GURALP SYSTEMS

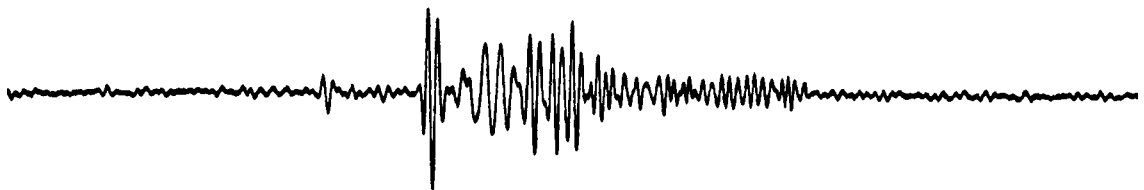# CMG   S.A.M & C.R.M

STORAGE & ACQUISITION
MODULE
& COMBINER REPEATER MODULE

OPERATOR'S GUIDE

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CONTENTS

1. INTRODUCTION

The Güralp Systems Storage and Acquisition Modules (SAM's) and Combiner-Repeater Modules (CRMs) are designed to provide the optimum solution for high performance Seismic Data Acquisition Systems, from a single autonomous sensor, to a multi-channel, multi-sensor seismic array.

The SAMs and CRMs are available with 2, 4 or 6 input ports, which can each accept digital inputs from 3-component broadband instruments or digital telemetry links.

The CRM combines data from an array of instruments and outputs it as a single stream for further transmission. For example, a standard CRM with 2 ports will combine two 3-component sensors plus state of health data sources into one (higher rate) output stream. The single combined output can then be sent via radio, telephone or digital telemetry.

The SAM can function in a similar manner as the CRM but includes the ability to store the combined data on a removable hard disc. The SAM can therefore be used where a telemetry link is unreliable or impractical. The stored data can be retrieved on, say, a monthly basis (depending upon the amount of data and disc size). The SAM's output port could be used to check an array of remote instruments whilst on site changing SCSI discs.

As part of the continuing development of all our products, the latest SAM has enhanced features, a Combine Repeater and Storage Module with dual functionality. This can be obtained either with or without a backup disc. The new SAM is flash programmable and can perform a stream synchronisation function, ie. where the SAM is collecting data from an array of instruments, the timing function for the whole array can be performed by the SAM unit with a GPS, rather than each individual instrument operating timing functions independently. Because of this enhancement, the front panel has a different layout and connector pinouts should be checked in the back of this manual.

The CMG-SAM module writes continuous data to a solid state Silicon File Data Buffer, and archives data from the silicon file to an internal hard disk. Data is stored on disk in Güralp Compressed Format (GCF). GCF uses a difference algorithm to express all data as 32, 16 or 8-bit differences, depending on the dynamic range required for the data block. GCF reduces baud rates and storage capacities compared to non-compressed data formats. The basic SAM system includes the Hitachi H8 16 Mhz microprocessor, 2 UARTs, 4 Mb silicon file data buffer and hard disk data storage (9 Gb SCSI as standard, with optional larger sizes or 2½ inch disc drives).

The output or **Aux** port means the SAM can download to, and is fully configurable through a PC serial port. Depending upon the users telemetry link and using Guralps SCREAM software, the SAM becomes transparent and the user can configure any of the attached instruments remotely.

To obtain the highest available resolution and noise performance from the digitisers particular attention has been paid to the design of power supply and isolation of analogue and digital circuitry (all serial i/o ports are optically isolated).

2. OPERATING INSTRUCTIONS

2.1 POWER SUPPLY

As the start-up current of the SCSI disc can be up to 1.5A, the SAM contains an internal backup battery to buffer the infrequent demand of the disc. This means normal running, demand is less than 200mA, but can be up to 300mA when recharging the internal batteries.

2.2 FRONT PANEL CONNECTORS
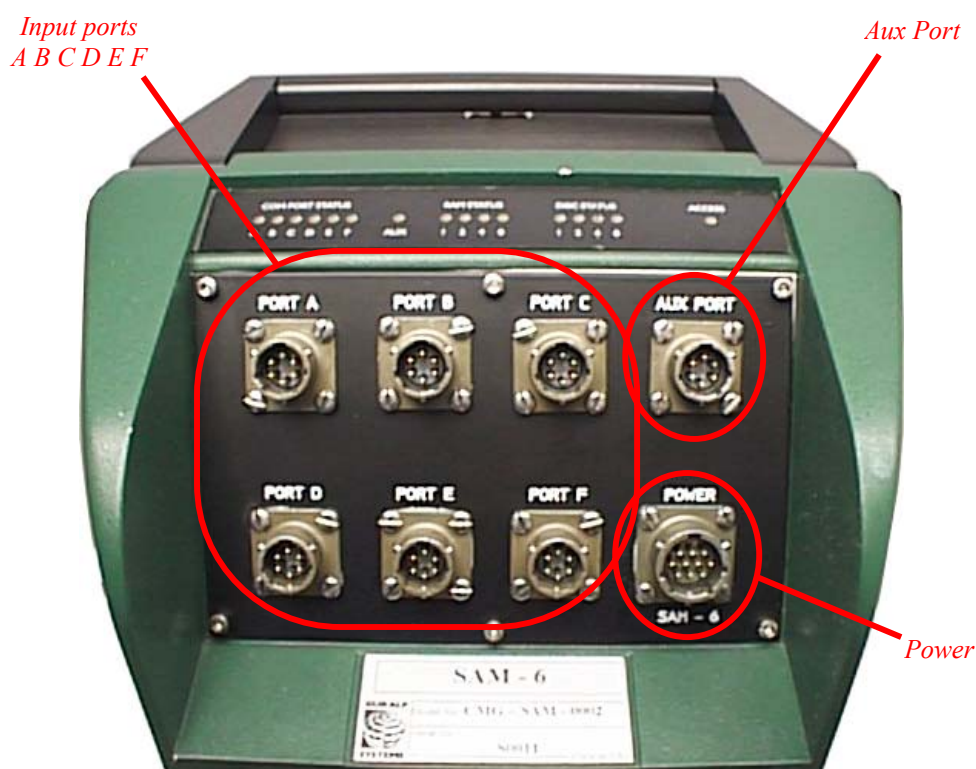
Port A (B, C, D, E, F)
        Input port from sensor digitiser.
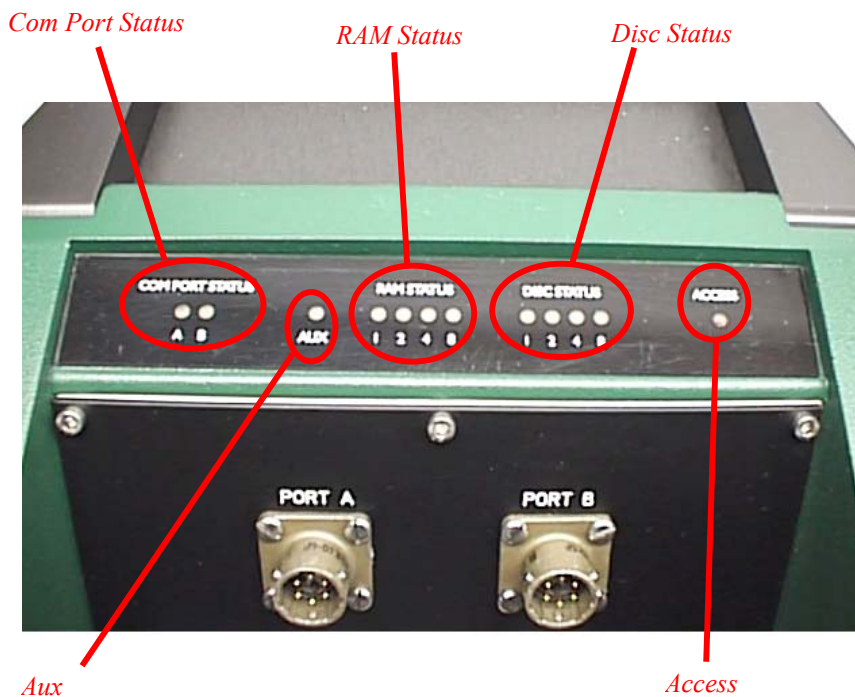
Aux Port
        Output port to PC (direct or via radio/telemetry link).

