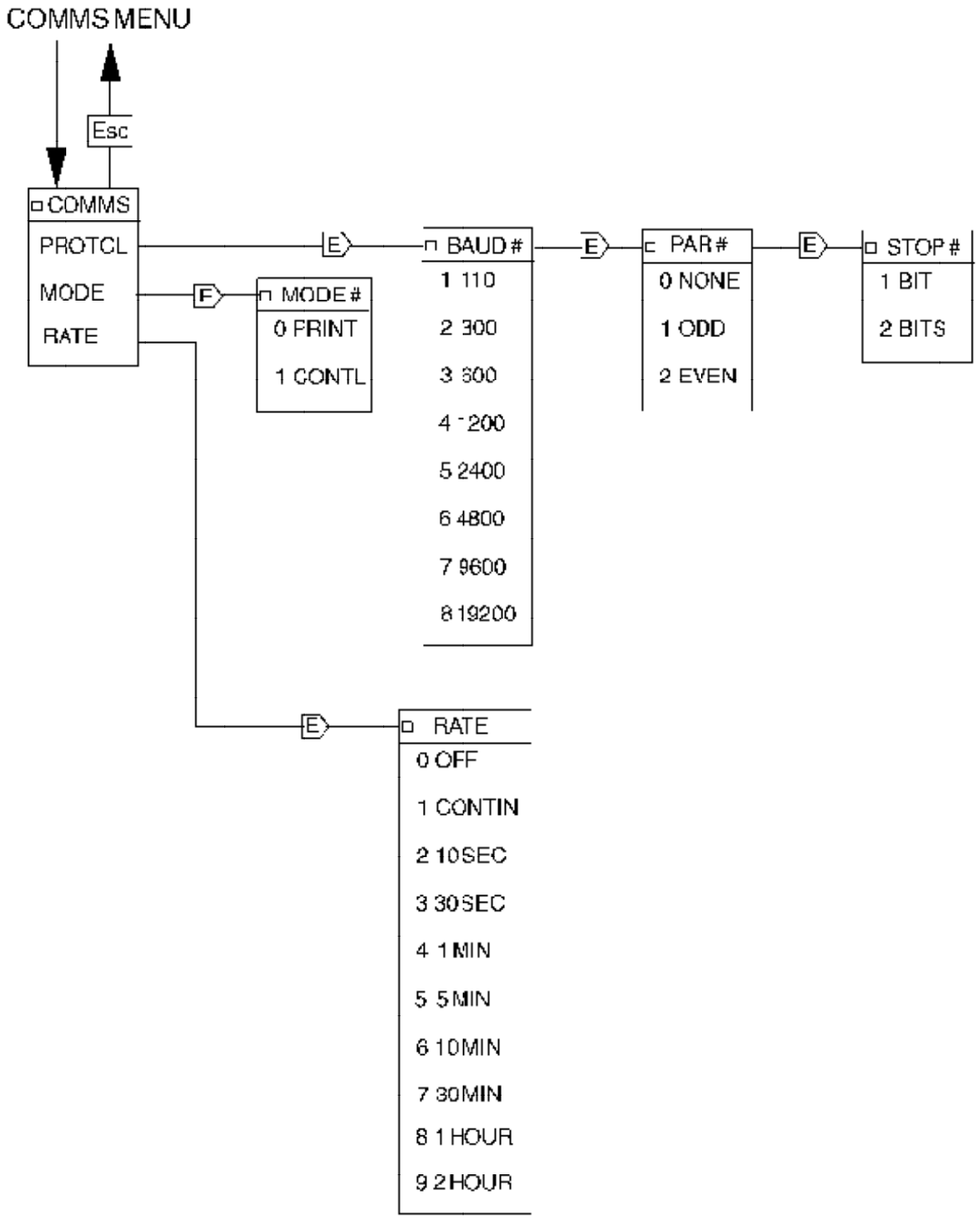
APPENDIX B

RS232 comms menu

Refer to AGC operating instructions D386-55-880 Appendix B for description of symbols used.



