AK protocol

for use with
Cambustion User Interface

User Manual

(version 1.8)

CAMBUSTION

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Preface

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Format

Command   <STX><DC>SATK xx<ETX>

xx:	K0	– All Channels
	Kn	– Channel "n"
	KV Ln	– "line" "n"
	Kn Mn	– Channel "n"/Range "n"

The command must always begin with **STX** (ASCII code 0x02)

STX is followed by **DC** (the Don't Care byte). **DC** can be any ASCII character, except **STX**, **ETX**, **DC1** (ASCII code 0x11) or **DC3** (ASCII code 0x13).

The AK command is four characters followed by a space (ASCII code 0x20), and then one of the "xx" designations listed:

- **K0** indicates that the command is sent to all Channels of all Units in the system.
- **Kn** indicates the command is to be sent only to the Channel defined by the specifier "n". Most commands can be sent to multiple Channels by listing the values in the command:
  e.g. **<STX><DC>**SATK K1 K3 K6**<ETX>**
  This sends the command SATK to K1, K3 and K6
- **KV Ln** indicates that the command is to be sent to a specific "line". A command must only be sent to one line at a time. The KV and Ln parts of this designation must be separated by a space (ASCII code 0x20).
- **Kn Mn** indicates the command is to be sent only to the Channel and Range specified. The Kn and Mn parts of this designation must be separated by spaces (ASCII code 0x20). Some commands can be sent to multiple Channels by listing the values in the command:
  e.g. **<STX><DC>**SEMB K1 M1 K4 M6**<ETX>**
  This sends the command SEMB to K1 M1and K4 M6

The command must always terminate with **ETX** (ASCII code 0x03). Note the **ETX** character must follow immediately from the "xx" designation.

Response   <**STX**><**DC**>SATK #<**ETX**>

#:   0 to 9   – Error status byte

The response includes **STX**, **DC** (the Don't Care byte), the 4-digit AK command, a number and **ETX**.

The number returned indicates the error status.

A change in error status causes the number given in Error status byte to increment by one. The number will cycle from 1 to 9, until all errors are resolved, when it returns to zero.

The response always terminates with **ETX**.

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Error Response   <STX><DC>SATK # ee<ETX>

	ee:	SE	– Syntax error
		BS	– Busy
		OF	– Offline
		DF	– Data error
		NA	– Not available

The error response includes **STX**, **DC** (the Don't Care byte), the 4-digit AK command, a number (the Error status byte), the error field "ee" which contains two characters (and is sometimes preceded by the Channel number) and **ETX**.

- Syntax error (SE):

Examples of syntax errors include misspelled commands, sending range-specific commands to a global destination, and omitting **STX** or **ETX** from the command. These errors are not preceded by a location.

- Busy error (BS):

If a command is sent to a Channel that is not able to accept the new command (because it is still carrying out a previous command), the response is the busy error.

- Offline error (OF):

If a command is sent to a Channel that is not connected the response is the offline error.

- Data error (DF):

If a command containing invalid data is sent the response is the data error.

- Not available (NA):

If a command is sent to a Channel that is not applicable to that hardware configuration (e.g. NO Mode sent to HC analyser) the not available response is sent.

Definitions

Analyser Components

Figure 1 - User Interface

The designation K0 addresses commands to all of the components (all Channels of all Units).

The K number allocated to a Channel depends upon the position of the Channel on the User Interface screen (see Figure 1).

"Line" Numbers

The Cambustion analysers do not follow the standard AK designation for line number. Instead the Channels on the left of the User Interface (K1, K3, K5 and K7 in Figure 1) are given the designation L1, and the Channels on the right (K2, K4, K6, and K8) are given the designation L2.