Power
        12V input power supply to SAM.

NOTE: See the appendix at the back of this manual for the pinouts of each plug.

2.3   FRONT PANEL LED's

Com Port Status

    The data input stream LED's show that the data is arriving to the port. During the period of valid data the LED is continuously lit.

Aux

    This 'bi-colour' LED will turn on green when the system receives the 'ACK' character from the block just transmitted (indicating that the data was received correctly by the PC or SAM); or turn red if the system receives a 'NACK' (Not ACKnowledged) from the last transmitted block.

    This LED is turned off when the DM starts transmission of the next block of data. Thus the time that this lamp is on green gives an indication of the amount of free time available on the link.

RAM Status

    A four element binary "*bargraph*" display is used to indicate the status of the silicon file buffer. Green LED's indicate the smallest binary bits (weight 1, 2, &3) and red is used for the most significant bits (weight 8). For example, 2 green LED's indicate $^3/_{16}$ full and 1 red LED indicates ½ full.

Disc Status

    Another four element binary "*bargraph*" display to show the relative content of the SCSI disc, similar to the RAM Status LED's above. Data are transferred from the silicon file buffer when it is 15/16th full (all LEDs lit) and data transfer stops when it is 1/16th full (1st green LED).

Access

    This lights red when the SCSI disc is being accessed, ie downloading data from the silicon buffer.

2.4 CONFIGURATION

In order for the digital SAM to communicate both in and out, the baud rates of each port must first be set to match the attached equipment. Initially the user will not know what the baud rates for each port of the SAM are set at. It is essential therefore that in order to communicate with the SAM the following procedure is adopted in the correct sequence.
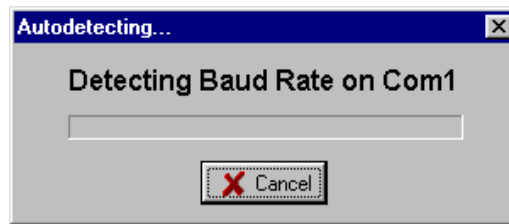
1) Plug the SAM into your PC serial port.
2) Start SCREAM. From the main start-up window (below), right click on **File**, and select **Setup**
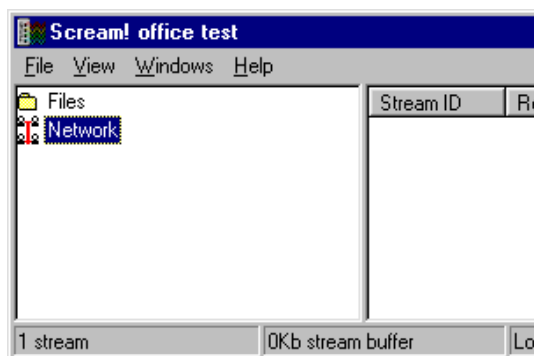
3) In the **Setup** window select the **Com Ports** tab (shown below) and right click on Com1 (or which ever com port you are using on your PC).
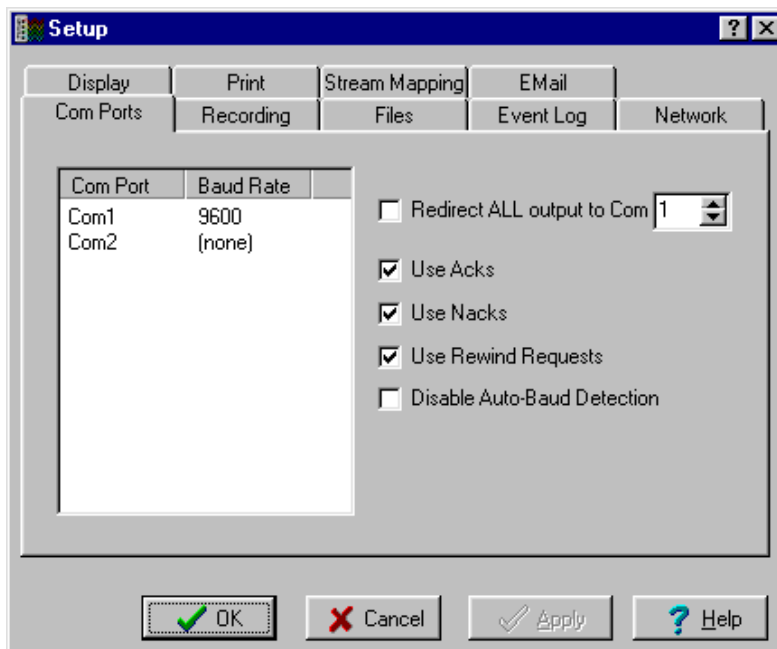
4) From the next pop-up menu select **Auto-Detect** and a further pop-up window, shown below, will appear.

