

B051

Falcon

Hand Held ASI Analyser



Handbook

Version 1.0



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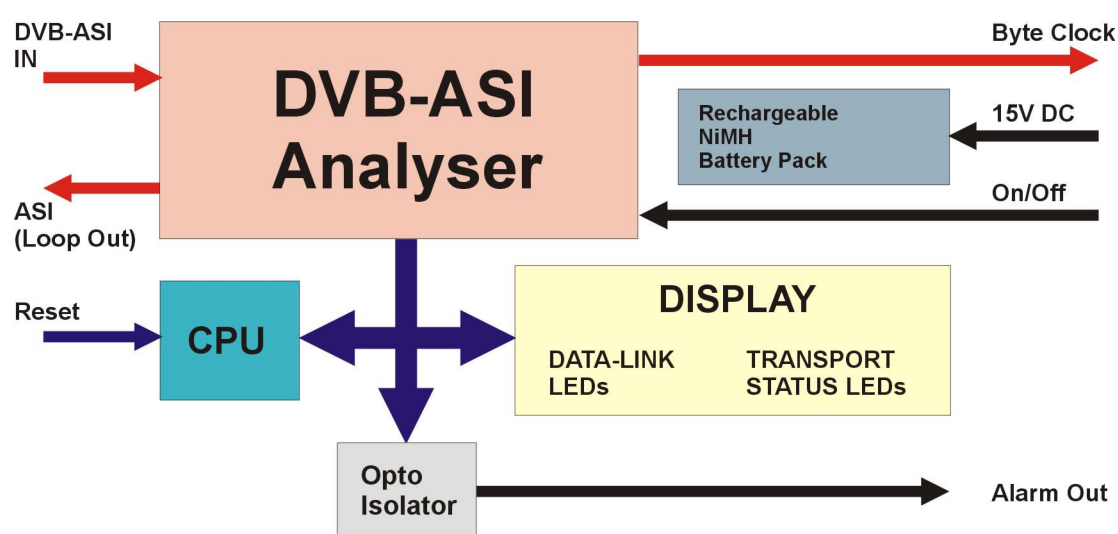
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Introduction

The battery powered hand-held B051 Falcon ASI analyser is designed to analyse DVB asynchronous serial interface (ASI) transport streams. The unit measures 157mm (w) by 70mm (h) by 210mm (d) and weighs under 1kg.

It provides real-time status of an attached ASI data link and performs basic checks on the ASI transport stream. Any errors detected are shown on the front panel and via rear connector opto-isolated outputs.



The B051 Falcon hand held ASI analyser

Main features

- Real time and latching status LED display
- Data link analysis – level, ASI rate, errors and mode
- Transport analysis – TS rate, data rate and flag status
- Up to five hour battery life
- One ASI input with loop-through output, 27MHz clock and opto-isolated alarm outputs
- Alarms include – Input level, non synch ASI clock, SBE, No PAT, PAT CC, Trans, DVB SI, stuffing > 80% and summary alarm
- External PSU/charger included

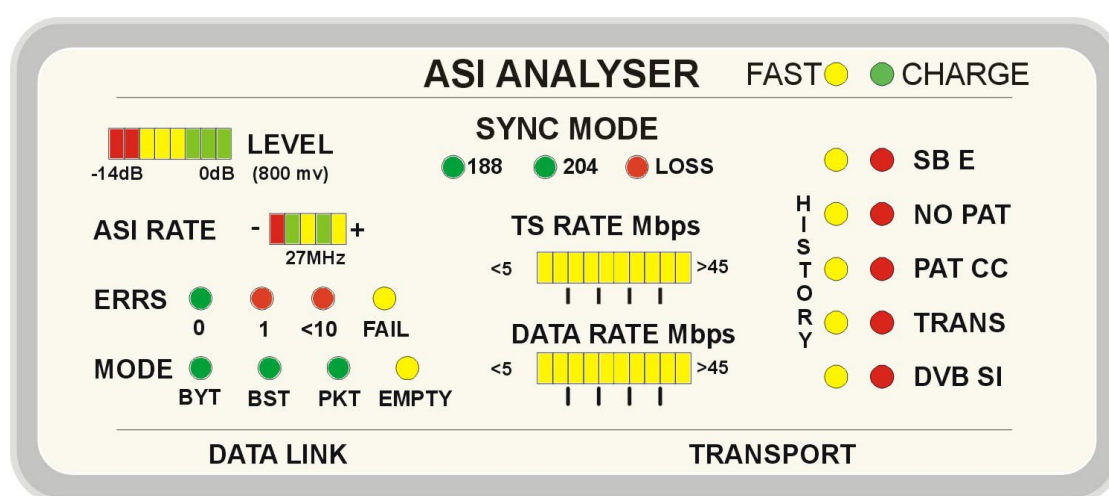
There are no operational controls on the Falcon ASI analyser front panel. An On/Off switch and Reset button are located at the rear of the unit.

