Industriefunkuhren

hopf Elektronik GmbH

Technical Manual

IRIG-B Generator-Module for analogue / digital Signals
of Type: IRIG-B / IEEE C37.118 / AFNOR NF S87-500

Module 7628

ENGLISH

Version: 02.01 – 06.03.2013

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Version number (Firmware / Manual)

THE FIRST TWO DIGITS OF THE VERSION NUMBER OF THE TECHNICAL MANUAL AND THE FIRST TWO DIGITS OF THE FIRMWARE VERSION MUST **COMPLY WITH EACH OTHER**. THEY INDICATE THE FUNCTIONAL CORRELATION BETWEEN DEVICE AND TECHNICAL MANUAL.

THE DIGITS AFTER THE POINT IN THE VERSION NUMBER INDICATE CORRECTIONS IN THE FIRMWARE / MANUAL THAT ARE OF NO SIGNIFICANCE FOR THE FUNCTION.

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Symbols and Characters

Operational Reliability

Disregard may cause damages to persons or material.

Functionality

Disregard may impact function of system/device.

Information

Notes and Information.

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Safety regulations

The safety regulations and observance of the technical data serve to ensure trouble-free operation of the device and protection of persons and material. It is therefore of utmost importance to observe and compliance with these regulations.

If these are not complied with, then no claims may be made under the terms of the warranty. No liability will be assumed for any ensuing damage.

Safety of the device

This device has been manufactured in accordance with the latest technological standards and approved safety regulations

The device should only be put into operation by trained and qualified staff. Care must be taken that all cable connections are laid and fixed in position correctly. The device should only be operated with the voltage supply indicated on the identification label.

The device should only be operated by qualified staff or employees who have received specific instruction.

If a device must be opened for repair, this should only be carried out by employees with appropriate qualifications or by ***hopf*** Elektronik GmbH.

Before a device is opened or a fuse is changed all power supplies must be disconnected.

If there are reasons to believe that the operational safety can no longer be guaranteed the device must be taken out of service and labelled accordingly.

The safety may be impaired when the device does not operate properly or if it is obviously damaged.

CE-Conformity

CE

This device fulfils the requirements of the EU directive 2004/108/EC "Electromagnetic Compatibility" and 2006/95/EC "Low Voltage Equipment".

Therefore the device bears the CE identification marking (CE = Communautés Européennes = European communities)

The CE indicates to the controlling bodies that the product complies with the requirements of the EU directive - especially with regard to protection of health and safety for the operator and the user - and may be released for sale within the common markets.

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1 General

The Module 7628 is a compact IRIG-B generator for the integration into Clock Systems and signal converters. This module converts an internal fed time information into an IRIG-B signal (analogue or digital).

The module can put out different IRIG-B Time Code Formats:

- IRIG-B according to IRIG Standard 200-98
  (format does not include any year date)
- IRIG-B according to IRIG Standard 200-04
- IEEE C37.118-2005 formerly IEEE 1344-1995)
- AFNOR NF S87-500

The output of signals is carried out via two **completely potential isolated** outputs. Here analogue or digital IRIG-B signals, depending on the module version, can be generated.

Its function is guaranteed by just supplying the Module 7628 with power and providing appropriate time information. Both are usually carried out in the basis system the Module 7628 is integrated in. However the module can also be used in an independent signal converter.

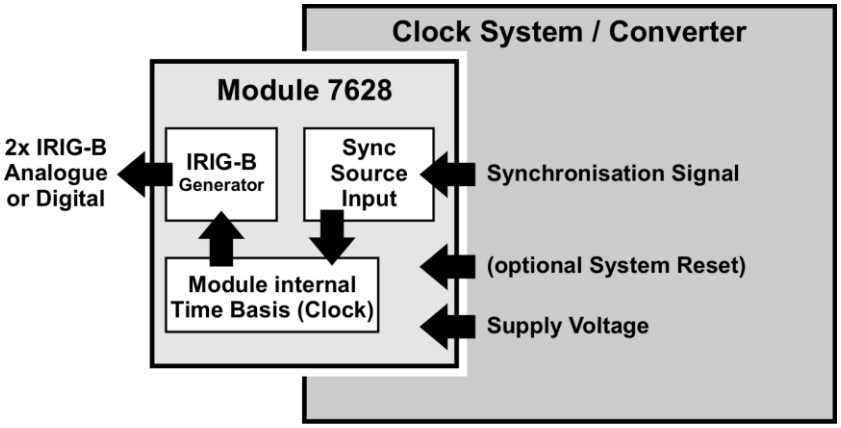
The Module 7628 requires approx. 2-3 minutes for a successful time synchronization, depending on the fed synchronization signal. As the module has no internal back-up clock and in order to receive an internal time for the time generation, it is required to synchronize the module after a reset or a power failure again.