EXPLANATION The SAM at this moment is not powered. When it is plugged in it will send out a 'Status' message. It is this we shall use to detect the output baud rate.

5) Plug the power supply into the SAM and the window will change to that shown below, indicating that it is reading data.
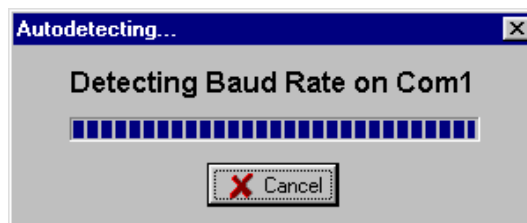
6) The baud rate detected between the SAM and your PC will appear here.

Click OK to return to the start-up window.

7) Depending upon whether the SAM is of the new flash memory type or not, there are different options open from this point.

- If the SAM is the flash memory type there will be a 30 second delay before this initial 'boot-up' when the SAM icon and ID will appear in the start-up window as in 9) below
- If the Sam is an older model then proceed as in 8) below
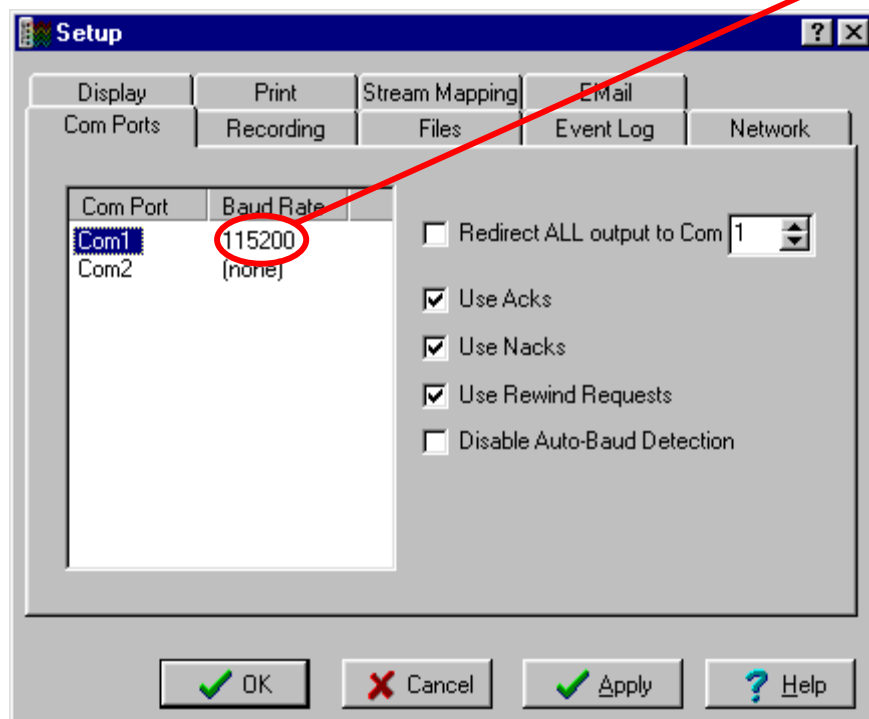
8) The user can now establish a link between PC and SAM. Until the baud rate had been set the SAM will not have received a full data packet and the main window in SCREAM will still look blank as below. Recycle the power supply.
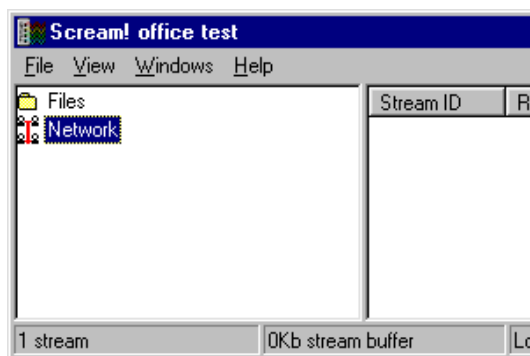
9) SCREAM will detect the SAM and display it as shown below
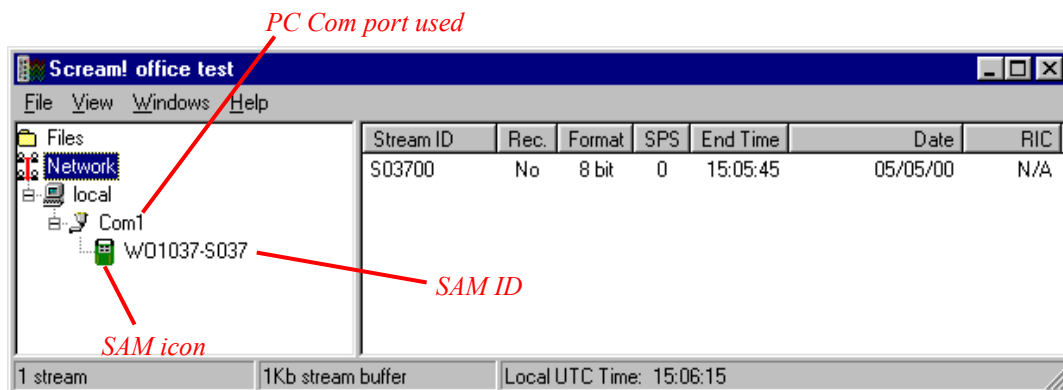
10) Now right click on the SAM icon or SAM ID (see picture above in 9)) and the window shown below will pop up.
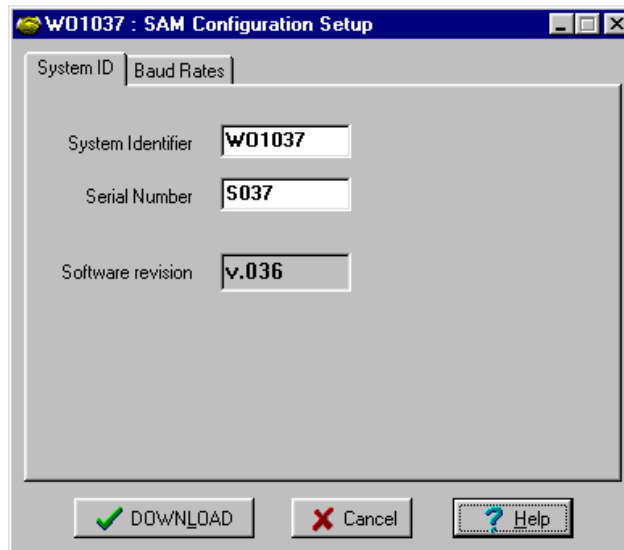
11) Select the **Baud Rate** tab and the following window will be displayed.
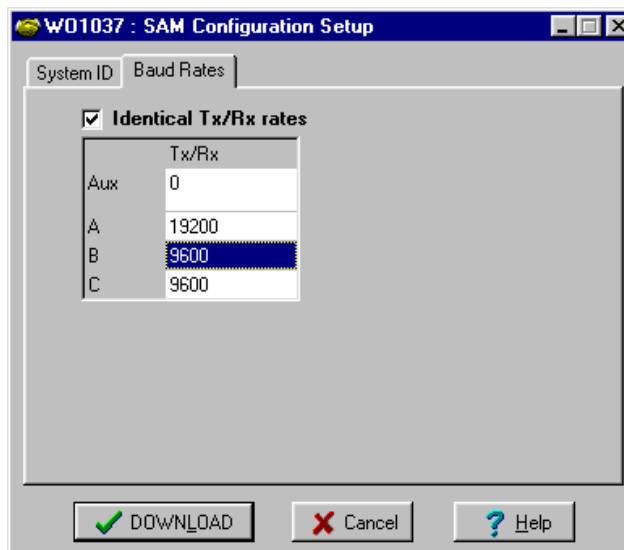
12) Right click on the current baud rate number in the display and a further popup menu will display a list of baud rates available. Select the required baud rate and it will appear in the **Configuration Setup > Baud Rates** window.

