VISTEK V1695 DUAL TRANSPORT STREAM MONITOR USER GUIDE

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1. DESCRIPTION

1.1 General

The **V1695** is a Dual Transport Stream Monitor card is designed for continuous monitoring of two MPEG-2 / DVB Transport Streams. These can be completely separate streams, or related streams arranged in a main and redundant configuration. Each stream is monitored independently.

Various monitoring functions are performed, from detection of Transport Stream (TS) failure to the loss of individual Service Information (SI) components. Many broadcasting companies have resorted to using TS analysis equipment in situations where 'in situ' monitoring equipment might have been a more appropriate course of action. The former is expensive and whilst comprehensive, their complexity can often prove an irrelevance or a distraction when switching decisions are to be made.

The V1695 was developed to address a particular Service Information switching requirement, but sufficient generality is included to make it of interest to anyone concerned with Transport Stream distribution for either digital terrestrial, satellite or cable applications.

The card provides three alarms corresponding to three levels of criticality for an input stream. These are:

1. Transport Stream Failure 2. Integrity Failure 3. Service Information Failure

The digital revolution in broadcasting has meant that an entirely new approach had to be adopted. Detecting signal failure now means more than a drop in level or a change in signal shape. Digital systems remove many of the traditional analogue problems, but introduce protocols, stuffing mechanisms and information integrity as novel monitoring concepts. The V1695 is intended to facilitate a degree of abstraction and preserve some of the simplicity of the analogue approach without burying the facts of the real situation.

The V1695 is DVB compliant. It is also compliant with ETR290 with respect to the measurements that are implemented. A selection of these has been chosen that are appropriate for monitoring applications. The details of these, as well as the accurate method of Service Information detection employed, can be found later in this document.

1.2 Functional

The **V1695** is designed to monitor Transport Streams. It is a dual card with the two channels working independently. Both TS inputs use the Asynchronous Serial Interface format on 75Ω coaxial connections.

The card simply monitors its TS inputs and signals any failures to the outside world. It does this by means of opto-isolated outputs, three per channel. The state of these outputs is mirrored directly by front panel LED's, three per channel.

The V1695 can be thought of essentially as a deluxe Transport Stream Detector card with additional DVB Service Information monitoring. The SI tables monitored are listed later in this section.

Standard TS detection is augmented with the inclusion of a TS Integrity Alarm. This goes inside the crucial PAT table in the TS to verify that it is a true PAT table. In addition, the integrity alarm shows errors that, if they were to persist, would be indicative of a serious TS problem.

The three V1695 alarms are shown below along with the labels carried by their LED's on the front panel. Also shown are the hardware names for the corresponding physical outputs. (SF = Special Function).

Front Panel	Alarm Name	Output
TS	TS Failed	SF1
Integ	TS Integrity Failure	SF2
SI	Service Information Failure	SF3
-	TS failed – Relay output	SF4
SF	Special Function	SF4* (see note below)

The alarms above are logical OR's of the following internal sub-alarms:

TS Failed	ASI level failed, TS_sync_loss, No TS
TS Integrity Failure	Sync_byte_error, Transport_error, PAT_upper_distance_error
Service Information Failure	SI table upper_distance_errors

The meaning of the sub-alarms for each alarm is given in the following pages.

Note:* *Unlike the SF1, SF2 and SF3 which are opto coupled outputs on a GPI port, SF4 is relay coupled. In the current (standard) version of the V1695 this output mirrors SF1. A forth alarm, named **SF on the front panel, is available for a custom alarm function. It is envisaged that output SF4 could be reconfigured to reflect the status of the custom **SF** alarm.*

1.2.1 TS Failed

ASI level failed – Ref [2] states that the minimum receiver sensitivity for an ASI receiver should be 200mVpp. This represents a 12dB attenuation from the standard output level of 800mVpp. The minimum sensitivity implies that ASI signals below this level are not guaranteed to be received properly by DVB equipment. ASI levels below 200mVpp are unreliable and therefore a TS failure alarm is issued at this point. Normal ASI operation would have the level well above this figure.

TS_sync_loss – This is the standard [4] loss of Transport Stream synchronisation alarm. Two consecutive corrupted sync bytes cause a loss. Five consecutive correct bytes must be achieved before the alarm is cancelled and other measurements made.