The according status of the module is shown by three LEDs in the front panel enabling to identify a successful or rather a disturbed synchronisation and the activities of the two signal outputs visually.

The signal output of Module 7628 depends on the appropriate synchronization status and also on internal settings.

The signal output is directly configured on the module via DIP switch and jumper.

Functional Principle:



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2 Connecting Elements of Module 7628

Connection

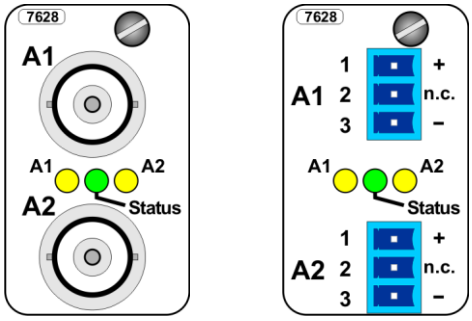
- The signal output is processed via BNC connector female or a 3-pole pluggable screw terminal depending on the module version.

Status Display

- The connecting elements have a LED (yellow) each showing the current signal outputs.
- The Status LED (green) indicates the synchronization status of the Module 7628 and is also used for diagnosis of the input signal at the internal synchronization input of the module in case of a problem.

ANALOGUE signal outputs are marked with A1 and A2 (possibly A3 and A4)

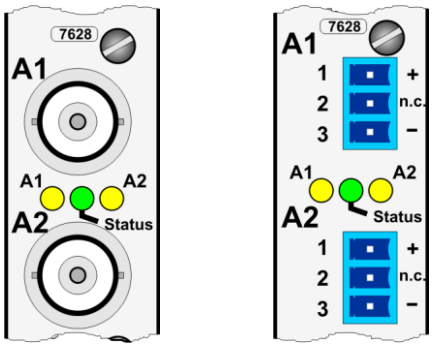
Module 7628 in DIN Rail Housing



BNC Connector female

Core - Signal Output POSITIVE
Shield - Signal Output NEGATIVE

Module 7628 in 3U/4HP Panel (19" Systems)

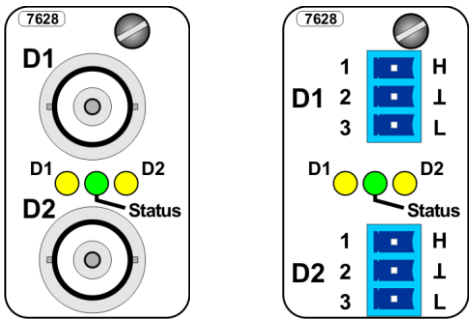


Clamp

1 (+) - Signal Output POSITIVE
2 (n.c.) - not connected
3 (-) - Signal Output NEGATIVE

DIGITAL signal outputs are marked with D1 and D2 (possibly D3 and D4)

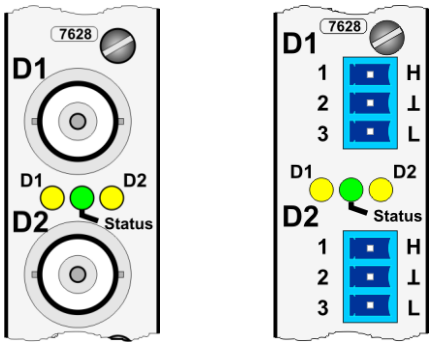
Module 7628 in DIN Rail Housing



BNC Connector female

Core - Signal logic - HIGH active
Shield - GND (Ground)