PORT CONNECTION CROSS REFERENCE TABLES

FUNCTION	CONNECTOR NAME	SCREAM CONFIGURATION SETUP BAUD RATES	TERMINAL WINDOW SETUP
SAM DIGITAL OUTPUT	AUX	A	PORT 0
SENSOR A DIGITAL INPUT	PORT A	B	PORT 1
SENSOR B DIGITAL INPUT	PORT B	C	PORT 2
SAM POWER SUPPLY	POWER	-	-

NOTE Currently the *Aux* port that is displayed in the SCREAM window in 10) above, is not available to the user. It is an internal facility only.

New Flash Memory SAM

FUNCTION	CONNECTOR NAME	SCREAM CONFIGURATION SETUP BAUD RATES	TERMINAL WINDOW SETUP
SAM OUTPUT & POWER SUPPLY	DATA OUT	A	PORT 0
SENSOR A INPUT	DATA IN PORT A	B	PORT 1
SENSOR B INPUT	DATA IN PORT B	C	PORT 2
GPS	GPS	-	-

NOTE When setting the baud rates, the user will need to consider the input rates of the input channels compared to the output channel, and the transmission rate of the of their data link from the SAM or CRM, that they are compatible with each other and are able to sustain the rate of transmission required.

13) When the user is satisfied that the selected baud rates are correct, click on the **System ID** tab and change the Sam identification, if required, by clicking in the relevant box, deleting and writing in a new ID. The **System Identifier** is restricted to six alpha-numeric digits and the **Serial Number** is restricted to four alpha-numeric digits.

14) Click on the **Download** button. The **Configuration Setup** window will disappear as the SAM reboots and the new SAM ID will appear in the main **Start-up Window**.

2.5 CHANGING S.C.S.I. DISCS

The 4 channel system takes approximately 25 minutes to fill the silicon buffer (8Mb) and then about 10 minutes to transfer the data to disc. The disc should preferably be changed during the period that it is not being accessed to avoid loss of data - if the disc is switched off and removed during the backup time no data is lost as long as there is still space available in the silicon file. When the disc is reinstalled backup will recommence when the silicon file is once again 15/16ths full.

The disc status bargraph indicates disc usage in the same manner. For a 1 Gb disc each 1/16th segment is approximately 64 Mb. Ideally the disc should be replaced when all LEDs are lit, indicating less than 64 Mb of space remaining. When the disc is completely full no more data is written to disc and the silicon file buffer will start to lose the oldest data. This situation is indicated by all 4 of the disc LEDs flashing simultaneously.

Whenever the disc key lock is turned to remove the disc the system indicates this state by alternately flashing the disc status LEDs (1+4 & 2+8). When the disc is reinstalled and the key lock closed the system automatically powers up the disc, indicated by the 'walking' LEDs and the 'access' lamp illuminating, and checks the FAT for the disc identity and space available.

If the disc-ID is different from the system-ID the FAT (File Allocation Table) will be initialised and the disc treated as empty so the disc status will show empty (no LEDS). If the disc-ID matches the system-ID the space used will be shown on the disc bargraph and the system will continue to use this disc until full.

Thus to reuse a disc once the data has been retrieved the first location in the FAT should be erased, or discs can be used in another SAM which would have a non-matching disc/system-ID.

2.6   FLASH MEMORY UPGRADE

For the later models with Flash memory it is possible for the user to upgrade the SAM or CRM software.

Guralp systems have a mailing list to keep Scream users up to date. To subscribe, send an email to listserver@guralp.com with a single line in the body containing "subscribe screamusers" (without the quotes). This will keep the users informed of latest upgrades available.

To find out what the users current software version is, either double click on the SAM icon in the main Start-up window and the **Configuration Setup** window will open up, or right click on the icon and select Configure from the pop-up menu for the same **Configuration Setup** window. The picture below shows "*Software revision v.050*".
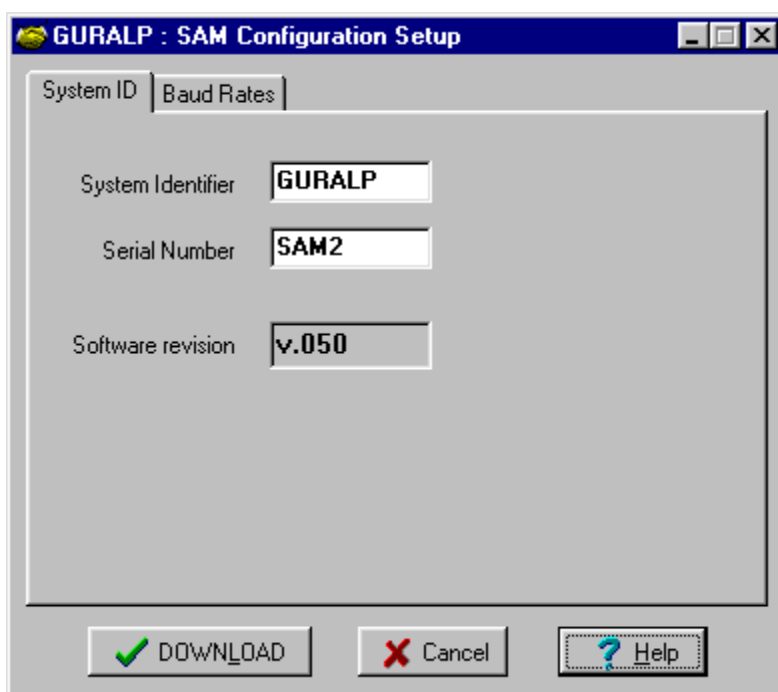
First obtain the latest software, then proceed as the following instructions.