Combined CO/CO$_2$ Analyser

Although the combined CO/CO$_2$ analyser measures two different gas components, the same K number is given to both gas components, as the detectors reside in the same sample head, and all the controls are common for both components (with the exception of the range)

Because the Range controls are independent for the CO and CO$_2$ outputs, the range numbers (sent via AK protocol) have the following effect:

Range 1:   CO: $0 - 20\%$ CO$_2$: $0 - 20\%$ Range 6:   CO: $0 - 10\%$ CO$_2$: $0 - 5\%$
Range 2:   CO: $0 - 20\%$ CO$_2$: $0 - 10\%$ Range 7:   CO: $0 - 5\%$ CO$_2$: $0 - 20\%$
Range 3:   CO: $0 - 20\%$ CO$_2$: $0 - 5\%$ Range 8:   CO: $0 - 5\%$ CO$_2$: $0 - 10\%$
Range 4:   CO: $0 - 10\%$ CO$_2$: $0 - 20\%$ Range 9:   CO: $0 - 5\%$ CO$_2$: $0 - 5\%$
Range 5:   CO: $0 - 10\%$ CO$_2$: $0 - 10\%$

Action Commands

SATK – Auto Calibration

Command-Syntax / All Channels (K0)

Command: SATK K0
Response: SATK <E>
Example: SATK K0
                      SATK 0

Command-Syntax / "Line" (KV Ln)

Command: SATK KV Ln
Response: SATK <E>
Example: SATK KV L1
                      SATK 0

Command-Syntax / Channel (Kn)

Command: SATK Kn … Km
Response: SATK <E>
Example: SATK K1 K3 K6
                      SATK 0

This command starts the automatic zero/span calibration procedure on the specified Channels. This procedure corrects the specified Channels for any zero and/or span drift that may have occured.

The function follows the sequence outlined below:

1. Calibrate DAC circuitry (FID Channels only)
2. Allow Zero gas to flow; wait for "Autocal Purge" Time
     (as set in Options window of User Interface)
3. Measure and correct for Zero Offset
4. Allow selected Span gas to flow; wait for "Autocal Purge" Time
     (as set in Options window of User Interface)
5. Measure and correct for Span Drift
6. Return to Default Gas selection, and original Range setting

If SATK is sent to a Channel where calibration is already in progress, or where the Channel is not yet ready to perform the calibration (because it is not yet warmed up) the response including "BS" is sent.

SEGA – Span Gas (SpanA)

Command-Syntax / All Channels (K0)

Command: SEGA K0
Response: SEGA <E>
Example: SEGA K0
            SEGA 0

Command-Syntax / "Line" (KV Ln)

Command: SEGA KV Ln
Response: SEGA <E>
Example: SEGA KV L1
            SEGA 0

Command-Syntax / Channel (Kn)

Command: SEGA Kn … Km
Response: SEGA <E>
Example: SEGA K1 K3 K6
            SEGA 0

This command flows span gas to the specified Channels. This function does not perform a calibration, but only allows the span gas to flow.

Notes:

1. Gas will continue to flow until another command is sent that switches off the gas flow, or the "time-out" limit is reached.

2. If the K0 (All Channels) command is used, then under some circumstances, insufficient gas may be supplied to some of the channels, as the demand will be much higher than usual, resulting in the signal being erroneous. It is better practice to send the Span and Zero gases individually to each Channel in turn.

SEGB – Span Gas (SpanB)

Command-Syntax / All Channels (K0)

Command: SEGB K0
Response: SEGB <E>
Example: SEGB K0
              SEGB 0

Command-Syntax / "Line" (KV Ln)

Command: SEGB KV Ln
Response: SEGB <E>
Example: SEGB KV L1
              SEGB 0

Command-Syntax / Channel (Kn)

Command: SEGB Kn … Km
Response: SEGB <E>
Example: SEGB K1 K3 K6
              SEGB 0

This command flows span gas to the specified Channels. This function does not perform a calibration, but only allows the span gas to flow.

Notes:

1. Gas will continue to flow until another command is sent that switches off the gas flow, or the "time-out" limit is reached.

2. If the K0 (All Channels) command is used, then under some circumstances, insufficient gas may be supplied to some of the channels, as the demand will be much higher than usual, resulting in the signal being erroneous. It is better practice to send the Span and Zero gases individually to each Channel in turn.