Getting started

The Falcon ASI analyser is switched on or off at the rear of the unit. It may be operated whilst being charged.

The front panel user interface consists of a number of status LEDs for the following:

- Data link functions
- Transport stream analysis
- Charging status



B051 Falcon hand held ASI analyser – front display

The front panel status LEDs are arranged so that DATA-LINK functions are grouped in the left hand LED column and TRANSPORT functions are grouped in the middle and right hand LED columns.

The simplest or most basic status information is always displayed at the top of a LED column and more advanced or abstract information is displayed at the bottom of a LED column.

The LOSS LED indicates that at least two consecutive Transport Stream sync bytes are in error.

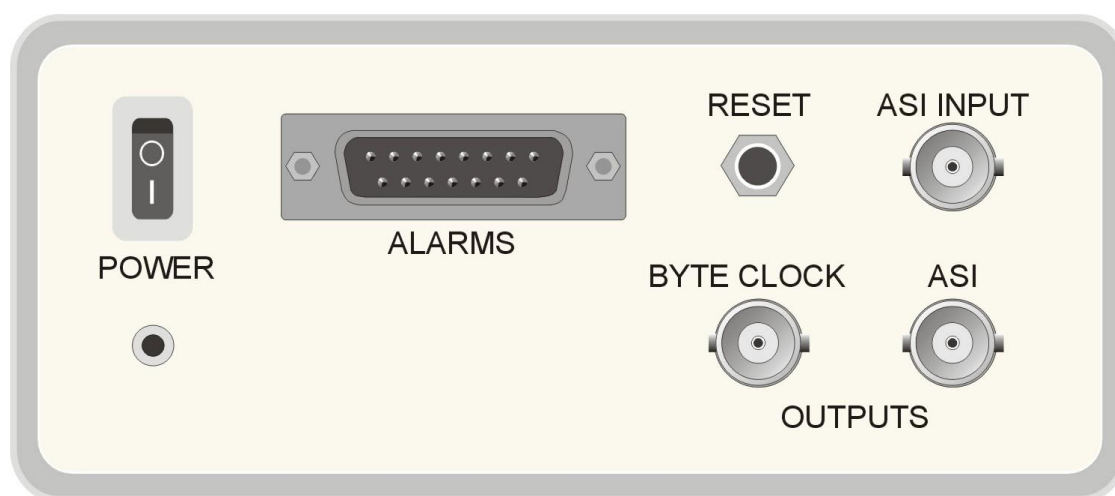
The red Transport Stream flag LEDs in the far right column indicate a current error, whilst the latched 'history' yellow/orange LEDs indicate the presence of previous errors. History errors may have only been transient. Latched yellow/amber 'history' LEDs may be cleared by pressing the RESET button at the rear of the unit.

Further details of data link and transport error LEDs are given in the Analyser Functions chapter.

The rear connector panel

The rear panel provides access the following:

- On/Off switch
- DC input jack
- Reset button
- ASI input and loop-through output
- 27MHz byte clock
- Alarm output 15 way female 'D' connector



B051 Falcon hand held ASI analyser – rear panel

Using the charger/power supply

The Falcon ASI analyser has an internal rechargeable NiMH battery capable of delivering five hours of continuous use. Connect the 15 Volt power supply/charger to the power jack at the back of the unit to charge the battery.

Charging takes place when the adapter is connected regardless of whether the unit is switched on or not. The state of the charging operation is indicated on the front panel.

Control of charge mode is automatic and depends on temperature, time and the amount of charge in the cells.

The green LED is illuminated if there is power connected in the back. This external power trickle charges the internal battery, even when fast charging is complete.