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APPENDIX C - RS232 Serial port errors

Appendix C1 Printer mode (MODE 0) errors

ERROR MESSAGE	REASON
OFF	Gauge switched off or Auto gauge off
SRKING	AIM gauge striking
AC ERR	Auto gauge fault
???	Unknown gauge type
‘ ‘	Unclassified error
ID ERR	Gauge type error
?VOLT	Gauge voltage under range
ADCERR	Volts conversion error
NOTSRK	AIM gauge not struck
EMERR	Ion gauge emission error
IGEMIS	Ion gauge is warming up, not timed out.
IG INH	Ion gauge inhibited
SW ERR	Gauge switch error.
FAULT	Gauge Fault
NEW ID	New gauge type detected
EXP BD	New expansion board detected
SYSERR	System Error
OVER R	CAPMAN pressure over range

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Appendix C2

Query command errors

ERROR NUMBER	REASON
0	No error
1 .. 10	Query command errors
1	Not a valid query or command word
2	Number(s) not found - needed as part of query or command
3	Number(s) not in valid range - too large
4	No ? at start of query
5	No ! at start of command
6	Not a valid word for a query (valid only for command)
7	Number(s) not in valid range - too small
8	Pressure incorrect format
9	No = in !DL - needed to mark start of message
10	Not a valid word for command (valid only for a query)
11	Relay lock out for serial control not set to manual - !RM must be sent before !RS can be used. !RO should be used to reset relay lockout to normal when finished using !RS commands
12	Pressure incorrect format - negative pressures not allowed.
13	Wrong channel - e.g. !GA4 accept error on channel 4 but there is no error on channel 4.

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ERROR NUMBER	REASON
14	Wrong gauge type - e.g. try to set type of gauge when that gauge does not have different types.
15 .. 200	Reserved words
201 .. 219	Gauge pressure voltage errors
201	Gauge switched off
202	Auto gauge off
203	Ion gauge degassing
204	AIM gauge striking
205	CAPMAN over range
206	Unknown gauge type
207	Ion gauge emission fault, not timed out
208	Ion gauge inhibited
209	Auto gauge fault
210	Gauge type error
211	Gauge voltage under range
212	Volts conversion error
213	AIM gauge not struck
214	Ion gauge emission error
215	Gauge switch error
216	Gauge fault
217	New gauge type detected
218	New expansion board detected

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ERROR NUMBER	REASON
219	Unclassified gauge error
220	WRG Pirani failure
221	WRG Inverted Magnetron short circuit
222	WRG striker filament broken
223	WRG Inverted Magnetron not struck
224	APGX filament broken
225	APGX calibration error
226	APGX-H tube not fitted
228	AIGX emission error
229	AIGX over range
230 .. 254	Reserved errors
255	BIOS system error

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APPENDIX D

Queries

In the lists that follows, the expression {a..b} means a number in the range a to b inclusive. For example: DEFINITION: ?AC {1..6}
CORRECT: ?AC 1
INCORRECT: ?AC 16

Appendix D1 List of queries

QUERY	MNEMONIC EXAMPLE	SYNTAX	REPLIES
AutoChannel	?AC 2	?AC {1..6}	{0..2}
ALl	?AL	?AL	{all data}
AutocontrolPressure	?AP 1	?AP {1..6}	{pressure}
iongaugeAutoRestrike	?AR5	?AR {1..6}	{0..1}
BAudrate	?BA	?BA	{1..8}
autoControlChannel	?CC 3	?CC {1..6}	{1..6}
CapmanDisplay/ASG Display	?CD 5	?CD{1..6}	{0..1}
relayControlHighpressure	?CH 3	?CH{1..6}	{pressure}
relayControlLowpressure	?CL 2	?CL{1..6}	{pressure}
iongaugeCOnstant	?CO 6	?CO {1..6}	{20..300}
iongaugeCUrrent	?CU 3	?CU{1..6}	{0..3}
CapmanVersion/ASGVersion	?CV3	?CV{1..6}	{0..10}
iongaugeDEgas	?DE 5	?DE{1..6}	{0..2}
DisPlay	?DP	?DP	{display data}
iongaugeFilamenT	?FT 2	?FT{1..6}	{1..2}
GAuge	?GA 3	?GA{1..6}	{gauge pressure}

