

Airborne Telemetry

ATS S6200 Telemetry Processing System Telemetry Products

FEATURES

- Versatile and Flexible Architecture
- Data Flow Architecture
- Dual Bus Architecture
 - VME64X Backplane for Setup, Control and Archive Data Output
 - Internal High-Speed Broadcast Bus (HSB) for real-time data movement between application modules
- Data Distribution via Reflective Memory
- TCP/IP Network Capability
- Real-Time Data Processor
 - Over 50 standard algorithms including Number Conversions, Data Compression, EU Conversions and
 - Supports Custom User developed Functions
- Parameter Time Tagging to 1 microsecond
- Input Types: PCM, 1553, Analog and Time
- Outputs: Analog, Discrettes, Archive and Reflective Memory Network



OVERVIEW

The Model ATS S6200 System is a flexible, high-performance telemetry data acquisition and processing system engineered to meet the demands of modern, high-rate, realtime applications. The system includes all of the components needed for recovering, processing, displaying and distributing data from multiple sources into multiple users. The ATS S6200 is composed of a Telemetry Front End Processor (TFE) and one or more external UNIX workstations.

APPLICATIONS

- Missile, Satellite Data Downlinks
- Aircraft Flight Test Data Streams
- Front-End Telemetry Data Processing
- Range Telemetry
- Simulation & Special Test Equipment
- Telemetry Ground Terminal



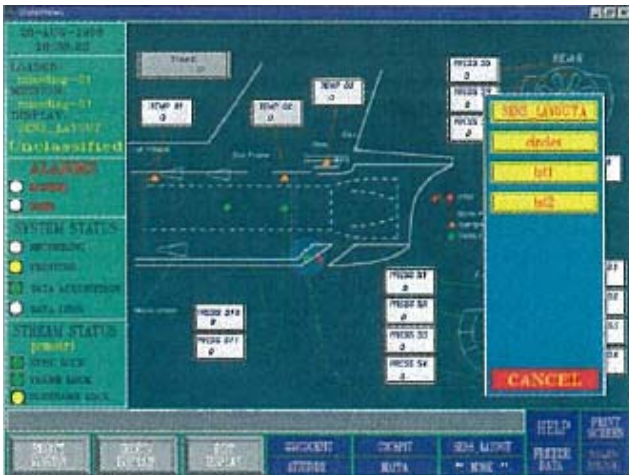
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ATS S6200 INTRODUCTION

The ATS S6200 features high-performance PCI based UNIX workstation(s) that are connected via a high-speed reflective memory network. Up to 255 workstations can be networked to the TFE to access the realtime telemetry data that has been generated. Each workstation can also be used as a network server, allowing up to 32 personal computers each to access to the telemetry data via traditional Ethernet.

The ATS S6200 TFE incorporates a dual bus architecture within a single VME chassis, which enhances the performance of the data acquisition hardware by providing a separate dedicated dataflow path for raw measurement data and a separate output path for processed, realtime output data products. Besides the reflective memory output interface, the TFE also provides local archiving via the integration of high-speed, high-density UltraSCSI disks.



The ATS S6200 setup and display software runs on a variety of UNIX workstations, and integrates an SQL relational database, a graphics library for realtime data display and a graphical screen editor to provide all of the necessary functions to process telemetry data. A number of additional tools, such as APIs and shared files, are also supplied to allow user developed applications (using 3rd party products like MATLAB) to obtain realtime data from the S6200.

The TFE provides one or more TDP telemetry data processor modules that implement Analog Device's SHARC family of DSP processors, which is supplied with a standard set of software

that provides the traditional set of telemetry processing functions. Both the TDP and the ATS software fully support the ability for the user to create custom algorithms that perform functions that are unique to the user's application.

This compact system can act as a stand-alone telemetry data acquisition unit whose output transfers the data to host computer devices or color graphics workstations for further data processing and display. The modular VME design allows for simplified field expansion capabilities and quick replacement of line replaceable units (LRUs).

CONTROL AND VERIFICATION

The ATS S6200 software package supplies a variety of capabilities that ensure the proper functionality of the system and its various hardware components.