No TS – In real systems the TS rate tends to be constant. However, it must be appreciated that the TS rate is an average quantity. Over the very short term, the rate of arrival of TS bytes is a variable quantity. In packet mode for example a whole packets worth of TS bytes will arrive at once followed by an empty period filled with ASI stuffing bytes. If ASI were to allow truly asynchronous TS byte arrival, a **TS_sync_loss** would not occur if TS bytes were merely absent for a while. This is because no sync error has occurred. The receiver is merely awaiting the next TS byte or packet. Obviously an upper limit must be placed on the Asynchronous nature of ASI and at some point a TS Detector must declare that the TS has gone missing. Thus if there are no TS bytes in one analysis second the **No TS** sub-alarm is activated, driving the **TS failed** alarm.

1.2.2 TS Integrity Failure

Sync_byte_error – This is the standard [4] Sync_byte_error alarm. A single corrupted sync byte will activate this alarm. DVB equipment tends to survive a single sync byte error without loss of synchronisation. However, repeated non-consecutive errors are indicative that something is seriously wrong. Thus the **Sync_byte_error** sub-alarm drives the **TS Integrity Failure** alarm so that it may be noted and the alarm integrated if required.

Transport_error – This is the standard [4] Transport_error alarm. It is activated whenever the Transport error indicator flag is discovered in the header of a TS packet. This flag is set by some Reed Solomon error correction equipment when the number of errors in the packet exceeds the error correction ability of the algorithm. The packet therefore still contains errors and should be ignored. Again a single instance of this will usually be survivable, however if it were to persist this would be a serious concern.

PAT_upper_distance_error – PAT's are vital for the TS to be decoded and this alarm is useful because it will sound if a null TS is present. This is a common TS failure mode where the TS is theoretically present but it has no data in it. As such a null TS is as useful as no TS. This sub-alarm is the standard [4] PAT upper distance alarm. The exception is that the distance threshold has been increased from 0.5 seconds to 1.2 seconds. This is to prevent premature switching of a signal that is still being decoded correctly. The alarm not intended as a specification check for the timing of the PAT's but merely to signal if they are missing. A robust table_id mechanism is used for detecting PAT's rather than relying on the Packet Identifier. This is because some equipment can produce non-standard Null TS failure modes, whose non- standard Null Packets have the same Packet Identifier as PAT's.

1.2.3 SI Failure

The SI alarm is driven by seven sub-alarms. Each of these sub-alarms is an upper distance measurement on an individual Service Information table. As with the PAT upper distance error, there is a safety factor added in above the standard [4] maximum upper distance. Again, the reason is so that each sub-alarm accurately reports a loss of the SI table concerned rather than a slight deviation from the specification. However, each table has its own timing and is checked individually. Again, a table_id mechanism is used to distinguish between tables that share a common packet identifier, and also to spot the Stuffing Table which can masquerade under a variety of Program Identifiers.

NIT-A – Network Information Table - Actual
SDT-A – Service Description Table - Actual
SDT-O – Service Description Table - Other
EIT-pf-A – Event Information Table present / following Actual
EIT-pf-O – Event Information Table present / following Other
TDT – Time and Date Table
TOT – Time Offset Table

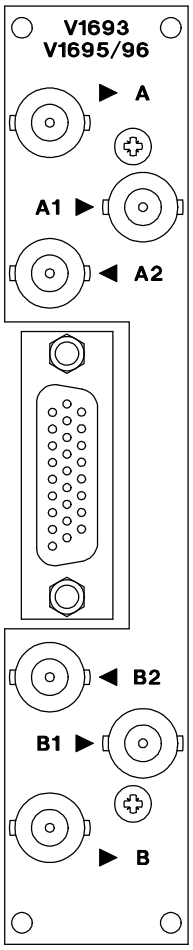
Details of these tables can be found in [3].