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QUERY	MNEMONIC EXAMPLE	SYNTAX	REPLIES
GaugeVersion	?GV 1	?GV{0..6}	{0..21}
GaugesWitch	?GW 3	?GW{1..6}	{0..1}
iongaugeHeaD	?HD 5	?HD{1..6}	{1..2}
IongaugeemissionStatus	?IS 4	?IS{1..6}	{0..2}
displayLineassign	?LB 2	?LB{2..3}	{1..6}
capmaNUnit	?NU 2	?NU{1..6}	{0..1}
PassWord	?PW1	?PW{1..2}	{0..999}
ParitY	?PY	?PY	{0..2}
RAte	?RA	?RA	{0..9}
RelayControlchannel	?RC 1	?RC {1..6}	{0..8}
RelayState	?RS 2	?RS{1..6}	{0..1}
turbointerlock	?SP 3	SP{1..6}	{0..1}
StopbitS	?SS	?SS	{1..2}
SYstem	?SY	?SY	{system error}
UnitS	?US	?US	{1..3}
?VErsion	?VE	?VE	{software version}
VoLts	?VL 3	?VL{1..6}	{voltage}
Zerocapman/ZeroASG	?ZS 4	?ZS{1..6}	{0..1}

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Appendix D2 Detailed description of queries

Note: x normally refers to gauge channel and is in the range 1..6 unless otherwise stated.

?AC x

Returns the current setting, off or on, for AUTO control and display for a particular channel x, as set in the SYSTEM menu.

0 = off
1 = autoturnon
2 = autoturnon and autodisplay.

?AL

This gives a complete list of all the information available using individual queries, except for ?DP. The information is transmitted one item per line, each line separated by CR LF. The block is terminated by four characters: $ CR LF EOF (ASCII chars 36, 13, 10, 26/CTRL-Z).

Order of information:

GAuge 1..6
GaugeVersion 0..6
GaugesWitch 1..6
VoLts 1..6
RelayState 1..6
RelayControlchannel 1..6
relayControlHighpressure 1..6
relayControlLowpressure 1..6
AutoChannel 1..6
autoControlChannel 1..6
AutocontrolPressure 1..6
Capmanidents 1..6
Capmandisplay 1..6
iongaugeDEgas 1..6
IongaugeemissionStatus 1..6
iongaugeHeaD 1..6
iongaugeFilamenT 1..6
iongaugeAutoRestrike 1..6
iongaugeCUrrent 1..6
iongaugeCOnstant 1..6
PassWord 1..2
BAudrate
ParitY
StopbitS
RAte
UnitS
SYstem
VErsion
$ (terminator)
CTRL-Z (end-of-file)

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?AP x

Returns the current value of the auto turnon/off pressure for a particular channel x, as set in the SYSTEM menu. Pressure displayed as mEse where m is the mantissa, s the sign + or -, and e is the exponent.

?AR

Returns the current setting of the ION GAUGE AUTO RESTRIKE flag for the gauge fitted to channel x.

0 = off
1 = on

?BA

Returns the current setting of the baud rate, as set in the COMMS menu.

1 = 110 bps
2 = 300 bps
3 = 600 bps
4 = 1200 bps
5 = 2400 bps
6 = 4800 bps
7 = 9600 bps
8 = 19200 bps

?CC x

Returns the auto control channel number, for a particular channel x, as set in the SYSTEM menu.

?CD x

Returns the display mode(y) of the ASG or CAPMAN gauge fitted to channel x

y = 0, floating point mantissa and exponent
y = 1, fixed decimal point.

?CH x

Returns the high SET PT pressure for a particular relay x, as set in the SYSTEM menu. Pressure displayed as mEse where m is the mantissa, s the sign + or -, and e is the exponent.

?CL x

Returns the low SET PT pressure for a particular relay x, as set in the SYSTEM menu. Pressure displayed as mEse where m is the mantissa, s the sign + or -, and e is the exponent.

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?CO x

Returns the current setting for the IGC gauge constant IG CON, for channel x, as set in the CONFIG menu. It is a number in the range 20 to 300, corresponding to values
2.0 to 30.0 (i.e. one implied decimal place).

?CU x

Returns the setting for the IGC gauge current CUR for channel x, as set in the ION menu.

