Kinetic
API Reference

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CHANGE RECORD

Version Number	Date	Description of Change
1.01	24 Feb 2012	This document applies to SBS-3 and later devices. Not applicable to SBS-1 family.
1.02	23 May 2012	Added packet types for AIS and ACARS data
1.03	15 Oct 2012	Updated for 6 SDR channels on the SBS-3 Firmware version L_0201_0000_0116_R_SBS3
1.04	12 Aug 2013	Updated for I/Q output packets on the SBS-3 and the SDR Puck. Firmware version L_0301_0000_0119_R_SBS3

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SBS-3 API Message Format

These messages can be used by opening a TCP socket on the SBS-3's main port (default 10001).

Message Protocol

Overall packet format

DLE character (10 hex)
STX character (02 hex)
Packet type (one byte)
Data (variable number of bytes depending on packet type)
DLE character (10 hex)
ETX character (03 hex)
High byte of CRC
Low byte of CRC

DLE stuffing

Any bytes in the data having a value of 10 hex will be preceded by a second 10 hex byte (DLE character). DLE stuffing also applies to the two CRC bytes.

Packet Type

The packet types are defined in KAL_MessageTypes.h and described below
The packet type 10 hex is not used due to the DLE stuffing.

Data field

This has variable content depending on the packet type. Data sub-fields are generally sent high byte first. Users should allow for the possibility that additional fields may be added to the end of the data fields at a future date, and therefore ignore any unexpected additional data.

CRC

The CRC is calculated using the CCITT-16 polynomial on the Packet Type and Data fields (before DLE stuffing). Not all applications or products will populate or check the CRC field. There should be no need for users to check the CRC when using a TCP connection.

Description of each packet type

0x01 - ADS-B or TIS-B data (KAL_PKT_MODES_ADSB)

Packet sent by SBS-3. This is data from ADS-B or TIS-B packets with DF=17, 18 or 19.

Byte 0 - packet type
Byte 1 - not used
Byte 2-4 - Rolling Timestamp – in 50 ns intervals
Byte 5-18 - the 14 bytes of Mode S data.

If the last 3 bytes of the Mode S data (parity bits) are zero then this indicates that the packet has been correctly received or error correction successfully applied.

0x05 - Mode S data – Long Format (KAL_PKT_MODES_LONG)

Packet sent by SBS-3, containing data from 112-bit Mode S packets other than ADS-B or TIS-B.

Byte 0 - packet type
Byte 1 - not used
Byte 2-4 - Rolling Timestamp – in 50 ns intervals
Byte 5-18 - the 14 bytes of Mode S data.

0x07 - Mode S data – Short Format (KAL_PKT_MODES_SHORT)

Packet sent by SBS-3. This is data from 56-bit Mode S packets with DF = 0 to 15.

Byte 0 - packet type
Byte 1 - not used
Byte 2-4 - Rolling Timestamp – in 50 ns intervals
Byte 5-11 - the 7 bytes of Mode S data.

0x09 - Mode A/C data (KAL_PKT_MODEAC)

Byte 0 - packet type
Byte 1 - not used
Byte 2-4 - Rolling Timestamp – in 50 ns intervals
Byte 5: Mode A/C reply bits: SPI-0-0-C1-A1-C2-A2-C4
Byte 6: Mode A/C reply bits: A4-X-B1-D1-B2-D2-B4-D4

0x11 - Enquire Serial Number (KAL_PKT_SERIAL_ENQ)

Command packet sent to the SBS-3. Response is a KAL_PKT_SERIAL_REPLY.
Byte 0 - packet type
Byte 1 - message tag - used to identify the response packet.

0x17 - Login Request (KAL_PKT_LOGIN_REQ)

Command packet sent to the SBS-3. Response is a KAL_PKT_LOGIN_INFO.

Note - it is not necessary to log into the SBS-3 in order to receive data or send commands. However useful version data is returned, and also the green log in LED and yellow ethernet login LED are turned on when this command is received.

Byte 0 - packet type
Byte 1 - message tag - used to identify the response packet.

0x19 - Set Baud Rate (KAL_PKT_RS232_BAUD_SET)

Sent to the SBS-3
Sets the baud rate on the RS232 port

Byte 0 - packet type
Byte 1 = message tag
Byte 2 to 5 - baud rate data (LS Byte first)

0x1a - RS232 Data for Output (KAL_PKT_RS232_OUT)

Sent to the SBS-3, containing data to be output on the RS232 port

Byte 0 - packet type
Byte 1 = message tag
Byte 2 to ... - serial data

0x1d - Set Mode (KAL_PKT_MODE_SET)

Packet sent to the SBS-3. Sets the device operating mode (the specified data is written to the KAL_REG_MODE register).