Module 7628 in 3U/4HP Panel (19" Systems)



Clamp

1 (H) - Signal logic - HIGH active
2 (⊥) - GND (Ground)
3 (L) - Signal logic - LOW active

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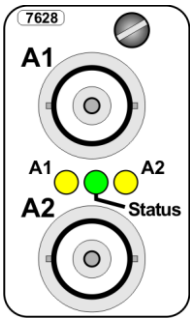

Example: A1/A2 – BNC Connector female		
LED	**Meaning**	
Status	LED (green) – Synchronisation status	
	LED	**Function**
	on	Signal output synchronized
	on/off 900/100 msec	Signal output realized with active SyncOFF Timer
	on/off 100/900 msec	Signal output on basis of internal time information of the module (without external synchronization)
	on/off approx. 2 Hz	Module is in testing mode for signal output
	FLASHING	Module has no valid time information
	off	Board damaged / no voltage
A1	LED (yellow) – Indication of signal output at BNC connector female A1	
A2	LED (yellow) – Indication of signal output at BNC connector female A2	
BNC	**Function**	
A1	Signal output of IRIG-B / IEEE C37.118 / AFNOR	
A2	Signal output of IRIG-B / IEEE C37.118 / AFNOR	

3 Commissioning

After the parameterization of the module (via DIP switch and jumper) has been completed commissioning is carried out by switching-on the basis system or rather the converter.

4 Configuration of Module 7628

The used synchronization signal and the signal output at the connecting elements need to be configured according to the appropriate application.

Attention: Never work on the open unit when voltage is applied! Danger to life!

ESD The system contains ESD-sensitive components, briefly when touching these elements ESD safety measures needs to be observed.

Using the module in ***hopf*** basis systems the relevant settings are usually carried out at the factory.

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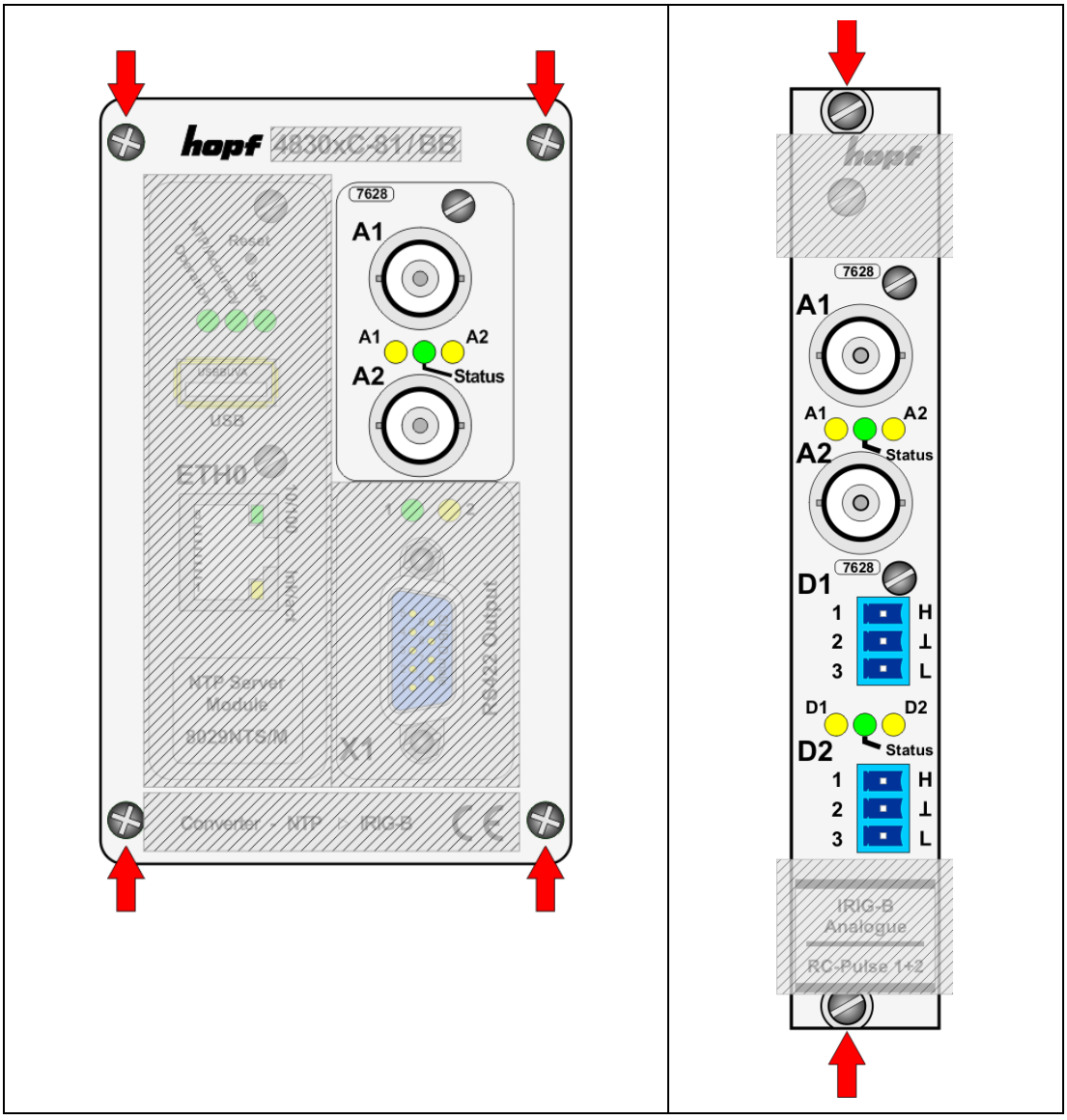
4.1 Access the Module 7628