0 = Auto selection
1 = 100 uA
2 = 1 mA
3 = 10 mA

?CV x

Returns the ASG or CAPMAN gauge type (y) fitted to channel x

Gauge type y =	0	1	2	3	4	5	6	7	8	9	10
Full scale (mBar or Torr)	0.05	0.1	0.2	1	2	10	20	100	200	1000	2000

?DE x

Returns the setting for the IGC or AIGX DEGAS control for channel x, as set in the ION or AIGX menu.

0 = off
1 = inhibited
2 = on.

?DP

Returns the current information displayed on the AGC front panel. This information requires specialised decoding and is reserved for future use.

?FT x

Returns the IGC filament FIL selected for channel x, as set in the ION menu.

1 = filament 1
2 = filament 2

?GA x

Returns the current pressure reading for gauge channel x, as displayed on the front panel of the AGC. Pressure displayed as mEse where m is the mantissa, s the sign + or -, and e is the exponent.

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?GV x

Returns the gauge version for channel, as displayed on the front panel when the IDENT control is on.

For x = 0, this returns the expansion board identification:

0 = not fitted
1 = CAPMAN
2 = Standard active gauge type fitted

For x= {1..6}, this returns the gauge identification (6, 7, 14, 16, 17 and 18 are not allocated):

0 = Not fitted
1 = 590 CM capacitance manometer
2 = 600 CM capacitance manometer
3 = Turbo
4 = Pirani M medium pressure
5 = Pirani L low pressure
6 = Linear convection gauge, APGX-H
8 = thermocouple type 4D
9 = thermocouple type 6M
10 = active inverted magnetron, AIM-C
11 = active inverted magnetron, AIM-S
12 = ion gauge controller, resistive degas
13 = ion gauge controller, electron bombardment degas
15 = active strain gauge, ASG
19 = active inverted magnetron, AIM-X
20 = wide range gauge
21 = linear active pirani gauge
22 = active ion gauge, AIGX

?GW x

Returns the current switched state (OFF or ON) for gauge channel x, as controlled using the front panel CYCLE key when in normal gauge display mode. If gauge channel x is a turbo controller then this will return the state of the start/stop line.

0 = off
1 = on

?HD x

Returns the IGC HEAD selected for channel x, as set in the ION menu.

1 = head A
2 = head B

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?IS x

Returns the emission status for IGC or AIGX connected to channel x.

0 = off
1 = inhibited
2 = emission start
3 = on.

?LB x

Returns gauge channel assigned to display line x (2..3)

?NU x

Returns the unit (y) of the CAPMAN gauge connected to channel x

y = 1 MBAR
y = 0 TORR

?PW x

Returns the current value of password x, as set in the PASS menu (1..2).

0 = password off.
A number in the range 1 to 999 = password set to this value.

?PY

Returns the current setting of the parity, as set in the COMMS menu.

0 = none
1 = odd
2 = even

?RA

Returns the current setting for the printer RATE as set in the COMMS menu.

0 = off
1 = continuous
2 = 10 seconds
3 = 30 seconds
4 = 1 minute
5 = 5 minutes
6 = 10 minutes
7 = 30 minutes
8 = 1 hour
9 = 2 hours

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?RC x

Returns the current channel assigned to relay x, as set in the SYSTEM menu.

0 = relay is off.
1..6 = channel number assigned to the relay.
7 = relay is normally on, switches off if any gauge has a fault condition.
8 = relay is on.

?RS x

Returns state of relay x, as displayed on the front panel.

0 = off
1 = on.

?SP x

Returns the current setting of the turbo interlock line connected to channel x.

0 = off
1 = on.

?SS

Returns the current setting of the stop bits, as set in the COMMS menu.

1 = 1 stop bit
2 = 2 stop bits

?SY

Returns the current setting of the query-command system error.

0 = no errors
1..255 = error, refer to Appendix B for description of error number.

?US
Returns the current units setting for gauge units, as set in the CONFIG menu.

1 = mbar
2 = Pascal
3 = torr

?VE
Returns the AGC software Part Number as a 7-character string.

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?VL x

Return the gauge voltage reading for channel x. Millivolts displayed as a number -30000 to +30000. -30001 or +30001 indicates voltage under/over range.

?ZS x

Returns the zero state (y) of the ASG or CAPMAN gauge fitted to channel x.

y = 0, Zero correction not applied.
y = 1, Zero correction applied to pressure reading.