The yellow LED indicates, 'fast charging' and therefore the battery is not fully charged when illuminated. The yellow LED will go out after the 3-hour fast charge limit but trickle charging will continue.

Resetting the unit

In the unlikely event that the unit fails to respond correctly, the RESET button on the rear panel may be pressed to help restore normal operation. The RESET button will also clear the yellow/amber latched transport error LEDs.

Connecting an ASI source

Connect a valid DVB ASI source to the ASI input connector. A loop-through output will be available at the lower ASI BNC.

Synchronising an oscilloscope

The 27 MHz byte rate clock output is provided to trigger an external oscilloscope.

Analyser Functions

Data-link Functions

Signal Level

The first check performed by the B051 is the signal level check. This is the most fundamental of the data-link checks. The specification for ASI data-links states that the minimum sensitivity for an ASI receiver is 200mVp-p. If the signal level falls below this for some reason, correct reception of the signal by the next piece of equipment in the chain cannot be guaranteed. The 200mVp-p level represents an attenuation of 12dB from the normal working voltage of 800mVp-p. The level indicator on the front of the unit shows signal level attenuation in 2 dB steps from 800 mVp-p. Below 200mVp-p the signal level alarm on the rear of the device is activated. On the front panel, this is accompanied by the level indicator entering the red zone. The level alarm therefore indicates when the data-link signal has fallen out of its voltage specification.

ASI Rate

ASI is transmitted down the serial link at 270 Mbit/s. The maximum deviation permitted is 100ppm in each direction. When the unit has correctly aligned itself to the 10bit ASI data-link codes, it can decode them and recover the original 8 bit words. The byte rate is thus 27Mhz. If the line rate deviates by 50ppm, this will result in a recovered byte clock deviation of 50ppm, and this will be indicated on the front panel by the illumination of one of the yellow ASI rate LEDs. Similarly the out of specification 100ppm or worse condition is indicated by illumination of one of the red LEDs. The line rate is measured positively or negatively with respect to the accurate on board crystal reference. If one of the red conditions exists, the ASI rate alarm on the rear of the unit will be activated.

ASI Errors

The 10bit ASI data-link words must be valid. That is they must appear in the valid 10 bit codes look up table. Additionally an ASI data-link keeps track of the number of ones and zeros that have been sent to date. This is known as the running disparity. For every 8 bit Transport Stream word there are two 10 bit data-link equivalents, one for each disparity state. The data-link receiver must always be sent the correct 10 bit version for whatever disparity state it is in. If it is expecting a positive disparity code and it receives a negative code this is an error. As well as maintaining no net d.c. component in the line, the disparity system adds to the robustness of the 10 bit code, allowing random noise induced bit errors to be spotted. Whilst the bit error rate specification for an ASI data-link is of necessity very low, errors can occur, and the Analyser is equipped to detect and display them. The ASI Errors

section of the display provides the user with the assurance that the data-link is intact. Errors here will point to a local fault in the equipment immediately preceding the analyser.

A single ASI error is usually survivable, but more than this certainly indicates there is a problem. Indeed if a single error occurs more than once within a few days, this is also cause for concern. The Analyser considers the data-link to have failed at a rate of 10 errors per second and will cease to perform Transport Stream calculations. Between 1 and 10 errors per second it will still attempt to perform measurements, despite the fact that this is way beyond the ASI error specification. It will have varied success, depending upon where in the data the errors occur, or if they occur during periods of ASI stuffing.

One or more errors in any one-second period will trigger the rear panel ASI errors alarm.

ASI Modes

Packet mode

ASI 10 bit words may be sent contiguously in groups of 188.

Byte mode

Words may also be sent individually, separated by stuffing characters.

Data sent in any other combination than an entire second of PACKET or BYTE mode is called BURST mode.

The EMPTY mode

The TS can stop altogether, and the ASI data-link will continue to output valid characters. In this case they will all be stuffing characters. Stuffing characters are the words that the data-link inserts to ensure that the ASI bit rate is maintained at 270Mhz regardless of what the TS rate is.

The mode with 100% stuffing is known as EMPTY mode. This LED is yellow, because although legal ASI, from a broadcast point of view all content has been lost.

Transport Stream Functions

TS Sync Mode

Transport Stream packets can be 188 bytes or 204 bytes in length. Whichever mode is currently being used is indicated on the front panel.

The LOSS LED is the ETR 290 first priority error: TS_sync_loss.