1) In SCREAM's main startup window, right click on the SAM icon and select **Terminal** from the pop-up menu. This will open as shown
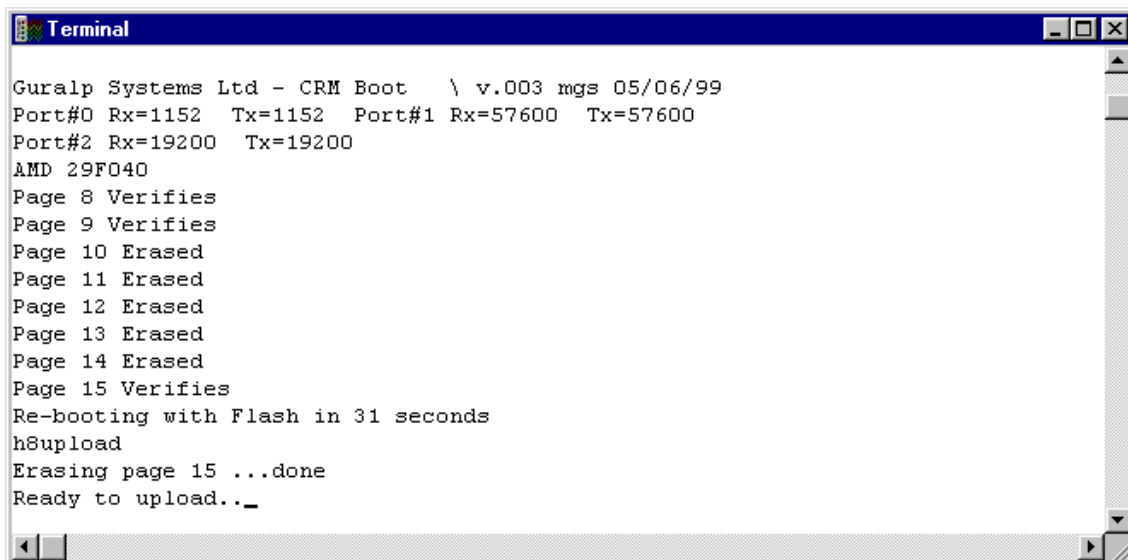
2) If the user presses the **Enter** key "*ok*" will appear on a new line, signifying that there is two-way communication with the SAM.

3) Re-boot the SAM by turning the power off then on again and the initial boot-up information will be displayed similar to that shown in the picture below.

```
Terminal                                                                    _ □ ×
  ok


Guralp Systems Ltd - CRM Boot   \ v.003 mgs 05/06/99
Port#0 Rx=1152   Tx=1152   Port#1 Rx=57600   Tx=57600
Port#2 Rx=19200   Tx=19200
AMD 29F040
Page 8 Verifies
Page 9 Verifies
Page 10 Erased
Page 11 Erased
Page 12 Erased
Page 13 Erased
Page 14 Erased
Page 15 Verifies
Re-booting with Flash in 31 seconds
_
```
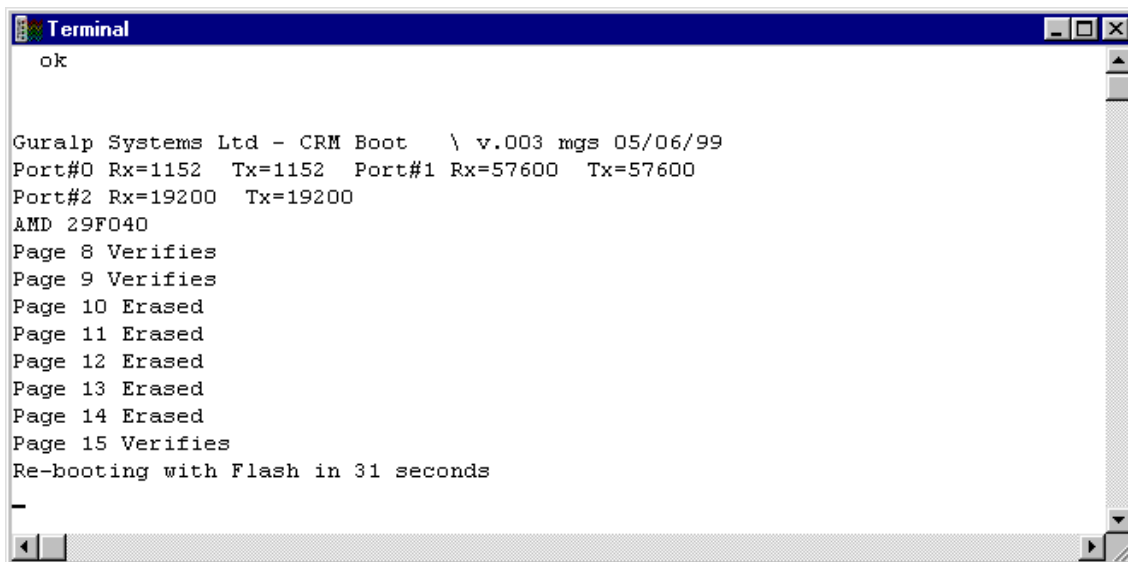
4) In the instance shown above, the user then has 31 seconds to type "*h8upload*" then press enter. After the next message "*Ready to upload*" appears, as shown below, right click anywhere on the terminal window and select **send file** from the pop-up menu.

```
Terminal                                                                    _ □ ×
Guralp Systems Ltd - CRM Boot   \ v.003 mgs 05/06/99
Port#0 Rx=1152   Tx=1152   Port#1 Rx=57600   Tx=57600
Port#2 Rx=19200   Tx=19200
AMD 29F040
Page 8 Verifies
Page 9 Verifies
Page 10 Erased
Page 11 Erased
Page 12 Erased
Page 13 Erased
Page 14 Erased
Page 15 Verifies
Re-booting with Flash in 31 seconds
h8upload
Erasing page 15 ...done
Ready to upload.._
```