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APPENDIX E

Commands

In the lists that follows, the expression {a..b} means a number in the range a to b inclusive. Where {value} appears, the valid range of numbers varies according to the individual item addressed. For example: DEFINITION: CD {1..6} = {0,1}
CORRECT: CD 1 = 1
INCORRECT: CA 16 = 3

Appendix E1 List of commands

COMMAND	MNEMONIC EXAMPLE	SYNTAX
AutoChannel	!AC2=1	!AC{1..6}={0..2}
AutocontrolPressure	!AP1=1.2E-2	!AP{1..6}={pressure}
iongaugeAutoRestrike	!AR1=0	!AR{1..6}={0..1}
BAudrate	!BA 1	!BA {1..8}
autoContolChannel	!CC 3 = 6	!CC {1..6} = {1..6}
CapmanDisplay/ASGDisplay	!CD 3=0	!CD{1..6} = {0..1}
relayControlHighpressure	!CH 3=3.3E-1	!CH{1..6}={pressure}
relayControlLowpressure	!CL2=3.1E-2	!CL{1..6}={pressure}
iongaugeCOnstant	!CO 6=2	!CO{1..6}={20..300}
iongaugeCUrrent	!CU 3=1	!CU{1..6}={0..3}
SetCapmanVersion/ASGVersion	!CV 3=5	!CV{1..6}={0..10}
iongaugeDEgas	!DE 5=0	!DE{1..6}={0..1}
DisplayLock	!DL = Hello	!DL ={up to 7 characters}
DisplayRelease	!DR	!DR
iongaugeFilamenT	!FT 2=1	!FT{1..6}={1..2}
AcceptGAugeerror	!GA 2	!GA{1..6}

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COMMAND	MNEMONIC EXAMPLE	SYNTAX
Acceptnewgauge	!GV 3	!GV{1..6}
GaugesWitch	!GW 3=1	!GW{1..6}={0..1}
iongaugeHeaD	!HD 5=2	!HD{1..6}={1..2}
KeyLock	!KL	!KL{1..2}
KeyUnlock	!KU	!KU
KeY	!KY3	!KY{0..4}
DisplaylineAssign	!LB 2=4	!LB{2..3} = {1..6}
MOde	!MO 1	!MO {0..1}
capmaNUnit	!NU1=0	!NU{1..6}={0..1}
PassWord	!PW1=888	!PW{1..2}={0..999}
ParitY	!PY1	!PY{0..2}
QueryMode	!QM	!QM
RAte	!RA 2	!RA{0..9}
RelayControlchannel	!RC 1=0	!RC{1..6}={0..8}
RelayManual	!RM	!RM
RelaymanualOff	!RO	!RO
RelayState	!RS2=1	!RS{1..6}={0..1}
turbointerlock	!SP2=1	!SP{1..6} = {0..1}
StopbitS	!SS1	!SS{1..2}
UnitS	!US 1	!US {1..3}
restart	!YY	!YY

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COMMAND	MNEMONIC EXAMPLE	SYNTAX
enablecapmanZeroing/ASG	!ZS 1=0	!ZS{1..6} = {0..1}
ZeroVoltcapman/ZeroASG/ calibrateWRG/calibrateAPGX	!ZV 3	!ZV{1..6}
defaultsettings	!ZZ	!ZZ

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Appendix E2 Detailed description of commands

Note: x normally refers to gauge channel and is in the range 1..6 unless otherwise stated.

!AC x = y

Sets state y, off or on, for AUTO control and auto display for channel x, as in the SYSTEM menu.

0 = off
1 = autocontrol on
2 = autocontrol and autodisplay on.

!AP x = pressure

Sets the auto turnon/off pressure for channel x, as in the SYSTEM menu. Pressure MUST be set as m.mmEse where

m.mm is the mantissa to 2 decimal places 1.00 to 9.99
s the sign + or -
e is the exponent 0..9

!ARx=y

Sets the ION GAUGE AUTO RESTRIKE option for channel x to

0 = off
1 = on

!BA x

Sets the baud rate x, as in the COMMS menu.

1 = 110 bps
2 = 300 bps
3 = 600 bps
4 = 1200 bps
5 = 2400 bps
6 = 4800 bps
7 = 9600 bps
8 = 19200 bps

!CC x = y

Sets the auto control channel number y, for channel x, as in the SYSTEM menu.