Byte 0 - packet type
Byte 1 = message tag
Byte 2 to 5 - mode data

0x1e - Set LEDs (KAL_PKT_LED_SET)

Packet sent to the SBS-3, in order to control the front panel LED's.
Note - these LEDs will also be turned on or off by the SBS-3's firmware during normal operation so the effect of using this command may be unpredictable.
Byte 0 - packet type
Byte 1 = message tag
Byte 2 = first byte of LED data (each bit is 1=LED on, 0 = off).
Byte 3 = first byte of bit mask specifying which LEDs should be set
(1 = set LED according to bit in Byte 2, 0 = leave this LED unmodified).
Byte 4 = second byte of LED data (each bit is 1=LED on, 0 = off).
Byte 5 = second byte of bit mask specifying which LEDs should be set

The lower 3 bits of the first byte of LED data sets the tri-colour LED
0x00 = off, 0x01 = blue , 0x02 = red , 0x04 = green

0x20 - Status response (KAL_PKT_STATUS)

This packet is sent by the SBS-3 in response to a command where an error occurred, or when no other packet type is expected to be sent in response.
Byte 0 - packet type
Byte 1 = message tag from the original command
Byte 2 = status code (0 = OK)

0x21 - Serial Number Reply (KAL_PKT_SERIAL_REPLY)

Sent by the SBS-3 in response to ***KAL_PKT_SERIAL_ENQ***
Byte 0 - packet type
Byte 1 = message tag
Byte 2 = status (should be 0x00)
Byte 3 to 10 - serial number data as 8 characters of text

0x26 - Login Information (KAL_PKT_LOGIN_INFO)

Sent by the SBS-3 in response to ***KAL_PKT_LOGIN_REQ***

Byte 0 - packet type
Byte 1 = message tag
Byte 2 to 9 - serial number data in text format
Byte 10 to 25 - version string “SBS-3”
Byte 26 - Firmware version low byte
Byte 27 - Firmware version high byte
Byte 28 - FPGA version number - major
Byte 29 - FPGA version number - minor
Byte 30 - reserved - set to 0
Byte 31 - reserved - set to 0
Byte 32 - User interface version number - major
Byte 33 - User interface version number - minor
Byte 34 - Device ID low byte = 0x00
Byte 35 - Device ID high byte = 0x03 for SBS-3

0x2a - RS232 Output Echo (KAL_PKT_RS232_OUT_ECHO)

Sent by the SBS-3. Echos back the characters sent in a KAL_PKT_RS232_OUT packet

Byte 0 - packet type
Byte 1 = message tag
Byte 2 to ... - serial data

0x2b - RS232 Input Data (KAL_PKT_RS232_IN)

Used by the SBS-3 to send any input data received on its RS-232 port.

Byte 0 - packet type
Byte 1 = message tag
Byte 2 to ... - serial data

0x2c - Software Option Report (KAL_PKT_OPTION_REPORT)

Output automatically by the SBS-3 after successful login.

Byte 0 - packet type
Byte 1 = message tag
Byte 2 - option status bitmap (bit 0 = option 1 set ... bit 7 = option 8 set)

Note:
Option 1 = external radio interface (always set on the SBS-3)
Option 8 = internal radio interface (automatically set on the SBS-3)

0x38 - Status Report from Radio (KAL_PKT_RADIO_STATUS)

This packet type is used by the SBS-3 to send periodic status reports for the internal radio receivers.

Byte 0 - packet type
Byte 1 - message tag - not used - set to 0x00
Byte 2 - reserved - set to 0x00
Byte 3 - number of SDRs - set to 0x06 on firmware version L_0201_0000_0116_R_SBS3 or later; set to 0x04 on earlier firmware versions
Byte 4 - bytes of data per SDR channel
Byte 5 - number of tuners
Byte 6 - bytes of data per tuner
Byte 7... data for each SDR, followed by data for each tuner

The SDR data currently sent for each channel is :
Received Signal Strength Indicator (1 byte)
Flags (1 byte). Bit 0 is set if squelched. Bit 7 is set if channel is muted.

The data currently sent for each tuner is:
AGC value in dB (1 byte)
followed by 3 reserved bytes

0x3b - Digital Audio Data (KAL_PKT_AUDIO_DATA)

Contains a chunk of digital audio data from the mixer
Byte 0 - packet type
Byte 1 - tag (= 0x00)
Byte 2 to 129 - digital audio data. Number of bytes per sample depends on audio format

0x45 - Register Data (KAL_PKT_REG_DATA)

This packet type is sent by the SBS-3 to return internal register data request using KAL_PKT_REG_ACCESS.