For the configuration of the component it needs to be pulled out of the appropriate ***hopf*** basis system / converter and the following steps are to be accomplished:

1. Switch-off and disconnect the device
2. Loosen the fixing screws of the appropriate front panel



3. Pull the panel with Module 7628 carefully out of the housing. Ensure that no internal connecting cables are turned off or get damaged.
4. Configure the component via DIP switch and jumper.
5. Afterwards insert the component carefully into the housing by considering the connecting cable.
6. Fix the front panel with the screws.

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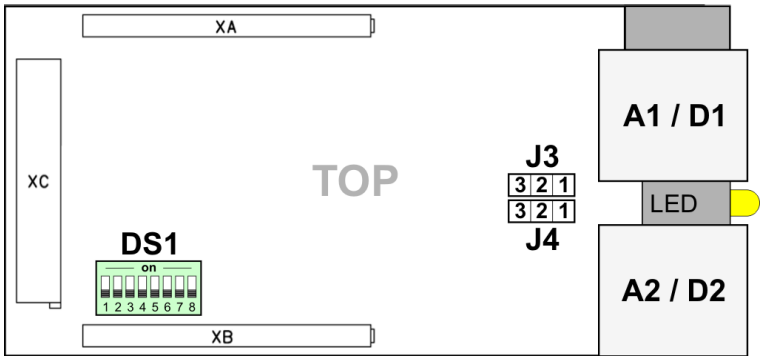
4.2 Parameterization of Module 7628

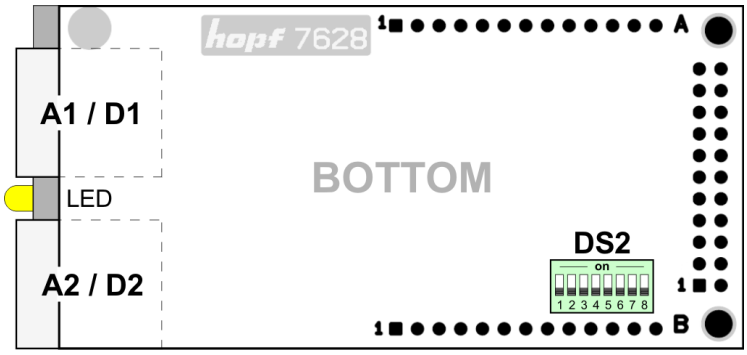
There are two DIP switches and two jumpers on Module 7628 for parameterization. The DIP Switch DS1 and the jumper J3/J4 are on the component side and (TOP) and the DIP Switch DS2 on the conductor side (BOTTOM).