!CD x=y

Set display of ASG or CAPMAN channel x to FLOAT or FIXED

y = 1, fixed decimal point
y = 0, floating point, mantissa and exponent.

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!CH x = pressure

Sets the high SET PT pressure for relay x, as in the SYSTEM menu. Pressure MUST be set as m.mmEse where

m.mm is the mantissa to 2 decimal places 1.00 to 9.99
s the sign + or -
e is the exponent 0..9

!CL x = pressure

Sets the low SET PT pressure for relay x, as in the SYSTEM menu. Pressure MUST be set as m.mmEse where

m.mm is the mantissa to 2 decimal places 1.00 to 9.99
s the sign + or -
e is the exponent 0..9

!CO x = y

Sets the IGC gauge constant y IG CON, for channel x, as in the ION menu. A number in the range 20 to 300, corresponding to a value 2.0 to 30.0 (i.e. one implied decimal place).

!CU x = y

Sets the IGC gauge current y CUR for channel x, as in the ION menu.

0 = Automatic selection
1 = 100 µA
2 = 1 mA
3 = 10 mA

!CV x = y

Sets the CAPMAN/ASG type y on channel x. Types are defined in the ?CV query.

!DE x = y

Sets the IGC or AIGX DEGAS control y for channel x, as in the ION or AIGX menu.

0 = off
1 = on.

Note: If degas is on, ?DE x should be used to check that degas actually comes on, because this could be inhibited by the qualifying gauge. (IGC only).

!DL ={up to 7 characters}

Sets the AGC front panel display to read the message, and locks out any normal messages generated by the AGC itself, until the the command !DR is sent.

The AGC always powers up with the display operating normally.

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!DR

Releases the AGC front panel display so that normal messages generated by the AGC itself are displayed.

!FT x = y

Sets the IGC filament FIL y for channel x, as in the ION menu.

1 = filament 1
2 = filament 2

!GA x

Accept the error being reported for the gauge on channel x.

Note: Gauge may need to be cycled off then on again to clear some errors instead of/ as well as using this command. If the actual fault is not corrected the error will quickly return.

!GV x

Acccept the new gauge ID reported on channel x. If appropriate to the gauge, set a default type. This type should then be altered if necessary to match the actual gauge e.g. CAPMAN/ASG range.

!GW x = y

Sets the switched state y, off or on, for gauge channel x, as controlled using the front panel CYCLE key when in normal gauge display mode. If gauge channel x is a turbo controller then this will switch the start/stop line and the display. If auto-controlled the gauge will not turn o n if at the wrong pressure.

0 = off
1 = on.

!HD x = y

Sets the IGC HEAD y for channel x, as in the ION menu.

1 = head A
2 = head B

!KLx

1 = Locks out the AGC front panel keys, so they do not operate at all.
2 = Locks out the AGC cycle key. Disables access to SYSTEM and GAUGE menus.

!KU

Unlocks the AGC front panel keys so they operate normally. The AGC always powers up with the keyboard unlocked.

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!KY x

Sets the key press x equivalent to the AGC front panel key.

0 = UP
1 = DOWN
2 = ENTER
3 = ESCAPE
4 = SET

!LB x=y

Assign gauge channel x to display line y (2..3)

Note: This command is only valid for a triple line display AGC.

!MO x

Swaps the AGC serial mode x between printer mode and query-command control mode. This command is active even when the AGC is in printer mode, and may be used to take over control of the AGC remotely.

0 = printer mode
1 = control (query-command) mode.

Note: If !MO 1 is sent, if it is successful, an error code will be returned, because the AGC will be in query-command mode, when every command and query produces a response.

Note: If !MO 0 is sent, if it is successful, no error code will be returned, because the AGC will have gone into printer mode, when the only output produced is normal logging data.

!NUx=y

Sets the unit (y) of the CAPMAN gauge connected to channel x.

y = 0 torr
y = 1 mbar

!PW x = y

Sets password x to value y, as set in PASS menu.

y=0 turns password x off.
y in the range 1 to 999 enables password x.

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!PY x

Sets the parity x, as in the COMMS menu.