2. INSTALLATION

2.1 Rear Panel Connections

Signal	Connector	Comments
A1	BNC	**ASI A** Input
A2	BNC	Not Used
A	BNC	Not Used
B1	BNC	**ASI B** Input
B2	BNC	Not Used
B	BNC	Not Used
Control & Status	26 way D type	See table below

GPI REMOTE	
Pin	**Signal**
1	NC
2	NC
3	A_SF1_C…Ch A **TS** Failure
4	A_SF1_E
5	A_SF2_C…Ch A **Integ** Failure
6	A_SF2_E
7	A_SF3_C…Ch A **SI** Failure
8	A_SF3_E
9	A_SF4_Relay NO…Ch A open on alarm
10	A_SF4_Relay Common
11	A_SF4_Relay NC…Ch A closed on alarm
12	A_SF4_Relay Common
13	0V/GND
14	0V/GND
15	B_SF4_Relay Common
16	B_SF4_Relay NC…Ch B closed on alarm
17	B_SF4_Relay Common
18	B_SF4_Relay NO…Ch B open on alarm
19	B_SF3_E
20	B_SF3_C…Ch B **SI** Failure
21	B_SF2_E
22	B_SF2_C…Ch B **Integ** Failure
23	B_SF1_E
24	B_SF1_C…Ch B **TS** Failure
25	NC
26	NC



Rear Panel Type: V16VR3K

Important note: Rear module type V16VR3K is not compatible with module type V1692. See module datasheets for correct types.

Electrical parameters / notes for connection to GPI port

(i) The opto outputs (SF1-3) are uncommitted NPN transistors.

(ii) Collector-emitter voltages should be limited to 30-35V @ 50mA.

(iii) The opto-outputs are normally turned on and will become high impedance during an alarm.

(iv) To use the opto-outputs as non-isolated open collector circuits the emitter should be connected to the local 0V (PIN 13+14).

(v) SF4's Alarm (Relay) is SF1 (TS Failure).

2.2 Hardware Link and Switch Settings

2.2.1 Jumpers

There are two user selectable jumper links, **JP1** and **JP2**, on the V1695 PCB assembly. JP1 refers to channel **A**. JP2 refers to channel **B**.

Each link has two possible positions. Position **1** and position **0**. Position 1 is the normal setting.
The function of these jumpers is associated with 'power-up' and/or fitting a replacement unit in a 'powered' rack-frame:

Position **1**: Alarm indicators will register 'no fault' on power-up. Alarms will subsequently be indicated if and when they are detected. If the TS stream is OK the 'no fault' condition will remain.

Position **2**: Alarm indicators will register failure of the TS on power-up. Alarms will subsequently register a 'no fault' condition as and when the first monitoring routine/cycle has been completed. If there is a fault detected in the TS the relevant alarm will remain activated.

The above option has been included because certain fault conditions can take some tens of seconds to be detected. Position 2 serves to assist a potential problem when a card is replaced in service. A service engineer could exchange a card and believe no fault has been detected. He may then leave prior to allowing completion of a full monitoring cycle.

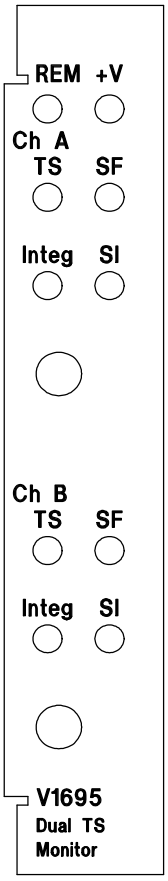
Jumper links **JP3**, **JP4**, **JP5** and **JP6** are reserved for possible future use. These should be left open circuit (i.e. no jumper fitted).

2.2.2 Links

Links **LK1** and **LK2** are reserved for possible future use. These should be left open circuit (i.e. no jumper fitted).

3. OPERATION

3.1 Front Panel Indications



LED Indicators:

REM Yellow – Flashing indicates DART control active
+V Green – Indicates DC power present & OK

Ch A
TS Red – Input A TS failure
SF Red – Input A Special Function failure
Integ Red – Input A Integrity failure
SI Red – Input A Service Information failure

Ch B
TS Red – Input B TS failure
SF Red – Input B Special Function failure
Integ Red – Input B Integrity failure
SI Red – Input B Service Information failure

3.2 Configuration

See Section 2.2.

3.3 Remote Monitoring

Alarms from the V1695 can be monitored using either or both of the following:

(i) Via opto (SF1-3) and relay (SF4) outputs on the 26 way high density D type connector on the rear module. See Section 2.1 for connection details.

Note: The card's outputs are all switched synchronously at high speed (27Mhz). The opto-isolators used on the outputs will, however, limit the switching time to around 100us and can, therefore, vary slightly between outputs. Relay output SF4 is available on each channel and shadows SF1. This is merely to improve the ease of interfacing the card with other systems. Both sides of the relay are available, normally open and normally closed, and none of the terminals are connected to other parts of the circuit.