SEGC – Span Gas (SpanC)

Command-Syntax / All Channels (K0)

Command: SEGC K0
Response: SEGC <E>
Example: SEGC K0
              SEGC 0

Command-Syntax / "Line" (KV Ln)

Command: SEGC KV Ln
Response: SEGC <E>
Example: SEGC KV L1
              SEGC 0

Command-Syntax / Channel (Kn)

Command: SEGC Kn … Km
Response: SEGC <E>
Example: SEGC K1 K3 K6
              SEGC 0

This command flows span gas to the specified Channels. This function does not perform a calibration, but only allows the span gas to flow.

Notes:

1. Gas will continue to flow until another command is sent that switches off the gas flow, or the "time-out" limit is reached.

2. If the K0 (All Channels) command is used, then under some circumstances, insufficient gas may be supplied to some of the channels, as the demand will be much higher than usual, resulting in the signal being erroneous. It is better practice to send the Span and Zero gases individually to each Channel in turn.

SEGD – Span Gas (SpanD)

Command-Syntax / All Channels (K0)

Command: SEGD K0
Response: SEGD <E>
Example: SEGD K0
                     SEGD 0

Command-Syntax / "Line" (KV Ln)

Command: SEGD KV Ln
Response: SEGD <E>
Example: SEGD KV L1
                     SEGD 0

Command-Syntax / Channel (Kn)

Command: SEGD Kn … Km
Response: SEGD <E>
Example: SEGD K1 K3 K6
                     SEGD 0

This command flows span gas to the specified Channels. This function does not perform a calibration, but only allows the span gas to flow.

Notes:

1. Gas will continue to flow until another command is sent that switches off the gas flow, or the "time-out" limit is reached.

2. If the K0 (All Channels) command is used, then under some circumstances, insufficient gas may be supplied to some of the channels, as the demand will be much higher than usual, resulting in the signal being erroneous. It is better practice to send the Span and Zero gases individually to each Channel in turn.

SEMB – Range Select

Command-Syntax / All Channels (K0)

Command: -
Response: -
Example: -

Command-Syntax / "Line" (KV Ln)

Command: -
Response: -
Example: -

Command-Syntax / Channel (Kn)

Command: -
Response: -
Example: -

Command-Syntax / Channel (Kn Mn)

Command: SEMB Kn Mn … Km Mm
Response: SEMB <E>
Example: SEMB K2 M1 K3 M5 K6 M2
             SEMB 0

This command sets the range for the specified Channel(s). Each Channel number must be followed by a range.

Note: The range number sent to the combined CO/CO_2 analyser will set both ranges according to the list below:

M1 =	HC: 0-200,000	NO/NOx: 0-20,000	CO: 0 – 20%	CO_2: 0 – 20%
M2 =	HC: 0-100,000	NO/NOx: 0-10,000	CO: 0 – 20%	CO_2: 0 – 10%
M3 =	HC: 0-50,000	NO/NOx: 0-5,000	CO: 0 – 20%	CO_2: 0 – 5%
M4 =	HC: 0-20,000	NO/NOx: 0-2,000	CO: 0 – 10%	CO_2: 0 – 20%
M5 =	HC: 0-10,000	NO/NOx: 0-1,000	CO: 0 – 10%	CO_2: 0 – 10%
M6 =	HC: 0-5,000	NO/NOx: 0-500	CO: 0 – 10%	CO_2: 0 – 5%
M7 =	HC: 0-2,000	NO/NOx: 0-200	CO: 0 – 5%	CO_2: 0 – 20%
M8 =	HC: 0-1,000	NO/NOx: 0-100	CO: 0 – 5%	CO_2: 0 – 10%
M9 =	HC: not used	NO/NOx: not used	CO: 0 – 5%	CO_2: 0 – 5%

SENO – NO Mode

Command-Syntax / All Channels (K0)

Command: -
Response: -
Example: -

Command-Syntax / "Line" (KV Ln)

Command: -
Response: -
Example: -

Command-Syntax / Channel (Kn)

Command: SENO Kn
Response: SENO <E>
Example: SENO K2
                      SENO 0

This command verifies the presence of the correct hardware on the CLD analyser to measure NO. If the SATK function is currently being performed, the response includes "BS" after the Channel number.