The jumpers are only available on module versions for analogue signal outputs.

Component Side



Conductor Side



4.2.1 Overview of DIP Switches / Jumper

The DIP Switch should only be adjusted with an appropriate tool in order to avoid damage to the switch.

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4.2.1.1 DIP Switch DS1

SW8	Step Size for SyncOFF Timer
off	10 minutes
on	1 hour

SW7	SW6	Factor for SyncOFF Timer
off	off	2x SW8 (Step Size) ⇨ SyncOFF Timer (20min / 2h)
off	on	4x SW8 (Step Size) ⇨ SyncOFF Timer (40min / 4h)
on	off	6x SW8 (Step Size) ⇨ SyncOFF Timer (60min / 6h)
on	on	8x SW8 (Step Size) ⇨ SyncOFF Timer (80min / 8h)

SW5	Service Mode
off	Reserved for ***hopf*** Elektronik GmbH. The setting should not be changed and must always be **off**!

SW4	SW3	SW2	SW1	Selection of Sync Source
off	off	off	off	01: ***hopf*** Binary string with PPS (NTP configuration)
off	off	off	on	02: ***hopf*** System-BUS 6000 with PPS
off	off	on	off	03: ***hopf*** System-BUS 7001 with PPS
off	off	on	on	04: ***hopf*** Master/Slave-String – Transmission cycle: every minute
off	on	off	off	05: ***hopf*** Master/Slave-String –Transmission cycle: every second
off	on	off	on	06: ***hopf*** Master/Slave-String with PPS – Transmission cycle: every min.
off	on	on	off	07: ***hopf*** Master/Slave-String with PPS – Transmission cycle: every sec.
off	on	on	on	08: DCF77 Pulse (1Hz) – Local time (MEZ)
on	off	off	off	currently not connected (currently ***hopf*** Binary string with PPS)
on	off	off	on	currently not connected (currently ***hopf*** Binary string with PPS)
on	off	on	off	currently not connected (currently ***hopf*** Binary string with PPS)
on	off	on	on	currently not connected (currently ***hopf*** Binary string with PPS)
on	on	off	off	currently not connected (currently ***hopf*** Binary string with PPS)
on	on	off	on	currently not connected (currently ***hopf*** Binary string with PPS)
on	on	on	off	currently not connected (currently ***hopf*** Binary string with PPS)
on	on	on	on	currently not connected (currently ***hopf*** Binary string with PPS)

DIP Switch SW5 of DS1 must always be **off** (service mode).

For the signal generation the selection of the sync source 08: DCF77 pulse (1Hz) – local time (MEZ) means a fixed defined difference time (Time Zone Offset) of +1h from local time to UTC for the time zone MEZ.
The other sync source settings use the difference time transferred with the sync source signal.

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4.2.1.2 DIP Switch DS2

SW8	Identification of Input Signal via Status LED (Green)
off	Status LED (green) for synchronization display
on	Diagnosis Mode – Indication of the received synchronization signal at the internal input of Module 7268

SW7	SW6	Signal Output IRIG-B / IEEE C37.118 / AFNOR
off	off	Always when time in the module is valid
off	on	When the module is currently synchronized **or** the SyncOFF Timer is active
on	off	Only when the module is currently synchronized
on	on	Test Mode – Test signal output

SW5	SW4	SW3	Selection of Output Format IRIG-B / IEEE C37.118 / AFNOR
off	off	off	IRIG-B / B007+B127 (time, year, second of day)
off	off	on	IRIG-B / B003+B123 (time, second of day)
off	on	off	IRIG-B / B006+B126 (time, year)
off	on	on	IRIG-B / B002+B122 (time)
on	off	off	IEEE C37.118 (formerly IEEE 1344)
on	off	on	AFNOR NF S87-500
on	on	off	Not connected (currently IEEE C37.118)
on	on	on	Not connected (currently IEEE C37.118)

SW2	SW1	Selection of the Time Zone for the Output
off	off	Local time
off	on	UTC time
on	off	Standard time (local time without ST/WT changeover)
on	on	Not connected (currently local time)

4.2.1.3 Jumper J3/J4

The output amplitude BNC connector female A1/A2 is set via jumper J3/J4 (***chapter 4.2.4 Parameterization of the Output Amplitude (only applicable for analogue signals)***).