- ❑ A Setup Compiler that validates user specified format information
- ❑ Verification of Mission Setup Information
- ❑ Status Monitoring
- ❑ System Diagnostics that can detect a failed module
- ❑ Board Level Diagnostics that can pin-point a failed functional block

TFE CONTROLLER: MVME5500™ POWERPC SBC

The Motorola MVME5500™ is the latest flagship of the Motorola VME product line, enabling higher levels of performance in a single VMEbus slot. Combined with the Wind River VxWorks™ Real-Time Operating System (RTOS) and L3-TE application code, this module has the role of S6200 system controller, responsible for all communication with the host(s) and control of the local hardware components.

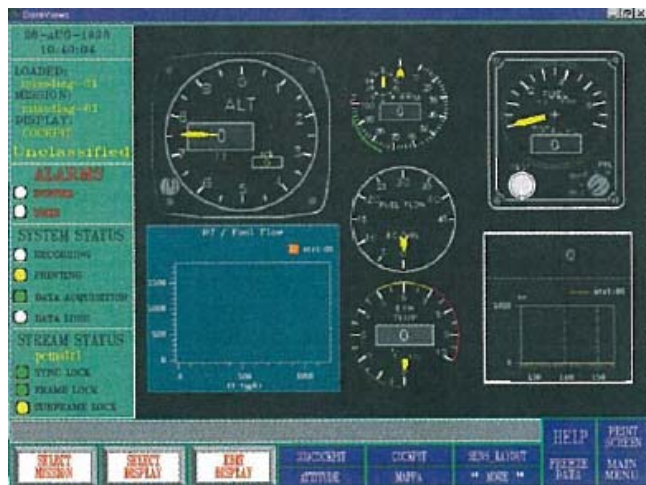
The MVME5500 utilizes the MPC7455 processor running at 1 GHz, which is ideal for data intensive applications. The powerful Marvell system controller, with support for a 133 MHz host bus and a 133 MHz SDRAM memory bus, is well matched to the high-speed processor. To match the system I/O to the outstanding processor performance, the MVME5500 provides dual 64-bit, 33/66 MHz PCI buses.

The MVME5500 module incorporates a Gigabit (GigE) Ethernet interface, which provides the communication path to the external workstations. It also includes an UltraSCSI daughtercard that is used to control the local archive disk, which is typically a high density, high-performance, single disk.

As part of its function suite, the MVME5500 also provides a serial interface that allows local control via the Modular Debugging Tool (MDT) interface, which includes direct access to the hardware and provides the interface for TFE system diagnostics.

DATA DISPLAY

The ATS S6200 software package supplies a full GUI to support the setup and control of the data acquisition hardware. The graphics functionality is supplied by the 3rd party DataViews software package, which includes a graphical editor. This editor allows the user to develop custom displays using any combination of internal objects, as well as importing from external industry standard graphics files such as TIFF, GIF and JPEG.



DATA ACQUISITION

The S6200 TFE is a fully integrated, high-performance, dataflow data acquisition system that is comprised of L3-TE and COTS hardware products. The S6200 implements a dual bus structure that allows data to be moved between L3-TE telemetry application modules without any interaction with the VME system controller.

The high-speed HSB bus operates at a maximum throughput rate of 6 Msps, where each sample consists of an 18-bit identifier (ID Tag), 14-bit fine time tag and 32 bits of data. The data can represent any of the measurement types supported by the TFE, including raw telemetry data, time, status, processed data, 1553 or analog data.

S6200 TFE INPUTS

The S6200 TFE supports a variety of inputs.

- PCM: For the traditional telemetry input, L3-TE can provide a 10 Mbps or 20 Mbps Bit Sync and the DCM602 Frame Sync and Decommulator.
 - All of L3-TE's bit synchronizer are fully IRIG compliant and perform to 1 dB over theory. The module accepts the user provided base-band input and provides data and 0° clock for the DCM602 module.
 - The DCM602 module performs format synchronization of a serial input stream at rates up to 20 Mbps. One DCM602 module supports synchronization and decommutation of a minor frame and one subframe. Multiple DCM602 modules can be daisy-chained to support multiple independent subframes, sub-subframes or asynchronously embedded formats. All data measurements generated by the DCM602 are individually time stamped with a fine time value that has a resolution of one microsecond.