Note: If this command is sent to a non-CLD Channel, or to a CLD equipped with the hardware for NOx measurement instead of the hardware for NO measurement, the response includes "NA" after the Channel number.

SMAN – Manual Mode

Command-Syntax / All Channels (K0)

Command: SMAN K0
Response: SMAN <E>
Example: SMAN K0
             SMAN 0

Command-Syntax / "Line" (KV Ln)

Command: -
Response: -
Example: -

Command-Syntax / Channel (Kn)

Command: -
Response: -
Example: -

This command sets the system into a "manual" mode. Once in this "manual" mode, only request commands and SREM are accepted – all other commands received the response "OF", indicating the system is Offline.

SMGA – Measure Gas

Command-Syntax / All Channels (K0)

Command:	SMGA K0
Response:	SMGA <E>
Example:	SMGA K0
	SMGA 0

Command-Syntax / "Line" (KV Ln)

Command:	SMGA KV Ln
Response:	SMGA <E>
Example:	SMGA KV L1
	SMGA 0

Command-Syntax / Channel (Kn)

Command:	SMGA Kn … Km
Response:	SMGA <E>
Example:	SMGA K1 K3 K6
	SMGA 0

This command routes sample gas to the specified Channel(s) and begins to measure.

SNGA – Zero Gas

Command-Syntax / All Channels (K0)

Command: SNGA K0
Response: SNGA <E>
Example: SNGA K0
             SNGA 0

Command-Syntax / "Line" (KV Ln)

Command: SNGA KV Ln
Response: SNGA <E>
Example: SNGA KV L1
             SNGA 0

Command-Syntax / Channel (Kn)

Command: SNGA Kn … Km
Response: SNGA <E>
Example: SNGA K1 K3 K6
             SNGA 0

This command flows zero gas to the specified Channels. This function does not perform a calibration, but only allows the zero gas to flow.

Notes:

1. Gas will continue to flow until another command is sent that switches off the gas flow, or the "time-out" limit is reached.

2. If the K0 (All Channels) command is used, then under some circumstances, insufficient gas may be supplied to some of the channels, as the demand will be much higher than usual, resulting in the signal being erroneous. It is better practice to send the Span and Zero gases individually to each Channel in turn.

SNOX – NOx Mode

Command-Syntax / All Channels (K0)

Command: -
Response: -
Example: -

Command-Syntax / "Line" (KV Ln)

Command: -
Response: -
Example: -

Command-Syntax / Channel (Kn)

Command: SNOX Kn
Response: SNOX <E>
Example: SNOX K1
              SNOX 0

This command verifies the presence of the correct hardware on the CLD analyser to measure NOx. If the SATK function is currently being performed, the response includes "BS" after the Channel number.

Note: If this command is sent to a non-CLD Channel, or to a CLD equipped with the hardware for NO measurement instead of the hardware for NOx measurement, the response includes "NA" after the Channel number.

SPAU – Energy Saving Mode

Command-Syntax / All Channels (K0)

Command: SPAU K0
Response: SPAU <E>
Example: SPAU K0
            SPAU 0

Command-Syntax / "Line" (KV Ln)

Command: -
Response: -
Example: -

Command-Syntax / Channel (Kn)

Command: -
Response: -
Example: -

This command sets the system into a "energy saving" mode (all analysers switched to "Off").

SREM – Remote Mode

Command-Syntax / All Channels (K0)

Command: SREM K0
Response: SREM <E>
Example: SREM K0
             SREM 0

Command-Syntax / "Line" (KV Ln)

Command: -
Response: -
Example: -

Command-Syntax / Channel (Kn)

Command: -
Response: -
Example: -

This command sets the system into remote mode. This command must be sent first to initiate Host control.

Note: After power on, the system is in "manual" mode, so the Host must send an SREM command in order to enable control of the system.