These jumpers are not available at outputs for digital outputs.

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4.2.2 Parameterization of the Synchronization Source

Adjustment via: DS1 / SW1-SW4 – Default: No Default-Setting

The Module 7628 can be synchronized by different time information. Using these modules in ***hopf*** basis systems the necessary settings are performed by default (ex Works).

Using the module in converter units the settings may be required by the customer.

This selection determines what kind of time information should be evaluated by the module.

Currently ***hopf*** specific time formats as well as the DCF77 pulse (1Hz) with local time (MEZ) are available for the synchronization.

01: ***hopf*** Binary string with PPS (NTP configuration)
02: ***hopf*** System-BUS 6000 with PPS
03: ***hopf*** System-BUS 7001 with PPS
04: ***hopf*** Master/Slave-String – Transmission cycle: Every minute
05: ***hopf*** Master/Slave-String – Transmission cycle: Every second
06: ***hopf*** Master/Slave-String with PPS – Transmission cycle: Every min.
07: ***hopf*** Master/Slave-String with PPS – Transmission cycle: Every sec.
08: DCF77 Pulse (1Hz) – Local time (MEZ)

There is no synchronization of the Module and also no generation of the signal for the output in case of an incorrect setting.

4.2.3 Parameterization of the Signal Outputs

The output of the IRIG-B signal can be parameterized for different applications.

4.2.3.1 Selection of the Output Format IRIG-B / IEEE C37.118 / AFNOR

Adjustment via: DS2 / SW3-SW5 – Default: OFF/OFF/OFF

This setting determines which of the available time (IRIG-B / IEEE C37.118 / AFNOR NF S87-500) should be put out at the connecting elements.

4.2.3.2 Signal Output in Relation to the Synchronization Signal

Adjustment via: DS2 / SW6-SW7 – Default: OFF/OFF

The behaviour of the signal output in relation to the internal condition of synchronization can be set.

If the module is in a synchronization state without having outputs, the outputs are inactive (no output of a carrier signal).

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Different output criteria can be set:

- **Signal output always when time is correct**
  By means of this synchronization signal a module internal clock is synchronized that independently runs until the next reset in case of a synchronization failure. This time basis is used for the signal generation if the synchronization signal is lost.
- **When the module is currently synchronized or the SyncOFF Timer is active**
  In this mode a signal output is only provided when the module is really synchronized by the internal synchronization signal **and** as long as the SyncOFF Timer is not expired (after synchronization failure).

  The SyncOFF Timer is automatically activated when the external synchronization of the module fails. The SyncOFF Timer is reset automatically after re-synchronization.
- **Only when the module is currently synchronized**
  With this adjustment only a signal output is provided while the module is really synchronized via the internal synchronization signal.
- **Output of test signal**
  For test purposes the output of an "IRIG-B signal" is possible with this setting even without synchronization of the module.

  For the test signal a fixed-programmed time information is used. After start of the module with an activated test signal a time loop of one hour is put out.

  The time loop starts with the fixed-programmed time value: **14:30h 27th April 2007**

  The output format of the test signal complies with the one selected via the DIP switch for the "normal" output.

4.2.3.3 Parameterization of the Value for the SyncOFF Timer

Adjustment via: DS1 / SW6-SW8 – Default: OFF/OFF/OFF

Based on the adjustment of the appropriate output mode the time for the output of signals after loss of the internal synchronization signal (e.g. in case of failure) can be determined via the SyncOFF Timer.

- Switch SW8 of DS1 is used for setting the increment of the time value.
- Switches SW6 to SW7 of DS1 are used for setting the factor for the increment.

These three switches allow the adjustment of the SyncOFF Timer from 20-80 minutes or rather from 2-8 hours.

4.2.3.4 Time Basis for Output IRIG-B / IEEE C37.118 / AFNOR

Adjustment via: DS2 / SW1-SW2 – Default: OFF/OFF

The synchronization sources supported by the module provide all necessary information in their protocols enabling the module to process the signal generation with the different time bases.