Byte 0 - packet type
Byte 1 - message tag - used to identify the response packet
Byte 2 to 11 - contain the values originally sent with the KAL_PKT_REG_ACCESS packet
Byte 12... - register data

0x54 - Register Access (KAL_PKT_REG_ACCESS)

This packet type is sent to the SBS-3 to read or write the internal registers. This command is used to control the internal radio receivers, configure IP addresses, etc.

Byte 0 - packet type
Byte 1 - message tag - used to identify the response packet
Byte 2 - op code bit mask for required operation.

Byte 3 - reserved
Byte 4 - register number low byte
Byte 5 - register number high byte
Byte 6 - register subgroup low byte
Byte 7 - register subgroup high byte
Byte 8 - register group low byte
Byte 9 - register group high byte
Byte 10 - number of consecutive register bytes to access
Byte 11 - reserved - should be 0
Byte 12... - register data if KAL_REG_OP_WRITE is set

The response is KAL_PKT_REG_DATA if the bit KAL_REG_OP_READ is set in the operation mask, otherwise a KAL_PKT_STATUS is returned.

Valid op codes are :
KAL_REG_OP_WRITE 0x01 - sets registers to the values sent in the command
KAL_REG_OP_RESTORE 0x02 - restores values from non-volatile memory
KAL_REG_OP_DEFAULT 0x03 - resets values to default
KAL_REG_OP_READ 0x04 - reads the register data
KAL_REG_OP_SAVE 0x08 - saves values to non-volatile memory
KAL_REG_OP_NV_ONLY 0x10 - if this bit is set then only the data in the non-volatile store is read or written. The RAM register itself in the SBS-3 is left unchanged.

More than one of the above values can be ORed together, e.g.
KAL_REG_OP_WRITE | KAL_REG_OP_SAVE
writes data to the RAM and non-volatile memory

KAL_REG_OP_WRITE | KAL_REG_OP_SAVE | KAL_REG_OP_NV_ONLY
writes data to the non-volatile memory only (RAM setting is unaffected)

KAL_REG_OP_RESTORE | KAL_REG_OP_READ | KAL_REG_OP_NV_ONLY
reads data from the non-volatile memory only (RAM setting is unaffected)

KAL_REG_OP_RESTORE | KAL_REG_OP_READ
reads data from the non-volatile memory and also sets the RAM to the restored value

0x57 - AIS Data (KAL_PKT_AIS_DATA)

This packet type is used to send the binary data from a decoded AIS message.

Byte 0 - packet type
Byte 1 - AIS channel that the message was received on (0 = channel A,
1 = channel B, assuming SDR channel tuned to 161.975 MHz)
Byte 2 - number of complete bytes in the AIS data
Byte 3 - number of extra bits in the AIS data (0 if data is an exact number of bytes)
Bytes 4, 5 - result of decoder CRC calculation (should be FFFF if message has no errors)
Bytes 6-8 - reserved
Byte 9... the binary message data

0x58 - ACARS Data (KAL_PKT_ ACARS_DATA)

This packet type is used to send the data from a decoded ACARS message.

Byte 0 - packet type
Byte 1 - SDR channel that the message was received on (0 = SDR channel 1,
1 = SDR channel 2 etc.)
Byte 2 - number of characters in the ACARS message
Byte 3,4 - result of decoder CRC calculation (should be 0 if message has no errors)
Byte 5 ... the message (7-bit ASCII characters, with parity in the high order bit)

0x59 - I and Q Data (KAL_PKT_ IQ_DATA)

This packet type is used to send I and Q data from an SDR channel. See also the descriptions for register KAL_REG_IQ_CONFIG and KAL_REG_SDR_DEMOD below.

Byte 0 - packet type
Byte 1 to 4 - a 32-bit sequence number, incremented each packet (LSB first)
Byte 5 - number of bytes per sample (2, 3 or 4, representing 8, 12 or 16 bit samples)
Byte 6 to 8 - reserved
Byte 9 to 200 - the data (192 bytes)

For 8 bit sample size, the first byte of each 2-byte sample is the I data and the second byte is the Q data.
For 12 bit samples, the sample bytes consist of
first byte - lower 8 bits of I data
second byte - bits 0-3 are upper 4 bits of I data
bits 4-7 are lower 4 bits of Q data
third byte - upper 8 bits of Q data
For 16 bit samples, the sample bytes consist of
first byte - lower 8 bits of I data
second byte - upper 8 bits of I data
third byte - lower 8 bits of Q data
fourth byte - upper 8 bits of Q data

Description of Registers

This section describes the registers within the SBS-3 that can be accessed using KAL_PKT_REG_ACCESS.