5) Through your computers directories find the file to be uploaded and click on it, or type in the full path and file name to display it in the **File name** edit box, then click on the **Open** button.
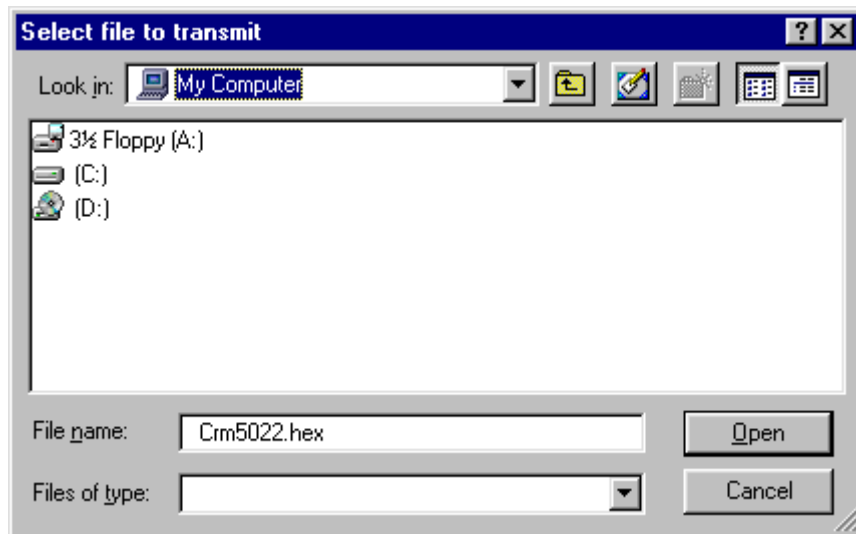
Whilst the file is loading a countdown window as shown below will be on display.
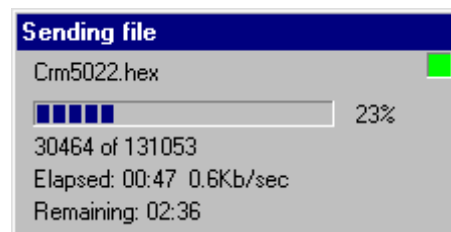
6) Finally, re-boot the SAM by switching off and on, for the new program to install.

3. DIGITAL I/O INTERFACE

The primary digital interface for the systems is the multiple serial port card. Each card can contain 1 or 2 dual UARTs (Universal Asynchronous Receiver Transmitters) and upto 2 cards can be fitted to a SAM/CRM unit. This allows a system with upto 8 serial ports to be configured.

The multiple serial port card is usually configured as several data inputs for a SAM unit allowing it to collect data from upto 8 digitiser units located locally, using RS232 or RS422 links, or more remotely using radio links or telephone modems.

Each of the serial ports on a module can be configured for a wide range of standard baud rates (with different settings available for transmit and receive channels), allowing a wide range of data links to be used depending on the required data rates.

Each dual UART is optically isolated to avoid ground loops which could degrade the performance of the ADC's.

The serial port module includes 32k RAM for data buffering and formatting by the transmission/reception process.

4. MICROPROCESSOR

The system is designed around a low power, high performance 16bit microprocessor (Hitachi H8/500 series). This features a large address space (1Mb - 16 *64k pages) for data storage and manipulation and many integrated functions such as multiple timers and serial i/o ports.

The modular (paged) structure of the processor architecture is used to advantage in the modular design of the system, each module being assigned to a separate 'page'. Each module is associated with an 'I/O' function and can be simply added to the system at an available page. Every module includes 32k of RAM, which is used for data buffering and workspace for the module's software.

An important feature of the system design is its ability to synchronise the sampling of the analogue to digital converter to an external time reference so that data samples are accurately time stamped (at the source). The microprocessor timebase serves as the system time reference and can be synchronised and tuned to an external reference such as GPS to maintain sampling accurately synchronised to UTC. To avoid the cost and power consumption of multiple GPS receivers in larger arrays the systems can also be synchronised to a centrally transmitted time reference using a scheme similar to that employed by the National Radio Time Standards (WWV,MSF and DCF77). As this only involves sending 2 characters per second it can utilise a low bandwidth, even half-duplex link.

To achieve the high degree of timing precision required for a 24 bit digitiser system the microprocessor timebase is run from a precision voltage controlled oscillator which is software controlled from the external reference so that its frequency is accurately set and maintained with temperature and ageing. The control is sufficiently accurate to maintain precision sampling for long periods (several hours) in the absence of an external reference once the system has stabilised.

All the timing functions are derived via the internal timer/counter channels from the precisely set processor frequency so that sampling and time-stamping are accurately maintained with reference to UTC. The system also automatically compensates for the pure time delay introduced by the digital filtering/decimation of the DSP which provides data output at different sample rates simultaneously.

The main microprocessor board incorporates a battery-backed Real-Time Clock and RAM which is used to set the systems internal software clock at start-up independent of the availability of the external time reference. The RAM is used to store system parameters such as the optimum control voltage setting for the system timebase and the system configuration.

The microprocessor module includes the (multi-tasking) system operating software in EPROM on page '0' with space for future expansion onto page 1 with additional ROM and RAM. This module can also support either 128k or 512k of static RAM for system workspace or data buffering depending on the system requirements (number of data channels and sample rates).

The microprocessor serial port provides an interactive interface for system setup and configuration.

5.   DATA STORAGE

4.1 SILICON FILE

The solid state memory provides the SAM and CRM units with a large amount of low-power storage and data buffering so that systems can utilise data transmission links on a time shared basis or where the data link is unreliable providing local storage and re-transmission. It is also used in conjunction with the hard disk storage option to buffer data accesses to the disk allowing the disk to be powered down for extended periods to reduce overall system power consumption.

The module can be configured with from 1 to 8 Mbytes equivalent to 1000 to 8000 data blocks and upto 2 modules can be fitted to one system.

This unit uses low-power dynamic RAM (uPD42644 1Mb*4 Silicon file) accessed as 1k blocks in the processor address space. The processor provides the low frequency 'self-refresh' clock and control timing in conjunction with an FPGA to provide a rapid access, large capacity circular data buffer without moving parts and the associated high power consumption.

4.2 S.C.S.I. DISK

For systems that require long term storage of continuous and event triggered data, the SAM unit features an interchangeable SCSI disk drive (>1 Gbyte). This allows the acquired data to be retrieved simply by removing the disk drive and fitting a replacement unit.