That is at least two consecutive Transport Stream sync bytes were in error. This alarm is indicated on the rear connector too, and correctly blanks off all other TS calculations.

TS Rates and TS Data Rates

In order to establish how much real data is present in a given TS it is necessary to know something about how the different rates are calculated. In practice, the TS Rate tends to be fixed for a given system, regardless of the content actually being broadcast. In order to make up the data to the fixed TS Rate, null packets are inserted into the TS:

The TS Data Rate is calculated for both 188 byte mode and 204 byte mode as follows:

$$\text{TS DATA RATE} = (\text{TOTAL PACKET RATE} - \text{NULL PACKET RATE}) * 188 * 8$$

The TS Rate is given as follows:

$$\text{TS RATE} = \text{TS DATA RATE} + \text{RS BITRATE} + \text{NULL PACKET BITRATE}$$

The RS bitrate is only present in 204 byte mode and it is due to the extra 16 bytes of Reed Solomon or dummy information which is appended to the end of every packet:

$$\text{RS BITRATE} = \text{TOTAL PACKET RATE} * 16 * 8$$

Similarly,

$$\text{NULL PACKET BITRATE} = \text{NULL PACKET RATE} * 188 * 8$$

Note: The null packet concept is quite separate to the stuffing mechanism employed by ASI to maintain the ASI rate at 270 Mbit/s. Once the ASI stuffing has been discarded and the data-link decoded, the full TS remains including null packets.

Transport Stream Flags

The following LED alarms also have latched versions (yellow LEDs) which can be reset by the push button on the rear of the unit:

SBE

This is the ETR 290 first priority error: Sync_byte_error. That is at least one non-consecutive TS Sync byte in error.

NO PAT

Transport Stream Program Association Table (identified by packet identifier AND table_ID) is late or missing. DVB recommends a PAT packet should be sent at least every 0.5 secs. Threshold for this alarm is 1.2 secs.

PAT CC

ETR 290 continuity count error has occurred on the PATs. The continuity count error is implemented for PATs only. Most major discontinuities will be shown.

TRANS

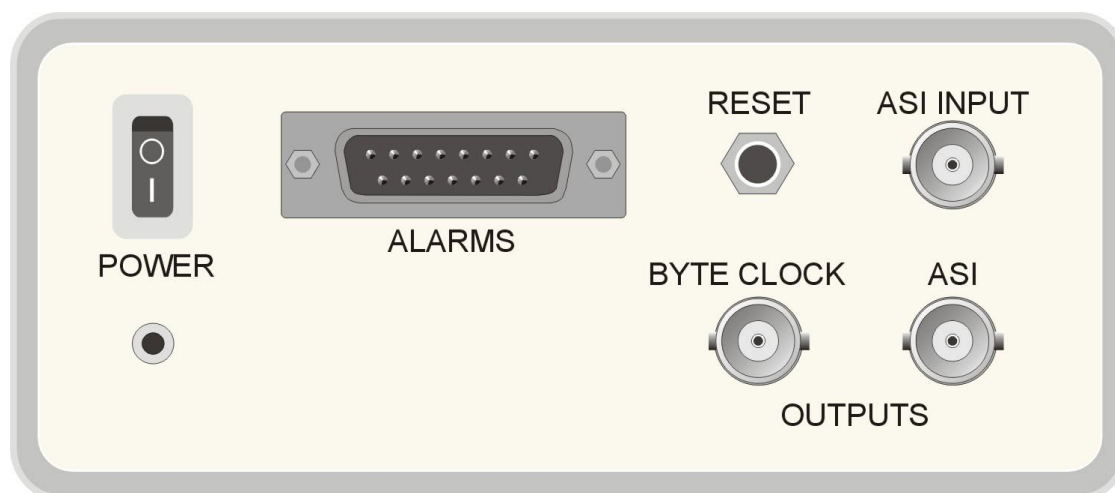
Transport Error Indicator flag was set in header of at least one packet. This is set (if supported) by equipment performing Reed Solomon correction on the TS if it finds too many errors to correct within a packet.

DVB SI

Every Service Information table comes with its own timing parameters. SI may be bursty so long as these upper distance parameters are met. However, it is possible to see the situation where all DVB SI is missing by use of a simple one second analysis window as implemented here. DVB SI is here defined as all non-PSI SI. If there is none present in a given second the alarm will sound.