SSON – "On" mode

Command-Syntax / All Channels (K0)

Command: SSON K0
Response: SSON <E>
Example: SSON K0
             SSON 0

Command-Syntax / "Line" (KV Ln)

Command: SSON KV Ln
Response: SSON <E>
Example: SSON KV L1
             SSON 0

Command-Syntax / Channel (Kn)

Command: SSON Kn … Km
Response: SSON <E>
Example: SSON K2 K4 K5
             SSON 0

This command sets the requested Channels to "On" mode. When this command is sent, any auto-calibration in progress on the addressed Channels is halted. The currently selected Range is kept.

Note: This command must be sent in order to switch the analysers into "On" mode so that measurements can be made.

SSPL – Purge

Command-Syntax / All Channels (K0)

Command: SSPL K0
Response: SSPL <E>
Example: SSPL K0
                     SSPL 0

Command-Syntax / "Line" (KV Ln)

Command: SSPL KV Ln
Response: SSPL <E>
Example: SSPL KV L1
                     SSPL 0

Command-Syntax / Channel (Kn)

Command: SSPL Kn … Km
Response: SSPL <E>
Example: SSPL K1 K3 K6
                     SSPL 0

This command flows purge gas to the specified Channels. This function does not perform a "back-flush" or cleaning of the sampling system, but only prevents soot to be taken into the sampling system (and hence blockages of the sampling system from occurring).

Note: Gas will continue to flow until another command is sent that switches off the gas flow.

STBY – Standby

Command-Syntax / All Channels (K0)

Command: STBY K0
Response: STBY \<E>
Example: STBY K0
             STBY 0

Command-Syntax / "Line" (KV Ln)

Command: STBY KV Ln
Response: STBY \<E>
Example: STBY KV L1
             STBY 0

Command-Syntax / Channel (Kn)

Command: STBY Kn … Km
Response: STBY \<E>
Example: STBY K2 K4 K5
             STBY 0

This command sets the requested Channels to "Standby" mode. When this command is sent, any currently executing function (e.g. calibration, span, zero etc.) is halted. The currently selected Range is kept.

If the system is in "energy saving" mode the specified Channels are set to "Standby" mode.

Request Commands

ASTA – Error Channel

Command-Syntax / All Channels (K0)

Command: ASTA K0
Response: ASTA \<E> Kx … Ky   ←   All Channels with an error
Example: ASTA K0
             ASTA 3 K1 K3 K8

Command-Syntax / "Line" (KV Ln)

Command: -
Response: -
Example: -

Command-Syntax / Channel (Kn)

Command: -
Response: -
Example: -

This command requests the Channels which currently have errors. All Channels with errors are included in the response. Detailed alarm information for each Channel can be obtained using the ASTF command.

ASTC – Clear Errors

Command-Syntax / All Channels (K0)

Command: ASTC K0
Response: ASTC <E>
Example: ASTC K0
             ASTC 0

Command-Syntax / "Line" (KV Ln)

Command: -
Response: -
Example: -

Command-Syntax / Channel (Kn)

Command: -
Response: -
Example: -

This command clears any errors currently showing in the Warnings, failures and Faults List window.

If an error or fault has not been resolved, it will reappear in the list after the list has been cleared.

This command is useful for clearing warning messages that are not critical to operation, as these will appear in the list of error codes, even though they may not require any operator intervention.

ASTF – Error Code

Command-Syntax / All Channels (K0)

Command: ASTF K0
Response: ASTF <E> <Error Code 1> <Error Code 2> … <Error Code n>
Example: ASTF K0
             ASTF 8 1 4 10 15 17 29 33 38

Command-Syntax / "Line" (KV Ln)

Command: -
Response: -
Example: -

Command-Syntax / Channel (Kn)

Command: ASTF Kn
Response: ASTF <E> <Error Code 1> <Error Code 2> … <Error Code n>
Example: ASTF K3
             ASTF 3 6 15 23

This command requests the error codes currently being generated by the system. The order of the error codes will correspond to the order of the list of Channel numbers returned by the ATSA command.