The registers fall into various **Register Groups**:

KAL_REG_GROUP_GENERAL 0x0001

This group contains some general registers that do not fall within one of the other specific groups. The sub group should be set to 0. Register numbers within this group are:

KAL_REG_VERSION_STR 0x0040
(16 bytes, read only) returns the version string padded with spaces
"SBS-3"

KAL_REG_FIRMWARE_VERS 0x0050
(2 bytes, read only, low byte first) returns the firmware version

KAL_REG_FPGA_VERS 0x0052
(2 bytes, read only, major then minor) returns the FPGA firmware version

KAL_REG_UI_VERS 0x0056
(2 bytes, read only, major then minor) returns the firmware user interface version

KAL_REG_DEVICE_ID 0x0058
(2 bytes, read only, low byte first) returns the device ID (= 0x0300 for SBS-3)

KAL_REG_NUM_TUNERS 0x0060
(read only) Returns the number of tuners available

KAL_REG_NUM_SDR 0x0061
(read only) Returns the number of SDR channels available

KAL_REG_MODE 0x0080
(4 bytes) mode settings for the 1090 MHz decoder
Can be used to control the amount of data that is sent for bandwidth purposes
Only the first byte is used currently.
Bit 0 - enables sending of TCAS data (DF=0 and 16)
Bit 1 - enables sending of all other Mode S data,
including DF 11 with nonzero PI field

Bit 2 - enables sending of Mode A and C data
Note - Mode S messages with DF= 4, 5, 20, 21, and 11 (with PI = 0) are enabled as standard, as well as ADS-B / TIS-B / ADS-R messages.

KAL_REG_IQ_CONFIG 0x0087
bit 7 - enables output of I and Q data (for SDR channel 1)
bit 0-4 selects number of data bits per sample (can be 8, 12 or 16)
Note - when enabling I and Q data output on the SBS-3 or SDR Puck, the demodulation type for SDR channel 1 should be set to 3.

KAL_REG_GROUP_NETWORK 0x0002

This group of registers is used to configure the Ethernet port. The sub group should be set to 0. The register numbers within this group are:

KAL_REG_NET_IP_ADDR 0x0000
(4 bytes) specifies the IP address

KAL_REG_NET_SUBNET_MASK 0x0004
(4 bytes) specifies the IP subnet mask

KAL_REG_NET_GATEWAY 0x0008
(4 bytes) specifies the IP gateway address

KAL_REG_NET_ETH_SPEED 0x000c
Sets the speed of the ethernet interface
0 = 10M, 1 = 100M

KAL_REG_NET_ETH_DUPLEX 0x000d
0 = half, 1 = full duplex

KAL_REG_NET_ETH_ANE 0x000e
0 = auto negotiate off
1 = auto negotiate on (default)

KAL_REG_NET_RESET 0x000f
If set to 1, Ethernet port will be powered up automatically regardless of whether USB is connected.

KAL_REG_NET_MAIN_PORT 0x0010
(2 bytes) specifies the TCP port for the main control/data port

KAL_REG_NET_NMEA_PORT 0x0012
(2 bytes) specifies the TCP port for NMEA data - will be used for implementation of AIS data

KAL_REG_GROUP_TUNER 0x0003
This group contains registers used to configure the SBS-3's two internal SDR tuners. The sub-group identifies which tuner (0= tuner A, 1 = tuner B).

KAL_REG_TUNER_MIN_FREQ 0x0000
(4 bytes, low byte first) Read only register returning the minimum frequency in Hz that this tuner can be set to.

KAL_REG_TUNER_MAX_FREQ 0x0004
(4 bytes, low byte first) Read only register returning the maximum frequency in Hz that this tuner can be set to.

KAL_REG_TUNER_ID 0x0008
(2 bytes) An enumerated value specifying the type of tuner (= 0x0000)

KAL_REG_TUNER_CENTRE_FREQ 0x0010
(4 bytes, low byte first) Sets the centre frequency for this tuner (in Hz).

KAL_REG_TUNER_BANDWIDTH 0x0014
(4 bytes, low byte first) The bandwidth in Hz of the tuner. Currently set to 8MHz on the SBS-3.

KAL_REG_TUNER_POWERUP 0x0018
Set this byte to 1 in the non volatile memory to make this tuner power up automatically when the SBS-3 is powered up.

KAL_REG_TUNER_SPECIFIC 0x0020
Register range reserved for tuner-specific configuration (none currently defined)

KAL_REG_GROUP_SDR 0x0004

This group contains registers used to configure the SBS-3's SDR channels. The sub-group identifies which SDR (0 = SDR1, 1 = SDR2, 2 = SDR3, 3 = SDR4, 4 = SDR5, 5 = SDR6).