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4.2.4 Parameterization of the Output Amplitude (only applicable for analogue signals)

Adjustment via: J3 and J4 – Default: 2-3

The output amplitude for the connecting elements A1/A2 is set via the jumpers J3/J4. The load-dependent amplitude ranges are defined in ***Chapter 6 Technical Data***.

Jumper J3 for Output at Connecting Element A1	
1-2	Small amplitude
2-3	Large amplitude

Jumper J4 for Output at Connecting Element A2	
1-2	Small amplitude
2-3	Large amplitude

4.2.5 Parameterization of the Status LED (Green)

Adjustment via: DS2 / SW8 – Default: OFF

For the diagnosis of the internal synchronization signal the status LED (green) can be adjusted to indicate the internal input signal of the module 1:1.

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5 IRIG-B / IEEE C37.118 / AFNOR NF S87-500

The following telegrams / Time Code formats can be put out by Module 7628:

- IRIG-B according to IRIG Standard 200-98
- IRIG-B according to IRIG Standard 200-04
- IEEE C37.118-2005 (formerly IEEE 1344-1995)
- AFNOR NF S87-500

5.1 IRIG-B nach IRIG Standard 200-98

The IRIG-B format consists of a time code of 74 bits and a repeat rate of one second. The bit frame is 10msec. The quality rating of a bit is marked by the pulse width modulation and is a multiple of a millisecond.

For synchronisation on the beginning of the second a neutral logical condition is required named identifier.

- Logical 0 = 2msec H-level
- Logical 1 = 5msec H-level
- Identifier = 8msec H-level

The 74 time code bits are divided into

- 30 bits for the BCD value of the seconds, minutes and hours and the current day of the year
- 27 bits for the input of control information
- 17 bits for the binary value of the current seconds of the day

Within one second 100 bit frames can be transferred. Not used bit frames are completed with a logical zero.

Information referring to the year, difference time UTC to local time and status daylight saving time / winter time are not included in the telegram according to IRIG Standard 200-98.

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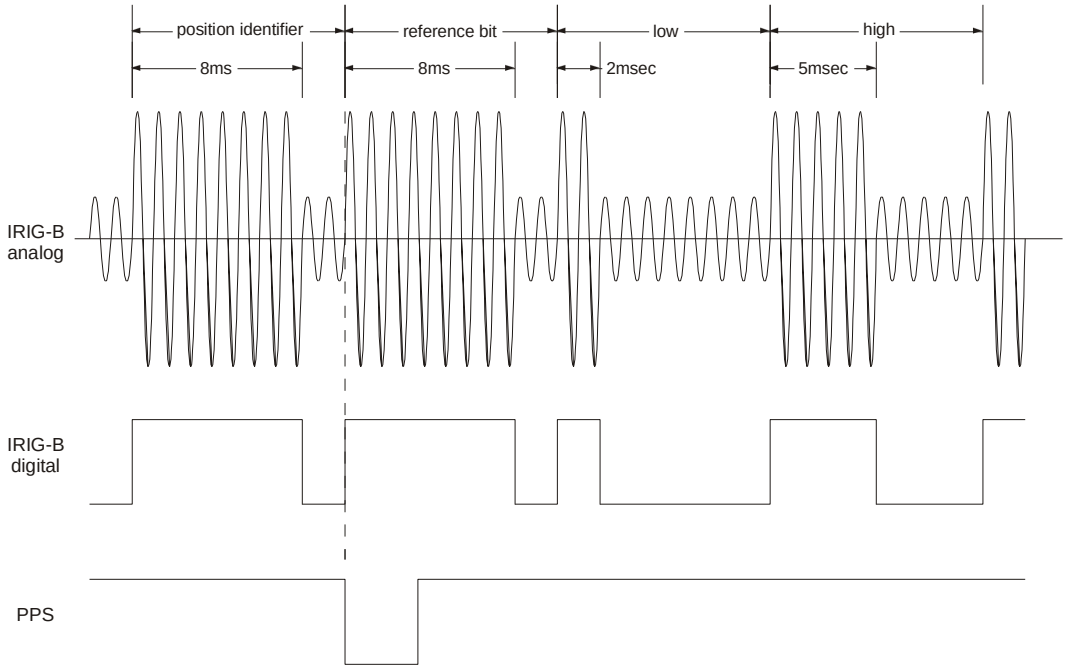
The below drawing shows the IRIG-B signal quality rating in analogue and digital format.