For "ASTF K0", the entire list of error codes is returned.
For "ASTF Kn", the list of error codes for the specified Channel is returned.

A list of Error Codes and their meanings is given in Appendix B.

ASTZ – Device Status

Command-Syntax / All Channels (K0)

Command: -
Response: -
Example: -

Command-Syntax / "Line" (KV Ln)

Command: -
Response: -
Example: -

Command-Syntax / Channel (Kn)

Command: ASTZ Kn
Response: ASTZ <E> Mx=Mode Gx=Gas Select Rx=Gain Range Px=Progress to ready
Example: ASTZ K1
              ASTZ 0 M1 G0 R1 P95

This command requests the current state of one of the channels.

Mx = Mode

M0 =   Off
M1 =   Standby/Pause
M2 =   On
M3 =   Autocalibrate

Gx = Gas Select

G0 =	HC: Sample	NO/NOx: Sample	CO: Sample	CO_2: Sample
G1 =	HC: Span A	NO/NOx: Span A	CO: Span A	CO_2: Span A
G2 =	HC: Span B	NO/NOx: Span B	CO: Span B	CO_2: Span B
G3 =	HC: Zero	NO/NOx: Zero	CO: Zero	CO_2: Zero
G4 =	HC: Purge	NO/NOx: Purge	CO: Purge	CO_2: Purge
G5 =	HC: not used	NO/NOx: Span C	CO: Span C	CO_2: Span C
G6 =	HC: not used	NO/NOx: not used	CO: Span D	CO_2: Span D

Rx = Gain Range

R1 =	HC: 0-200,000	NO/NOx: 0-20,000	CO: 0 – 20%	CO_2: 0 – 20%
R2 =	HC: 0-100,000	NO/NOx: 0-10,000	CO: 0 – 20%	CO_2: 0 – 10%
R3 =	HC: 0-50,000	NO/NOx: 0-5,000	CO: 0 – 20%	CO_2: 0 – 5%
R4 =	HC: 0-20,000	NO/NOx: 0-2,000	CO: 0 – 10%	CO_2: 0 – 20%
R5 =	HC: 0-10,000	NO/NOx: 0-1,000	CO: 0 – 10%	CO_2: 0 – 10%
R6 =	HC: 0-5,000	NO/NOx: 0-500	CO: 0 – 10%	CO_2: 0 – 5%
R7 =	HC: 0-2,000	NO/NOx: 0-200	CO: 0 – 5%	CO_2: 0 – 20%
R8 =	HC: 0-1,000	NO/NOx: 0-100	CO: 0 – 5%	CO_2: 0 – 10%
R9 =	HC: not used	NO/NOx: not used	CO: 0 – 5%	CO_2: 0 – 5%

Px=Progress to ready
x = Percentage towards being ready (100% = Ready)

Appendices

A   Configuration for AK protocol

The User Interface software must be upgraded to enable the AK protocol option. Please contact Cambustion for details of this upgrade.

The AK protocol works over RS232 or TCP. RS232 is supported in all versions of the User Interface. TCP is supported in version 5.2 onwards.

