

Spacelink^{NGT} SE985 TM/TC Processor Card

Since the introduction of its first Telemetry & Telecommand (TM/TC) system in 1986, Satellite Services B.V. has steadily expanded the range of its products, capabilities and performance. The new range of products called "SpaceLink^{NGT}" builds on the experience gained over the past twenty years. The SpaceLink^{NGT} product line consists of a number of building blocks, each based on common and proven hardware and software elements. The SpaceLink^{NGT} product range features a high degree of hardware component integration, scalability and proven software.

The SE985 forms the single-board heart of a baseband processing system with its capability to handle a variety of simultaneous up- and downlink streams at varying rates. The SpaceLink^{NGT} SE985 board can be configured for multiple purposes including TM Acquisition, TM Simulation, TC Reception and TC generation. All four purposes are possible in parallel and in real-time (depending on speed).

The SpaceLink^{NGT} SE985 board is purpose built for a wide range of speed applications (up to 150Mbps real-time). The PCI based card uses the latest technology in integrated programmable logic that allows true "System-On-A-Programmable-Chip" (SOPC) solutions. The unique re-configurable architecture of the SE985 card means that it can be easily re-configured to handle many types of coding standards and industry standards, such as CCSDS/ESA TM/TC.

The telemetry decommutation chain supports selectable Viterbi decoding/Correction, Frame Synchronisation or Turbo Coded Frame Acquisition, RAW data dump mode, selectable Pseudo-randomizer and Reed-Solomon decoding/correction.

In parallel with TM decommutation, the SE985 board can also serialise TC (CLTU's) with selectable convolutional encoding, decode serial TC (CLTUs) and pass them on to the host for further processing. CLCW feedback can also be done directly on the board.

The SE985 board can also build and generate simulated transfer frames/Channel Access Data Units (CADU's), either from host provided data or locally using pre-defined data. Again, this is all in parallel with TM decommutation. The simulator can overlay a sync pattern, VCFC and MCFC counters before passing it on for FECW and CLCW calculation/insertion, Reed-Solomon encoding, randomisation and convolutional coding. If required, this can result in complete CADU's. Each section of the encoding sequence can be switched in or out as required.

Selectable monitoring points allow signals and events to be monitored, while a remote LED status port enables status indicators to be driven. The SE985 board also has several feature connectors that allow piggyback cards to be connected to the board. These allow the use of other functions, such as BPSK/QPSK modulation/demodulation and customer specific interfaces.

The SE985 module is available in different (programming) variants which can support many different system deployments and processing speeds. In conjunction with the Spacelink^{NGT} IF transceiver or High-Rate demodulator, a complete ground station up/downlink chain can be implemented.



Features

- CCSDS/ESA standard TM/TC baseband processing card. Supports multiple stream processing including TM Acquisition, TM Simulation, TC Reception and TC generation. All four options being possible in parallel and independently. For High speed TM processing modes, supports I/Q combined as well as separate I & Q processing and simulation.

Input/output

- 16 selectable inputs/outputs using RS-422 or LVDS (ECL possible using optional board)
- Coding/Decoding options include NRZ-L, -M & -S, SPL and square wave BPSK modulation (QPSK and sine wave modulator available as separate and optional module)
- I/O expansion to 21 inputs and 21 outputs possible

Coding Schemes

- Reed-Solomon encoding/correction (IL 1-8) (255,223) E=16
- NRZ-M and Pseudo-randomization available
- Convolutional encoding & decoding (rate 1/2, K=7) (other schemes possible)
- Selectable FECW encoding and checking
- QPSK differential encoder/decoder (option)
- CCSDS Turbo coding (excl. correction)
- Future support for CCSDS punctured codes
- Future support for Reed-Solomon (225,239) E=8 correction

Telemetry Decommutation & Simulation

- Adaptive frame synchronizer
- Time stamping
- Programmable correlator up to 64 bits (Concatenated coding) and 256 bits (Turbo coding) wide
- Synchronisation before and after convolutional decoding
- Run-time configurable frame parameters
- Product Confidence Data (PCD) tagging at frame level
- Sustained bit rates from 1bps to 250 Mbps (in selected High-Speed configurations)
- Non-Standard Frame Lengths possible
- Randomization (enable/disable)
- Customer specific Ciphering / deciphering possible
- Full frame simulation (hardware+s/w)
- On card programmable idle frame/ content generator
- Physical (coded/uncoded) bit stream outputs
- Hardware sync marker & ID counter
- Programmable clock and data polarity

Telecommand Encoding/Decoding

- Serialisation of ESA/CCSDS standard CLTU's settable PLOP and CMM modes (TC encoder)
- Synchronisation & decoding of CLTU's from incoming bit stream (TC decoder)
- Supports multiple CLCW's
- Full Packet TC encoder/decoder through TM/TC CMS software

Time Maintenance

- Simulated OBT in CUC format (better than 1µs)
- External clock reference (better than 1µs accuracy)
- Optional on-board IRIG-B (10 kHz) interface