To minimise the system power consumption this module is usually used in conjunction with a large RAM buffer (either system 512k static RAM or silicon file) so that the disk drive can be powered down for long periods while data is accumulated in the buffer. This intermediate buffering also allows the drive to be removed from the system for data retrieval.

This module like all others occupies 1 page of the processor address space and includes 32k of RAM for read/write buffering in addition to the SCSI controller chip (53C94).

The disk filing system and data format have been designed especially for efficient operation in a continuous real-time system. All data are stored in a 1k block with a header which identifies the data stream (1 stream per ADC channel per sample rate) and the time of the first sample (by definition on an integer UTC second). On the disk all data blocks for a particular stream are linked together by disk address, the address on each block pointing to the next block - the current end of data has a null pointer. Disk space is allocated chronologically to the next 'cluster' (8 *1k blocks) of data available. When the end of disk is reached the system can simply wrap round to the beginning of the disk and automatically overwrites the oldest data. The data block format is described in more detail in the next section.

SCSI FILE ALLOCATION TABLE

The system uses the first few blocks (1 block = 2* 512 byte sectors) of the SCSI disc to store the pointers necessary to read and write the data streams. This table consistes of 16 byte fields used as 4 long word records.

The first field contains the 'system-id' (the first block header record - see next section) used to identify the disc, followed by the address (sector number) of the first data on the disc, the address of the end of data (next free sector) and the last address on the disc.

Subsequent fields are allocated to each data stream and start with the 'channel-id' (second field in the block header - see next section), the start address of the stream on disc, the address of the last block of data for this stream and the final record is used for a read access pointer.

Disc/System-id	Start of data	Start of free space	End of disc
1st Stream id	Start of stream	End of stream	Read pointer
2nd Stream id	Start	End	Read
3rd Stream id	Start	End	Read
etc ...			

6. DATA TRANSMISSION PROTOCOL & DATA BLOCK STRUCTURE

The block structure of the SAM/DM data format (which does NOT use BDTS format) lends itself to a simple block transmission/acknowledge protocol for transmission of the data between multiple SAM/DM units and central data acquisition systems.

To send blocks of data from one system to another each block is packaged in a 'transport' layer, which consists of a short block header and a checksum tail. The header consists of 4 bytes. The first is always an ASCII 'G' and the second is an incrementing block number (modulo 256). The other 2 bytes contain the length of the data block (binary, Motorola byte order). The checksum is also a 'word' (16 bit) being the sum of all the **bytes** in the data block **and** the 4 header bytes.

To optimise the use of available transmitter bandwidth the transmitted data block is truncated to the actual data length. As the systems currently only have 24 bit resolution the redundant most significant byte in 32 bit data blocks is also not included in these blocks i.e. 24 bit (3 byte) records are transmitted. This reduction is only applied to the *difference* records - the first and last *absolute* values are still transmitted as 32 bit values.

The transmission header consists of 4 bytes

Fixed identifier	ASCII 'G' (hex 47)
Block sequence number	0 - 255
Block size in bytes (excludes	Most significant byte
header and checksum)	Least significant byte

The digitiser units transmit data as complete blocks become available without any flow control except that provided by a simple positive/negative acknowledge (**ack/nak**).

Acknowledgement of received packets is not necessary as the transmitter only waits for a nominal 100 mSec before moving onto the next block, if ready. To acknowledge correct reception of a block the receiver should reply with an '**ack**' character (here defined as hex 01) and the least significant byte of the block's 'stream-id'. This allows for a system which has a simple broadcast acknowledgement via a common link (radio band) to many systems that are part of an array, each system is able to identify its own **ack/nak** by matching the identifier byte. Reception of a positive acknowledgement will enable the transmitter to terminate its wait timer and immediately proceed to the next block.

When the receiver detects a transmission error it should reply with a '**nak**' (here defined as hex 02) and the identifier byte. This will cause the transmitter to re-send the block of data.

DATA BLOCK STRUCTURE

Block Header

All elements of the GCF data block can be considered as long words (4 bytes or 32 bits).

The GCF block header consists of 4 elements (16 bytes) as shown

System-ID	32 bit number (base 36) - see below	
Stream-ID	32 bit number (base 36) - see below	
Date/Time	15 bit Day number	17 bit Second number
Format	R.F.U. s/sec	compression block size

The first element contains the unique identifier for the system from which the data came. This is usually a six character string encoded in base 36 i.e. each character can be extracted by taking the number modulo 36 and converting to the characters 0 - 9 and A - Z. Only positive integers are allowed (most significant bit=0) limiting the range of values to 0 - 7FFF,FFFF in hex (2,147,483,654 decimal) or ZIK0ZJ in base 36. This field can be set to any convenient unique identification number by the user, but units are shipped from the factory with this set to the factory Works Order number e.g. WO1234.

The second element identifies the stream of data i.e. source as horizontal or vertical sensor and its origin from the digitiser. This again uses base 36 encoding, but this field should not be changed as it is dynamically set according to the configuration of the digitiser.

This is best viewed in its base 36 form i.e. as 6 alphanumerics. The 4 most significant characters are the instrument serial number (decimal) and the 2 least significant characters encode the sensor component and digitiser output.

Stream-ID	digit 4 digit 3 digit 2 digit 1	Z,N or E	see text
	serial number	comp	source

The Guralp DM24 digitisers can output upto 4 data rates per component simultaneously.

The third header element contains the date/time information as a 15 bit day number packed with a 17 bit second number. The second number is the time since midnight - maximum 86,399 normally but possibly 86,400 in the case of a 'leap second'. The day number increments on the roll-over of the seconds count at midnight. The origin of the day number (day zero) was 17th November 1989. Thus the date/time can be uniquely decoded for the next 80 years.

The final header element defines the format of the data in the block, i.e. compression, sample rate, size etc.

The most significant (first) byte is currently unused and is set to zero.

The next byte contains the sample rate (s/sec in binary). If this field is zero this indicates that the block contains status (text) information.

The third byte is used to specify the compression format for all the data in the block. The 3 least significant bits are used to indicate whether the data elements (32 bits) contain 1, 2 or 4 sample points - i.e. a value 4 indicates that the data records should be treated as 4 8 bit differences, a value 2 means the data are 2 16 bit differences and the value 1 the data are a single 32 bit difference.

The fourth byte contains the count of the number of data records (32 bits).
The product of these last 2 bytes can be used to calculate the total number of sample points in the block.

Block Data.