(ii) Over DARTnet from a **V1605** 1RU controller or **View*find*** PC software when the card is fitted into a DART-equipped **V1606** or **V1603** rack.

APPENDIX A

Part 1 - Introduction to Transport Streams and ASI

ASI stands for Asynchronous Serial Interface. It is an interface for distributing a DVB/MPEG2 Transport Stream from point to point down a serial link. The transmission medium can be either 75Ω coax or optical fibre. The interface has been standardised and is in widespread use in Europe and elsewhere. At time of writing, the latest revision of the standard was published in EN 50083-9:1999. This publication describes 3 interfaces for use with Transport Streams. Of these, ASI has become the most commonly used. Although the ASI concept borrows heavily from a computer network interface known as Fibre Channel, ASI is designed exclusively to carry Transport Streams and so the DVB/MPEG2 Transport Stream standards are included in the ASI standard by reference.

The Transport Stream is the name given to the industry standard format for combining multiple television services and associated information into a single multiplex to enable it to be broadcast over a digital satellite, digital terrestrial or digital cable network. It was specified by the International Standards Organisation's MPEG committee. It is part of the standard commonly known as MPEG-2. This standard covers source encoding, compression and multiplexing processes. The multiplexing part is commonly referred to as MPEG-2 Systems. The inputs to the Systems layer are digital elementary streams of compressed video, compressed audio, private data and service information. MPEG-2 Systems defines how these are combined together to give the Transport Stream.

Extensions to the MPEG standard were drawn up by the DVB organisation when the industry began to use Transport Streams for real, and these extensions were ratified by ETSI. The idea was to provide mechanisms for describing the content of the Transport Stream for the benefit of target decoder boxes and the end user, and to do so within the MPEG rules, but in a specified manner. Thus the MPEG concept of Program Specific Information (PSI) was augmented to give Service Information (SI). In general PSI can be thought of as the minimum information a professional decoder would require to decode and reassemble the services. The non-PSI Service Information is in the main descriptive, and not as critical to the decoding process. The term 'Service Information' ideally covers both PSI and non-PSI. In practice, however, its use is ambiguous, sometimes referring to just the DVB extensions. For clarity we will use the term DVB SI when referring to just the extensions.

The MPEG-2 / DVB Transport Stream is composed of data packets, 188 or 204 bytes in length. This gives us two TS modes. In each case the data is contained in the first 188 bytes, but 204 mode has an extra 16 bytes which can be dummy bytes or Reed Solomon bytes for the packet. Both modes are supported by the V1695 ASI / TS card.

Part 2 - More on Transport Streams and ASI

An ASI / TS signal is hierarchical in nature. We have the TS, which contains the digital services (channels etc.) we wish to distribute. There are rules for how this information is packed into the TS. However, the TS is intended to pass through a variety of equipment on its journey and as such it cannot be the lowest layer in such a hierarchy. For each point to point link the TS requires a datalink protocol layer beneath it to describe exactly how the TS should be carried in keeping with the current transmission medium. Thus we have ASI. It provides a robust datalink mechanism and physical specifications that enable the TS to be distributed to the next piece of equipment with negligible errors introduced. Our transmission medium is 75Ω coax and in the case of ASI, the datalink mechanism is an 8 bit to 10 bit coding system.

The DVB / MPEG-2 Transport Stream consists of data packets. Some of these packets contain video whilst some contain audio and others contain data. This programme material forms the bulk of the useful information in the Transport Stream. In addition to this, however, some packets contain information to enable decoder equipment and the user to navigate around the various streams and conceptual groups of streams that are services. This information is known as Service Information. This SI has its origin in both the MPEG and the DVB standards. The MPEG standard began by specifying the form for this sort of information and the syntax. It was decided that it could be thought of as 'tables' of information that could be split across TS packets. These tables are an abstract convenience as they are rarely regenerated. A number of tables were defined by MPEG and these are commonly known as the Program Specific Information (PSI). DVB defined additional tables and together with the PSI they form the complete set of SI tables. The PSI tables are more fundamental to the decoding process, whilst the DVB SI tends to be more descriptive, although both sets are important.