- Time: The L3-TE TCP602 Time Code Processor provides timing data to the S6200 input modules to support the measurement time stamp functions. The module can provide time based upon either an internal clock, or it can synchronize to an industry standard IRIG-A, B or G input.
- 1553 and Analog: Non-PCM inputs are handled by the integration of COTS PCI Mezzanine Cards (PMC) on the AVME601 intelligent PMC carrier module. In this configuration, the AVME601's DSP monitors and collects inputs from the PMC modules and performs the required parameter identification tasks. The AVME601 receives timing data from the TCP602 to allow the module to perform the system-required time stamping functions.
- Data Compression Functions: Pass In, Pass Out, Pass Nth, Pass Bit(s) Match or Not Match, Pass Out of Floating Limits (ZFN), Pass In Floating Limits, Threshold
- Chaining & Output:
 - Serial: The output of any algorithm can be output as new parameter and/or routed to another algorithm for additional processing.
 - Parallel: The current value of the sample can be output and/or routed to any number of serial chains. This can be done using the full original input value (Distribute) or from a number of 1-32 bit fields (Split Word) extracted from the sample

TELEMETRY DATA PROCESSING

The S6200 TFE can be supplied with a large number of TDP601 telemetry data processors to perform any and all real-time processing that a user may have. In the S6200 TFE dataflow architecture, all samples of the specified measurements are processed as they occur.

The TDP module incorporates the Analog Devices DSP, and is supplied with a large number of basic processing functions that can be augmented by user developed algorithms. The DSP uses straight binary (Unsigned Magnitude), 40-Bit IEEE, and two's complement for all internal operations. [While the system data size is 32 bits, all internal floating-point functions are performed using an extended version to obtain the highest precision result].

- Number System Conversions: Straight Binary, IEEE Floating Point, DEC Floating Point, One's Complement, Two's Complement, MIL-STD-1750A Floating Point, BCD
- EU Processing: Table Lookup, Polynomial (max order: 15th)
- Math Functions: Standard Arithmetic, Trig, Exponentiation, Logarithmic, Square Root
- Logical Boolean Operations
- Derived Processing: The TDP601 fully supports the ability of using multiple measurements to perform derived algorithms. In this situation, one of the parameters is designated as the trigger that will initiate execution of the algorithm; during the algorithm, the latest samples of one or more measurements are obtained via memory references.
- Custom Functions: The user has the ability to develop C algorithms and integrate them with the standard algorithm set. In this process, the user code is downloaded into the DSP's instruction memory, from which it can be referenced in the same manner as the standard algorithms. This means that a user algorithm can be chained with other algorithms and/or create any number of new processed measurements. Parameters that a user may specify in the definition of a custom algorithm include: input (measurements), outputs, constants, storage and data tables.
- Embedded 1553 (Chapter 8) Format Processing: The TDP is supplied with the capability to process Chapter 8 1553 data. In this configuration, the DCM602 module treats all of the data as super-commutated measurements, which are then routed to the TDP601, which then identifies and processes each unique word using a combination of the message (defined by command word), the bus and the Chapter 8 type field.

The ATS S6200 Compiler performs all of the work necessary to manage the resources of the TDP, eliminating the need for the user to know anything about the internal operations of the module. L3-TE provides the necessary functions to perform I/O to get data into and out of the user functions.

DATA DISTRIBUTION & OUTPUTS

The ATS S6200 system supplies multiple levels of data distribution. Data distribution includes both the functionality to move data between the TFE and the external workstations, and to further move data to remote PC based users.

TFE Outputs – Archive & Reflective Memory

The AVME601 intelligent carrier module can be configured for a number of required system I/O functions, including the role as the VME-HSB gateway and separately as a carrier for 3rd party I/O modules.