KAL_REG_SDR_CENTRE_FREQ 0x0000
(4 bytes, low byte first) Sets the centre frequency for this SDR channel (in Hz)

KAL_REG_SDR_SOURCE 0x0004
Sets the source tuner for this SDR channel (0= tuner A, 1 = tuner B)

KAL_REG_SDR_DEMOD 0x0005
Sets the demodulation type for this SDR channel
- 0 = FM
- 1 = AM
- 2 = Wide Band FM
- 3 = I and Q data stream

KAL_REG_SDR_SQUELCH 0x0006
Sets the squelch level for this SDR channel

KAL_REG_SDR_MUTE 0x0007
Mutes this SDR channel if bit 7 is set

KAL_REG_SDR_RSSI 0x0008
(Read only) returns the Received Signal Strength Indicator value for this SDR channel

KAL_REG_GROUP_AUDIO 0x0005

This group of registers is used to control the audio mixer and the digital audio settings. The subgroup is 0 for the analog audio output and 1 for digital audio.

KAL_REG_AUDIO_NUM_INPUTS 0x0000
Sets the number of active inputs to the mixer

KAL_REG_AUDIO_MAX_INPUTS 0x0001
Read only register returning the maximum number of inputs for the mixer

KAL_REG_AUDIO_MODE 0x0002
Audio mode setting (applies for digital audio output only)
Bit 0 = 1 for stereo data (L and R channel samples are sent), 0 for mono (single channel)
Bit 1 = 1 for 16 bit data, 0 for 8 bit.
Bit 7 = 1 to enable output

KAL_REG_AUDIO_RATE 0x0003
Audio sample rate setting (applies for digital audio output only)
1 = 48000
2 = 24000
3 = 16000
6 = 8000

KAL_REG_AUDIO_MASTER_GAIN_L 0x0004
Master gain setting for left channel output (normal range 0-100).
Values over 100 may cause overloading (clipping) of the output.

KAL_REG_AUDIO_MASTER_MUTE_L 0x0005
Master mute for left channel - muted if bit 7 set.

KAL_REG_AUDIO_MASTER_GAIN_R 0x0006
Master gain setting for right channel output (normal range 0-100).

KAL_REG_AUDIO_MASTER_MUTE_R 0x0007
Master mute for left channel - muted if bit 7 set.

KAL_REG_AUDIO_INPUT0_CHAN 0x0010
SDR channel selector for first mixer input (0 = SDR 1, 1 = SDR 2 etc)
KAL_REG_AUDIO_INPUT0_GAIN_L 0x0014
Gain setting for left channel of first input (normal range 0-100).
KAL_REG_AUDIO_INPUT0_MUTE_L 0x0015
Mute setting for left channel of first input- muted if bit 7 set.
KAL_REG_AUDIO_INPUT0_GAIN_R 0x0016
Gain setting for right channel of first input (normal range 0-100).
KAL_REG_AUDIO_INPUT0_MUTE_R 0x0017
Mute setting for right channel of first input- muted if bit 7 set.
KAL_REG_AUDIO_INPUT1_CHAN 0x0018
SDR channel selector for second mixer input (0 = SDR 1, 1 = SDR 2 etc)
KAL_REG_AUDIO_INPUT1_GAIN_L 0x001c
Gain setting for left channel of second input (normal range 0-100).

KAL_REG_AUDIO_INPUT1_MUTE_L 0x001d
Mute setting for left channel of second input- muted if bit 7 set.
KAL_REG_AUDIO_INPUT1_GAIN_R 0x001e
Gain setting for right channel of second input (normal range 0-100).
KAL_REG_AUDIO_INPUT1_MUTE_R 0x001f
Mute setting for right channel of second input- muted if bit 7 set.
:
:
KAL_REG_AUDIO_INPUT5_CHAN 0x0038
SDR channel selector for sixth mixer input (0 = SDR 1, 1 = SDR 2 etc)
KAL_REG_AUDIO_INPUT5_GAIN_L 0x003c
Gain setting for left channel of sixth input (normal range 0-100).
KAL_REG_AUDIO_INPUT5_MUTE_L 0x003d
Mute setting for left channel of sixth input- muted if bit 7 set.
KAL_REG_AUDIO_INPUT5_GAIN_R 0x003e
Gain setting for right channel of sixth input (normal range 0-100).
KAL_REG_AUDIO_INPUT5_MUTE_R 0x003f
Mute setting for right channel of sixth input- muted if bit 7 set.