0 = none
1 = odd
2 = even

!QM

This command has exactly the same function as !MO 1. It puts the AGC directly into query-command control mode. This command is active even when the AGC is in printer mode, and may be used to take over control of the AGC remotely. It has been included to provide compatibility with Edwards Series 2000 remote-control programs.

Note: If !QM is sent, if it is successful, an error code will be returned, because the AGC will be in query-command mode, when every command and query produces a response.

Note: If !QM is sent and the system is in printer mode, if it is for some reason unsuccessful, no error code will be returned. This is because the AGC will remain in printer mode, which produces no responses to queries or commands.

!RA x

Sets the printer RATE x as in the COMMS menu.

0 = off
1 = continuous
2 = 10 seconds
3 = 30 seconds
4 = 1 minute
5 = 5 minutes
6 = 10 minutes
7 = 30 minutes
8 = 1 hour
9 = 2 hours

!RC x = y

Sets the channel y assigned to relay x, as in the SYSTEM menu.

0 = relay is off
1..6 = channel number assigned to the relay.
7 = relay is normally on, switches off if any gauge has a fault condition.
8 = relay is on

!RM

Sets relay lockout to manual, allowing use of !RS to set/reset relays. This command MUST be sent (at least once) before !RS can be used, to allow override of relay switching according to the relay pressure set points. The controller always powers up with relay lockout reset to normal.

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!RO

Resets relay lockout to normal, preventing use of !RS to set/reset relays. This command MUST be sent when finished using !RS , to re-enable relay switching according to the relay pressure set points. The controller always powers up with relay lockout reset to normal.

!RS x = y

Sets the state y, off or on, of relay x, as displayed on the front panel.

0 = off
1 = on.

Note: Relay lockout must be set to manual before this command will operate. Refer to !RM and !RO above.

!SP x = y

Sets the interlock state y for turbo channel x, as in the TURBO menu.

0 = off
1 = on.

Note: This is used with the !GW command to control the backing pump and the turbo pump independently (assuming an EXC120/300 controller is used). Setting SP to 0 prior to setting GW to 1 will cause the backing pump only to switch on. Setting SP to 1 will then switch on the turbo pump controller. If SP has not been set to 0 first, setting GW to 1 will switch on both the backing pump and the turbo pump simultaneously.

Note: This feature should not be used with auto-gauging as it will over-ride any auto-gauging control that has been set up.

!SS x

Sets the stop bits x, as in the COMMS menu.

1 = 1 stop bit
2 = 2 stop bits

!US x

Sets the units x, as in the SYSTEM menu.

1 = mBar
2 = Pascal
3 = Torr

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!YY

This causes the AGC to restart operation as if the electrical supply had been switched off, then on again.

!ZS x = y

Enable/disable zeroing of ASG or CAPMAN gauge fitted to channel x (1..6)

y = 1, enable zeroing
y = 0, disable zeroing

!ZV x

Perform zeroing function of CAPMAN or ASG, or calibrate the WRG/APGX fitted to channel x (1..6).

!ZZ

This resets all programmable items in the AGC to factory standard settings. This command should be used with caution, as all user programmed values will be lost.

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APPENDIX F

Default serial communications settings

PARAMETER	DEFAULT SETTING
TX/RX baud rate	300 baud (Factory) 9600 baud (User)
Parity	None
Stop bits	1
Character length (FIXED)	8 bits
Start bits (FIXED)	1
Operation mode	MODE 0 Printer mode

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APPENDIX G AGC RS232 timings

The AGC transmits serial data via the RS232 in blocks with each block of data consisting of up to 40 bytes and terminated with the CR LF ASCII characters. The time interval between the AGC receiving a message and responding to it will vary due to higher priority routines running in the AGC program. Higher priority routines include the update routine to the front panel display (which happens every time a pressure change is detected from a gauge), and any request that requires data to be written to the EEPROM (such as accepting a new gauge).

As the time interval between data blocks can vary, it is only possible to give typical and maximum timing intervals.

Note: The maximum of 3.6 seconds only occurs when data is written to the EEPROM. Only commands which change a setup that is remembered during a power down cause a write to the EEPROM. These commands, such as 'accept new gauge', 'set a relay setpoint' or changing the displayed units, are requested from the front panel or via the serial link.

	Typical	Maximum
Data block interval	100 ms - 400 ms	3.6 secs

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