As an aside, there also exists in the MPEG-2 Systems standard an alternative to the Transport Stream, for use on a single service in the computer environment. This is known as the Program Stream and it forms the multiplexing format for the elementary streams recorded on a DVD disk. It is not however used for broadcast.

APPENDIX B: REFERENCES

International Standards:

[1] ISO/IEC 13818-1 First Edition (1996-04-15)
Information technology – Generic coding of moving pictures and associated audio information: Systems

European Standards:

[2] BS EN 50083-9 (1999)
Cable networks for television signals, sound signals and interactive services – Part 9: Interfaces for CATV/SMATV headends and similar professional equipment for DVB/MPEG-2 transport streams

[3] EN 300 468 V1.3.1 (1998-02)
Digital Video Broadcasting (DVB);
Specification for Service Information (SI) in DVB systems

Technical Reports: EBU/CENELEC/ETSI-JTC

[4] ETR 290 (1997-05)
Digital Video Broadcasting (DVB);
Measurement guidelines for DVB systems

[5] ETR 211 Second Edition (1997-08)
Digital Video Broadcasting (DVB);
Guidelines on implementation and usage of Service Information (SI)

[6] ETR 154 Third Edition (1997-10)
Digital Video Broadcasting (DVB);
Implementation guidelines for the use of MPEG-2 Systems, Video and Audio in satellite, cable and terrestrial broadcasting applications

APPENDIX C

Abbreviations

BAT	Bouquet Association Table
BER	Bit Error Rate
CA	Conditional Access
CRC	Cyclic Redundancy Check
DVB	Digital Video Broadcasting
EIT	Event Information Table
EMM	Entitlement Management Message
ETR	ETSI Technical Report
ETS	European Telecommunication Standard
FEC	Forward Error Correction
IEC	International Electrotechnical Commission
IRD	Integrated Receiver Decoder
ISO	International Organization for Standardization
ITU	International Telecommunication Union
MPEG	Moving Picture Experts Group
NIT	Network Information Table
PAT	Program Association Table
PID	Packet Identifier
PLL	Phase Locked Loop
PMT	Program Map Table
PSI	MPEG-2 Program Specific Information (as defined in [1])
RS	Reed-Solomon
RST	Running Status Table
SDT	Service Description Table
SI	Service Information
TDT	Time and Date Table
TOT	Time Offset Table
TS	Transport Stream

Definitions

bouquet: A collection of services marketed as a single entity.

broadcaster (SERVICE Provider): An organization which assembles a sequence of events or programs to be delivered to the viewer based upon a schedule.

component (ELEMENTARY Stream): One or more entities which together make up an event, e.g. video, audio, teletext.

delivery system: The physical medium by which one or more multiplexes are transmitted e.g. satellite system, wide-band coaxial cable, fibre optics, terrestrial channel of one emitting point.

event: A grouping of elementary broadcast data streams with a defined start and end time belonging to a common service, e.g. first half of a football match, News Flash, first part of an entertainment show.

MPEG-2: Refers to the standard ISO/IEC 13818 [1]. Systems coding is defined in part 1. Video coding is defined in part 2. Audio coding is defined in part 3.

multiplex: A stream of all the digital data carrying one or more services within a single physical channel.

network: A collection of MPEG-2 Transport Stream (TS) multiplexes transmitted on a single delivery system, e.g. all digital channels on a specific cable system.

programme: A concatenation of one or more events under the control of a broadcaster e.g. news show, entertainment show.

section: A section is a syntactic structure used for mapping all service information defined in the present document into ISO/IEC 13818 [1] TS packets.

service: A sequence of programs under the control of a broadcaster which can be broadcast as part of a schedule.

service_id: A unique identifier of a service within a TS.

Service Information (SI): Digital data describing the delivery system, content and scheduling/timing of broadcast data streams etc. It includes MPEG-2 PSI together with independently defined extensions.

table: A table is comprised of a number of sub_tables with the same value of table_id.

Transport Stream (TS): A TS is a data structure defined in ISO/IEC 13818-1 [1]. It is the basis of the DVB standards.

Customer Version Information

Firmware Versions

45-XX-01, 45-XX-02, 45-XX-21

Firmware is labelled on the V1695 as above: The first number identifies the product, the second number gives the IC number on the board (labelled XX ‘don’t care’ above) and the final number is the firmware version. The latest version is version 21. This document is for that version.