Processing

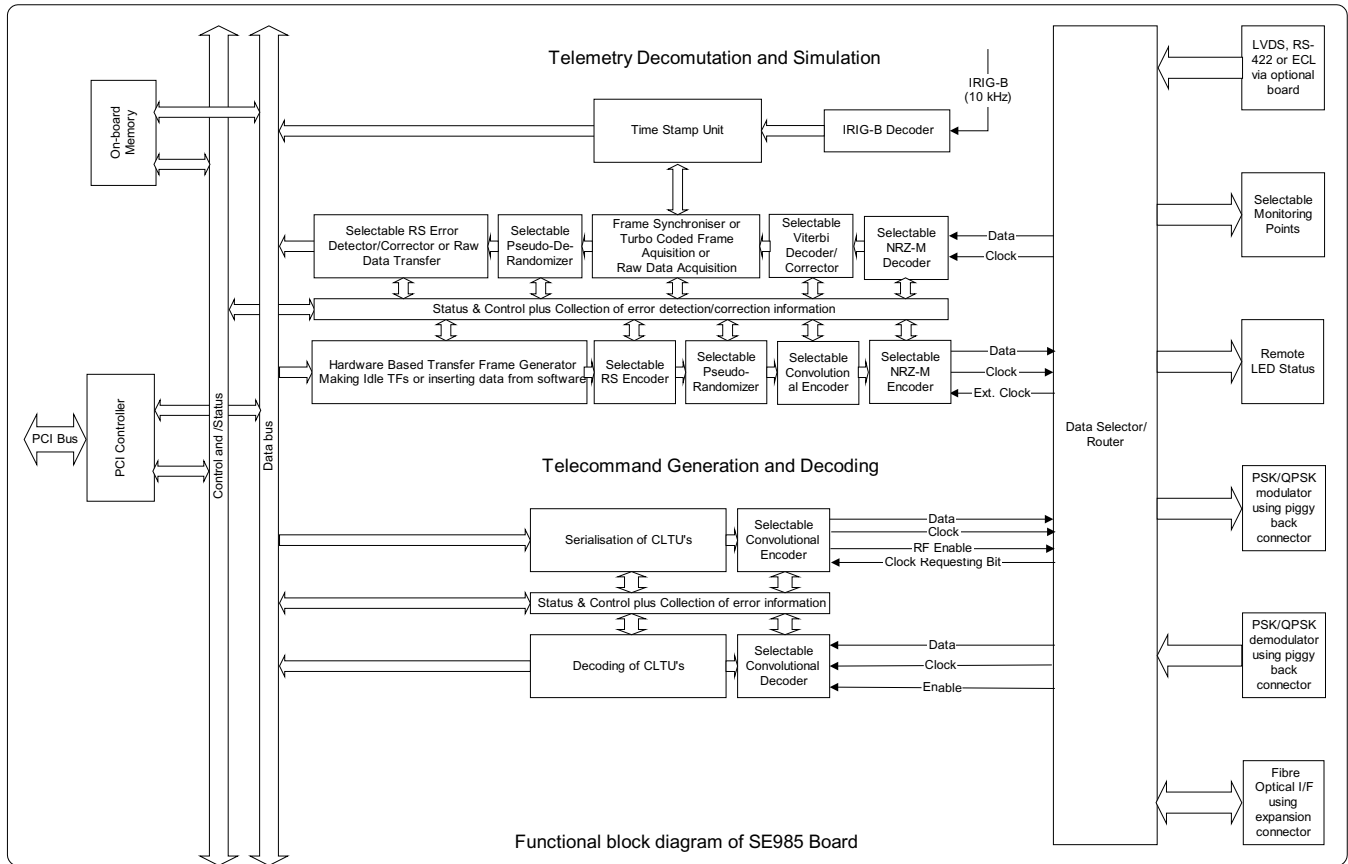
- Compliant to ESA and CCSDS standards
- PCM and non ESA/CCSDS standard formats possible

Control/Monitor Interfaces

- High performance PCI 2.1 bus interface with bus master DMA)
- Standard software available for remote interfacing 6 inputs/outputs for discrete interfacing or software selectable monitoring points
- 3-wire interface to remote LED status panel (up to 70 LED's)

This card is normally used with the SSBV TM/TC-CMS software to create an operational TM/TC baseband processing system.

Note that system deployments can make use of one or more of the above features and be tailored for performance and I/O



Functional block diagram of SE985 Board

The SE985 is usually deployed as part of an integrated and turn-key system, implemented as a highly compact 2U / 19" unit. (incl. PC, CMS software and physical/ LAN interfaces). This also includes LED front-panel monitoring and software selectable monitoring points.

Application Areas

- Ground Segment baseband processing
- Spacecraft / Payload AIT
- Portable Simulation Systems
- Launch Site verification
- CCS Validation



Experience

For over 20 years, Satellite Services B.V. has been designing and producing TM/TC base-band equipment. The products have been used on over 20 different spacecraft programmes. The demonstrable experience within Satellite Services B.V. covers both the PCM and CCSDS/ESA packet standards. The latest products can be used to satisfy many application areas whilst offering a built-in growth path which is directly compatible with other Satellite Services B.V. products. Given the strong links between SSBV and the major European Space Industries and Organisations, a constant line of feedback and insight into end-user and operational requirements is obtained.

With a 100% focus on space and space data communications, Satellite Services B.V. of The Netherlands is fully aware of past, present and evolving standards and constantly works on improving its products. We provide our customers around the globe with direct support. The highly skilled engineers who work for Satellite Services B.V. have been involved in the development as well as deployment of the equipment. This not only provides for high end products, but also for high end service.

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