Installation

All connections are provided on the rear panel of the unit. Alarm connections are provided via a 15 way female 'D' connector. All alarm outputs are optically isolated. DVB ASI I/O and the byte clock use BNC connectors. The 15 Volt charger/supply voltage is provided via a DC power jack.



B051 Falcon hand held ASI analyser – rear panel

Female 15 way 'D' connector alarm assignments

Pin No	Description	Comment
1	SIGNAL LEVEL	Voltage < 200 mV p-p
2	ASI RATE	Worse than 100ppm out
3	ASI ERROR	ASI ERRORS > 0
4	TRANS	TRANS
5	NO PAT	NO PAT
6	PAT CC	PAT CC
7	DVB SI	DVB SI
8	SUMMARY	OR of all alarms
9	LOSS	ETR 290 TS_sync_loss
10	SBE	ETR290 Sync_byte_error
11	LOW DATA RATE	DATA RATE < 5Mbit/s
12	SPARE	-
13	N / C	N / C
14	COMMON EMITTERS	COMMON EMITTERS
15	OV	POWER AND SIGNAL GND
Shell	Chassis	~10Ω FROM 0V

Problem solving

The charge LED should illuminate green whenever the internal battery has sufficient charge to operate the unit, or when the unit is connected to a power supply/charger, which is receiving power from the mains.

If the charge LED does not illuminate, there is not sufficient power to operate the Analyser.

Sample problems and their solutions

The unit does not appear to operate correctly

Check that the green charge LED is illuminated.

Check that a valid DVB ASI signal has been connected to the upper ASI INPUT BNC connector at the rear of the unit.

Check that the ASI input has not been inverted by passing it through a standard SDI distribution amplifier. Only non-inverting DVB-ASI DAs should be used.

If necessary, power cycle the unit and/or perform a Reset.

The green charge LED does not illuminate when switched on

Charge the internal battery.

The internal battery does not accept a charge even though the FAST and CHARGE LEDS illuminate

Return the unit to dB Broadcast or a local distributor for internal battery replacement.

Specification

Inputs	DVB ASI 75 Ω transformer coupled, 75 Ω loop-through output
Outputs	27MHz clock output (75 Ω BNC) typically used for triggering scope Opto-isolated alarm outputs on a 15 way female 'D' type connector
Power	Battery powered (NiMH) approx 5 hours, Low Batt indicator
Alarms provided at rear	Input level, non sync ASI, SBE, No PATT, PATT CC, Trans, DVB SI, stuffing >80% and summary alarm
Housing	Outline Dimensions: 157mm (w) by 70mm (h) by 210mm (d)
Weight	Under 1kg
Environmental	Temperature 0°C to 30°C Humidity 70% max.
Front panel	Data-Link and Transport status LEDs
Rear panel	DVB-ASI In/Loop out BNCs, 27MHZ byte clock out BNC, Reset switch, DC power jack, 15 way 'D' type connector (female), On/Off switch

Appendix

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 75 ohm 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, however ASI has become the most commonly used of these. Although the ASI concept borrows heavily from a computer networking 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. The Transport Stream was specified by the International Standards Organisation's MPEG committee and 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 however in practice its use is ambiguous, sometimes referring to just the DVB extensions. For clarity the term DVB SI will be used 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 all dB ASI/TS products.

Protocol Stack for ASI Transport Streams

- Elementary Streams - Audio, Video, Data, Service Information Tables.
- Transport Stream - 188 or 204 byte data packets and null packets
- ASI data link - 10 bit serial data and stuffing characters at 270 Mbps
- ASI physical - 75 Ohm coax (or fibre – not supported by B046)

An ASI / TS signal is hierarchical in nature. The TS contains the digital services (channels etc) to be distributed. 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 data link protocol layer beneath it to describe exactly how the TS should be carried in keeping with the current transmission medium. ASI provides a robust data link mechanism and physical specification to enable the TS to be distributed to the next piece of equipment with negligible errors introduced. Our transmission medium is 75 Ohm coax and in the case of ASI, the data link 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, some contain audio, and some data. This programme material forms the bulk of the useful information in the Transport Stream. However, in addition to this, 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, which 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 further 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.

References

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Information technology – Generic coding of moving pictures and associated audio information: Systems

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