The User Interface must be configured to receive the AK protocol commands. This can be achieved from the System Setup window
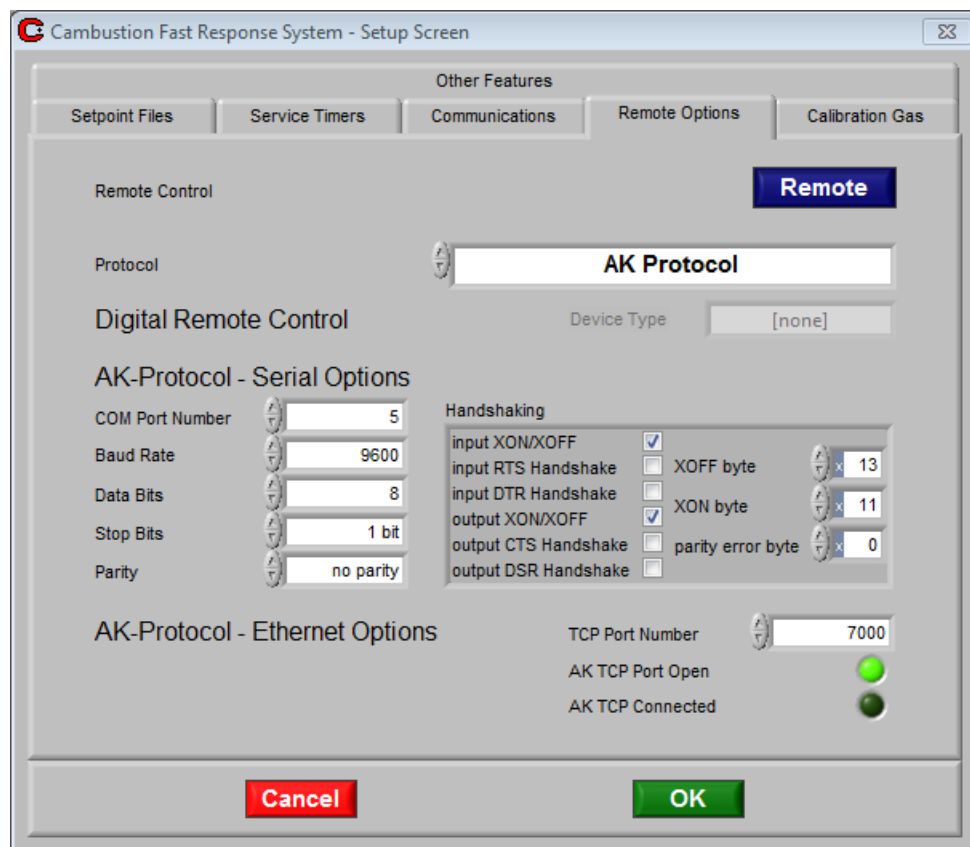
A.1 Communication Settings

Figure 2 - User Interface System Setup Window

By selecting the **Remote Options** screen in the System Setup window, the user has access to the settings for the RS232 COM port and/or Ethernet port to which the AK protocol commands are sent.

A.1.1   Protocol

The protocol selector should be set to "AK Protocol"

A.1.2   Remote Control

To enable remote control the button in the top right of the screen should be pressed so that it appears as shown in Figure 2.

A.1.3   Serial Port Options

The Serial COM port options should be set to mirror those on the port from which commands are sent. The user has control over the following parameters:

- *COM Port Number*
  Selects which COM port on the rear of the PC running the User Interface is used to send and receive commands.   *Default:*   COM1

- *Baud Rate*
  Specifies the baud rate in bits per second (bps) to be used for serial communication.
  Settings: 1200, 2400, 4800, 9600, 19200, 28800, 38400, 48000, 57600 or 115200
                                                                Default: 9600

- *Data Bits*
  Specifies the number of bits used per character.
  Settings: 7 or 8 bits   *Default:*   8 bits

- *Stop bits*
  Specifies the number of bits used to "frame" the data bits
  Settings: 1, 1.5 or 2 stop bits   *Default:*   1 bit

- *Parity*
  Parity is a means of checking the transmission is being received correctly. The transmitting device adds a parity bit, which is set according to the contents of the data bits. Most PC-based serial communication uses no parity.
  Settings: no parity, odd parity, even parity, mark parity or space parity
                                                                Default: no parity

- *Handshaking*
  The buttons in this box enable various levels of software and hardware handshaking. Handshaking controls the flow of data to prevent the buffer in either the sender or receiver from overflowing.
  XON/XOFF is a software handshaking protocol. When the receive buffer is nearly full the receiver sends the XOFF character (usually DC3, ASCII 0x13) to tell the other device to stop transmission. Once the buffer has emptied sufficiently, the receiver sends the XON character (usually DC1, ASCII 0x11) to indicate transmission can be restarted. Hardware handshaking using the RTS (Request To Send), DTR (Data Terminal Ready), CTS (Clear To Send) and DSR (Data Set Ready) lines can also be enabled.