5.2 IRIG-B nach IRIG Standard 200-04

The IRIG-B Standard 200-04 is an extension of the Standard 200-98. Additional IRIG telegrams with extended information were defined.

For example, the current year is additionally sent in the first control information field. That enables the issue of complete time/date information

5.3 IEEE C37.118-2005 (formerly IEEE 1344-1995)

This version of the IRIG Standard is an extension of the IRIG Standard 200-98. The 27 bits of the control information field are occupied with fixed data as year, time offset between UTC and local time, daylight saving time / winter time status etc. It is downward compatible to the IRIG Standard 200-98 (the IRIG Standard 200-98 is included as a subset).

5.4 AFNOR NF S87-500

This IRIG standard is issued by the French Institute of Engineering Standard and is built up on the Standard IRIG 200-98. 27 bits of the control information field are occupied with fixed data as year, month etc. It is downward compatible to IRIG Standard 200-98 (the IRIG Standard 200-98 is included as a subset).

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6 Technical Data

The company ***hopf*** withhold the right to hard- and software alterations at any time.

General

General Data	
Operation	via DIP switch and jumper
Installation Position	any position
Protection Type of Board	IP00
Dimensions of Module	multi-layer board 80mm x 40mm
Power Supply	5V DC ± 5% (via internal plug-in connection)
Power Consumption	approx. 500mA when both outputs are under load with 50Ohm approx. 830mA when short-circuits at both outputs
MTBF	> 950,000 hours
Weight	approx. 0.05kg

Temperature Range	
Operation	0°C to +50°C
Storage	-20°C to +75°C
Humidity	max. 90%, non condensing

CE compliant to EMC Directive 89/336/EC and Low Voltage Directive 73/23/EC	
Safety / Low Voltage Directive	DIN EN 60950-1:2001 + A11 + Corrigendum
EN 61000-6-4	
EMC (Electromagnetic Compatibility) / Interference Immunity	EN 610000-4-2 /-3/-4/-5/-6/-11
EN 61000-6-2	EN 61000-3-2 /-3
Radio Interference Voltage EN 55022	EN 55022 Class B
Radio Interference Emission EN 55022	EN 55022 Class B

Analogue Signal Outputs

Potential Isolation	
Insulation Voltage:	at least 500V DC 1000MΩ

Output Voltage A1/A2		
Jumper J3/J4	**600 Ω Load Resistance**	**50 Ω Load Resistance**
Position 1-2	approx. 3.9 Vpp	approx. 2.8 Vpp
Position 2-3	approx. 7.5 Vpp	approx. 5.6 Vpp

IRIG-B Modulation Depth	3 : 1

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Digital Signal Outputs

Potential Isolation	
Insulation Voltage:	at least 500V DC 1000MΩ

Output Voltage D1/D2		
Output HIGH	Current: max. 40 mA	Voltage: 5V +/-10%
Output LOW	Current: max. -40 mA	Voltage: 0.0 - 0.6V

Supported Output Formats

IRIG-B / Bxx7 (time, year, second of the day) according to IRIG Standard 200-04
IRIG-B / Bxx3 (time, second of the day) according to IRIG Standard 200-04
IRIG-B / Bxx6 (time, year) according to IRIG Standard 200-04
IRIG-B / Bxx2 (time) according to IRIG Standard 200-04
IEEE C37.118-2005 (formerly IEEE 1344)
AFNOR NF S87-500

Accuracy

Synchronisation via serial String + PPS or rather via DCF77 Pulse	
Accuracy of generation (Offset to external PPS/DCF77 pulse):	+ 7 to 8µs
Jitter (Offset to external PPS/DCF77 pulse):	+/-40ns

Synchronisation via serial String	
Accuracy of implementation (Offset to serial time mark):	+ 180 to 220µs
Jitter (Offset to serial time mark):	+/-50µs

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