As the gateway between the two buses, the AVME601 provides the following:

- Collects data and creates specific products for archiving or reflective memory network output.
 - Archiving of selected parameters, which can be any combination of raw (PCM, 1553, Analog), processed, status and time is performed by a combination of the module's buffer building capability and the use of the VME system controller's SCSI I/O module. Data that has been archived can be recalled or accessed in different methods, including playback or via FTP.
 - The AVME601 houses the required COTS PMC module to support the reflective memory network output. The reflective memory output consists of two specific items:
 - Current Value Table (CVT). For this output, the AVME601 outputs periodic samples for all measurements, where the target

address for a sample is based on the ID Tag of each measurement.

- Time History Buffer (THB). For this output type, all samples of selected measurements are routed to a THB to support higher-level display and analysis functions. The AVME601 generates a network interrupt on buffer full or timeout conditions that the host(s) can use to collect and process a new data set.

The data that is output onto the reflective memory is accessible by any workstation or PC that is on the network. Access to CVT table is simply done by mapping to the memory; for accessing the THB data, L3-TE supplies an API to support the selection of the required parameters and retrieval of data.

- Provides a Data Injection path, which is used for two purposes:
 - Allows the user to enter Kneepad data (user triggers, entry of specific test set initial values such as initial fuel weight).
 - Playing data from the local archive back into the system. The playback function includes both raw and processed measurements.

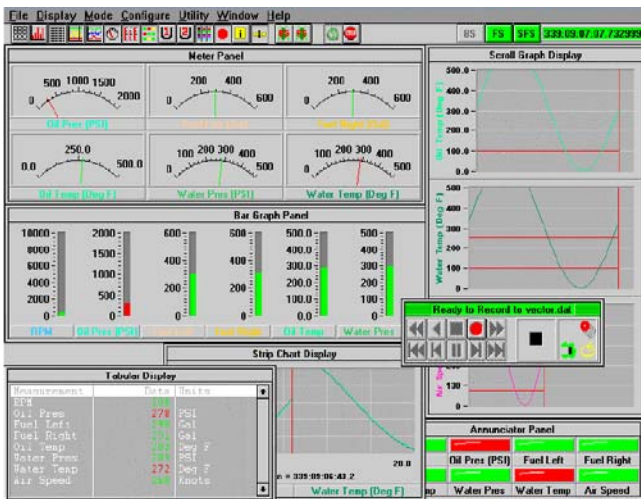
Workstation Network Outputs

The Reflective Memory network is used to move data from the TFE to any number of workstations that are normally in the same area of the ground station facility.

There are a number of other scenarios in which remote users need to obtain data from the vehicle under test. To support this requirement, the ATS S6200 software provides the mechanisms to collect data from the THB and transmit the data sets to a remote computer.

The communications between the networked components (UNIX workstation, remote computers and TFE) are implemented using a TCP/IP client/server approach, with a well-defined application protocol defined within the L3-TE Data Distribution Network (DDN) Interface Control Document. Each message consists of a message header at a minimum. If required, additional data is appended to the message header. The message header and any appended data conform to a Common Message Format (CMF), which is detailed within the ICD.

The L3-TE DAP (Data Analysis) program provides the user with an off-the-shelf PC based application that can obtain and display data using a fixed number of graphical objects.



The DDN is an open transport, allowing sophisticated customers to develop their own custom display and processing applications, such as obtaining data to directly insert into MATLAB. L3-TE supports the user by providing an API and examples on how to access configuration and real-time data from the DDN.

SIMULATION

The SIM601 module is a full function PCM simulator module. The module integrates a high-performance ADSP21060 processor that allows it to be configured to handle a wide variety of simulation functions.

The SIM601 generates an IRIG Chapter 4 serial data stream of variable length words, at a rate of 1 bps to 30 Mbps and supports all the standard IRIG PCM output codes. The module can support all the different telemetry formats including Frame, Subframe (ID, Recycle, Asynchronous, and Sub-Sub), Alternating Frame Sync (AFS), and Complementing Frame Sync (CFS).

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