Settings:		*Default:*	
	input XON/XOFF		ON
	input RTS Handshake		OFF
	input RTS Handshake		OFF
	output XON/XOFF		ON
	output CTS Handshake		OFF
	output DSR Handshake		OFF
	XOFF byte		DC3 (ASCII 0x13)
	XON byte		DC1 (ASCII 0x11)

The user does *not* have control over the **Buffer Size.** This is hard-set to 4096 bytes (4Kbytes).

A.1.4   Ethernet Port Options

The TCP port number should be the one to which commands are sent.

▪ *TCP Port Number*
Selects which TCP port used by the User Interface to send and receive commands.

Default: 7000

There are two indicator LEDs to show the status of the TCP connection, to aid with diagnosing problems:

▪ *AK TCP Port Open*
Indicates that the User Interface has opened the port, and is waiting for a connection to be initiated by the AK server.

▪ *AK TCP Connected*
Indicates that the AK server has successfully connected to the TCP port.

AK TCP communication is initiated by opening a TCP connection to the AK TCP port of the PC running the User Interface.

Please note that it may be necessary to configure firewall settings on the User Interface PC to allow AK TCP communication.

A.2 Serial Cable Pin Connections

A 9-pin null modem serial cable must be used to connect the COM port of the PC running the User Interface to the AK protocol host computer.

B Error Codes

Code No.	Message
0	No error
1	Fuel gas not available.
2	Air not available.
3	SpanA not available. Default gas selected.
4	SpanB not available. Default gas selected.
5	SpanC not available. Default gas selected.
6	SpanD not available. Default gas selected.
7	Zero gas not available. Default gas selected.
8	Purge gas not available. No gas/Sample selected.
9	Vacuum not available. Unit switched off.
10	Glow plug fault. FID flame failed to light.
11	Heated Sample Probe - Thermocouple failure. Head and Probe switched off.
12	Sample Head - Body thermocouple failure. Head and Probe switched off.
13	Sample Head - Exhaust thermocouple failure. FID flame extinguished.
14	FID flame has gone out.
15	Excessive Zero noise detected during autocalibration.
16	Excessive Zero offset detected during autocalibration.
17	Excessive Span noise detected during autocalibration.
18	Head gain has changed more than 10% since last calibration.
19	Sample Head is 20 degC hotter than the setpoint, and has been switched off. If the temperature of the sample head continues to rise, switch power to unit off and contact Cambustion.
20	Range not attainable. Maximum sensitivity selected.
21	Flame temperature too high. Head and Probe switched off.
22	Fuel pressure not in range.
23	Air pressure not in range.
24	FID pressure not in range.
25	CP pressure not in range.
26	Head temperature not in range.
27	Probe temperature not in range.
28	Vacuum test requires the Sample Head to be switched to Standby or switched Off.

29	Communications error between PC and services control unit.
30	CLD pressure not in range
31	APD temperature not in range
32	APD External Cooler temperature not in range.
33	NOx Convertor temperature not in range. Head and Convertor switched off.
34	NOx Convertor - Thermocouple failure. Head and Convertor switched off.
35	Detector temperature not in range.
36	Emitter intensity not in range.
37	External Cooler temperature not in range.
38	NDIR pressure not in range.
39	Filter chamber temperature not in range.
40	FID flame failed to light.
41	NOx concentration lower than NO concentration. Please change values and try again.
42	NOx convertor efficiency has fallen to less than 90%. Efficiency x.xx%
43	NOx convertor efficiency calculation error.
44	CO calibration error.
45	CO2 calibration error.
46	Calibration gas time-out. Default gas selected.
47	Calibration routine error. Default gas selected.
48	NOx convertor efficiency not checked. Efficiency 100% assumed.
49	Motor speed not in range.
50	Photomultiplier tube temperature not in range.
51	Emitter PWM% close to maximum.
52	Emitter Current too low.
53	Communications between Sample Head and Control Unit have failed.

C Contact details

In the event of a problem that is not covered in this user manual, please do not hesitate to contact Cambustion. We find that most problems are easily diagnosed and solved by a phone call, FAX, or e-mail message.

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