First absolute value	32 bits
First 1, 2 or 4 differences	1*32bit, 2*16bit or 4*8bit values
	....
	....
Final 1, 2 or 4 differences	same format 1, 2 or 4 differences
Final absolute value	32 bits

The first data record in the block, following this format record, is the initial 32 bit absolute value (forward integration constant). The last record is the final 32 bit absolute value (reverse integration constant). Between these are the specified number of data records. Each data record contains the specified number of 8, 16 or 32 bit differences from the previous value. The first difference is always zero as it corresponds to the first sample.

By definition each data block starts on an integral second and contains an integral number of seconds of data. The data block has a *maximum* size of 1024 bytes (16 byte header + 8 bytes for start and end value leaves 1000 bytes for data differences e.g. at 8 bit compression the block will contain 1000 sample points i.e. 10 seconds of data at 100 s/s - using minimum compression (32 bit) only 2 complete seconds of data can be fitted in a block at this sample rate - 2*100*4 = 800 bytes). Changes in signal level will result in the compression algorithm having to change the format so blocks are not necessarily filled to the maximum specified capacity, when the next second of data requires more dynamic range.

The data has this format when processed and stored in the DM and SAM units (maintaining data values on word boundaries in the processor), but when data blocks are transmitted via the serial ports, blocks of 32 bit differences have the redundant most significant byte (of the difference values) omitted to optimise the efficiency of the serial transmission.

7. SAM User Commands

Commands are NOT case sensitive.

Not all versions of SAM support all the features listed in this table.

Command	Description	Reboot*
HELP	Displays firmware version number, release date and command list	N
SET-ID	Interactive command. Follow prompts to set System and Stream IDs.	Y
SET-CLOCK	Interactive command to set the time in the SAM unit. This time is only used for time-stamping of SAM-generated status messages.	Y
p n BAUD	Sets port 'p' to baud rate 'n' for Tx and Rx. For 115200 baud, use n=1152. p = 0 for 'Data-Out' or 'Aux' connector on front panel p = 1 for Port A p = 2 for Port B etc.	Y
p n RX-BAUD	Sets the Rx baud rate independently of the Tx baud rate. Should only be used when connecting to devices that support asymmetric baud rates on a serial port.	Y
p n TX-BAUD	Sets the Tx baud rate independently of the Rx baud rate. Should only be used when connecting to devices that support asymmetric baud rates on a serial port.	Y
p SYNC-ON	Enables transmission of stream-sync signal on port 'p'. See 'BAUD' command for port mapping. p >= 1	Y
p SYNC-OFF	Disables transmission of stream-sync signal on port 'p'. See 'BAUD' command for port mapping. p >= 1	Y
p DUPLEX	Sets port 'p' for normal duplex operation p >= 1	Y
p SIMPLEX	Switches off transmission on port 'p' if a BROADCAST port is specified (output is re-directed to BROADCAST port). p >= 1	Y
p BROADCAST	Selects port 'p' for all transmissions (used in conjunction with SIMPLEX command). Set p=0 to disable broadcast mode.	Y
n GPS-TYPE	Sets type of synchronisation source to be used. n = 0 no time signal n = 2 Garmin n = 3 stream-sync Not all versions support all combinations	Y
n HR-CYCLE	Specifies period in hours between power-on of GPS. n=0 disables power-cycling of GPS (runs continuously). When n>0, GPS will automatically be switched off when clock synchronization is within a small tolerance.	N
RE-BOOT	The command prompts the operator to confirm this operation with 'y'. The system will then automatically reset after a delay of about 2 s.	-
SET-RTC	Sets the Real Time Clock. Only used for Status timestamping.	Y

	Use only if SET-CLOCK command is not recognised. Usage: HEX yyyy mm dd hh mm ss 0 SET-RTC	
n MB-FILE	Sets the amount of silicon file to use for transfers to the disk, 'n' in Megabytes	Y
RECYCLE	Sets the disk mode to overwrite the oldest data (circular store)	N
USE-ONCE	Sets the disk mode to non-circular mode (stops recording when the disk is full)	N
RESET-DISK *or* RESET-DISC	Resets the SCSI and marks as blank. The contents will be wiped from the disk on next write.	N
DIR	Lists the contents of the disk, including start and end dates and times.	N
FLUSH	Forces the contents of the Silicon File to be transferred to disk. Useful to clear out memory prior to disk removal or unit power-down	N
OPEN i s	Open a pass-thru link to the instrument with System ID 'i' and serial number 's'.	N
STREAMS?	Lists all streams detected by the SAM, displaying the serial number (and tap information), System ID, and port the stream is received on. Normally used in conjunction with OPEN command.	N
GO *or* CLOSE	Leave command mode and resume transmission of data blocks	N

* Some commands require a re-boot of the SAM in order for the changes to take effect. Note that if several settings are changed, it is not necessary to re-boot after each change – only one re-boot is necessary after all required changes have been made.

8. CONNECTOR PINOUTS

INPUT PORTS

(A & B on SAM 2)
(A, B, C, & D on SAM 4)
(A, B, C, D, E, & F on SAM 6)

FUNCTION	CONNECTOR KPT 06F-10-6S
Data Tx	A
Data Rx	B
Ground	F

AUX PORT
(OUTPUT)

FUNCTION	CONNECTOR KPT 06F-10-6S
Terminal Tx (Transmit to terminal)	A
Terminal Rx (Receive from terminal)	B
Data Rx	C
Data Tx	D
Ground	F

POWER

FUNCTION	CONNECTOR KPT 06F-12-10S
0 V	A
+12 V dc	B

FLASH MEMORY S.A.M
CONNECTOR PINOUTS

DATA IN

(Ports A & B on SAM 2)

FUNCTION	CONNECTOR KPT 06F-10-6S
Data Tx	A
Data Rx	B
CTS out	C
0 Vout	E
Signal Ground	F
RTS out, or, +V out	D
(manufactured option)	

DATA OUT

FUNCTION	CONNECTOR KPT 06F-10-6S
0 Vin	A
+ Vin	B
CTS Out	C
RTS Out	D
Signal Ground	G
Data Rx	J
Data Tx	K

GPS PORT

FUNCTION	CONNECTOR 02E-12-10P
0V Supply to GPS	A
+V Supply to GPS from SAM	B
1Hz Reference, RS232 Level Isolated	C
Terminal Tx (Transmit to terminal)	E
Terminal Rx (Receive from terminal)	F
Isolated GROUND	G
GROUND	H
COM2 Tx (Transmit to GPS)	J
COM2 Rx (Receive from GPS)	K