Industriefunkuhren

hopf
Elektronik GmbH

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Technical Manual

IRIG-B Output Board

Model 7265RC

ENGLISH

Version: 02.05 – 08.01.2015

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Valid for Devices 7265RC with FIRMWARE Version: **02.xx**

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.

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 and 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

This device fulfils the requirements of the EU directive 89/336/EWG "Electromagnetic compatibility" and 73/23/EWG "Low voltage equipment".

Therefore the device bears the CE identification marking (CE=Communauté Européenne)

CE = Communautes Europeénnes = 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.

Contents   Page

1 General Description of Functions

Board 7265RC is a 4-port IRIG-B/PPS pulse output board in euro format with a 3U/4HP front panel. It is designed for the *hopf* 7001RC GPS System in 19" (3U) rack.

The board is applicable for high-precision synchronization of external systems and data processor units.

Individually configurable different analogue and digital signals are assigned to the BNC outputs.

- Output of a IRIG-B signal generated on board 7265RC
    - IRIG IEEE 1344-1995
    - AFNOR NFS 87-500

> **i**   The IRIG-B 200-1995 Standard is contained as a subset in both modes.

- Output of the high-precise and internal system PPS pulse
- Output of analogue or digital signal from the internal system VG-ledge

Substantial parameters for individual applications are configured via the keypad of the *hopf* System 7001RC or the *hopf* Management Console (HMC).

The Basis System 7001RC can operate a maximum of 31 modularly and independently configurable boards 7265RC.

Board 7265RC provides Hot Plug capability allowing to remove and reinsert it at any free slot any time during operation of System 7001RC without influencing other system boards in their functionality.

2   Design of Function Board 7265RC

For each of the four (4) BNC outputs of board 7265RC four independently configurable signals A-D are individually available. A special Muxer-/Signal Router Switching guarantees the specific distribution of signals.

Signal B
- ○ PPS low active
- ○ PPS high active
- ○ digital IRIG B generated

Signal C
- ○ Signal from VG ledge C17
- ○ Signal from VG ledge C18

Signal A
- ○ Signal from VG ledge C12
- ○ analog IRIG B generated
- ○ digital IRIG B generated

Signal D
- ○ Signal from VG ledge C13

MUXER / Signal Router

BNC Output 1
- ○ Signal A
- ○ Signal B
- ○ Signal C
- ○ Signal D

BNC Output 2
- ○ Signal A
- ○ Signal B
- ○ Signal C
- ○ Signal D

BNC Output 3
- ○ Signal A
- ○ Signal B
- ○ Signal C
- ○ Signal D

BNC Output 4
- ○ Signal A
- ○ Signal B
- ○ Signal C
- ○ Signal D

2.1 Front Panel 3U/4HP of Board 7265RC

Board 7265RC has a 3U/4HP front panel for 19" systems, with the following components:

3U/4HP Front Panel

Send-/System Bus-LED - access to the internal system bus

BNC connector - Output 1

BNC connector - Output 2

BNC connector - Output 3

BNC connector - Output 4
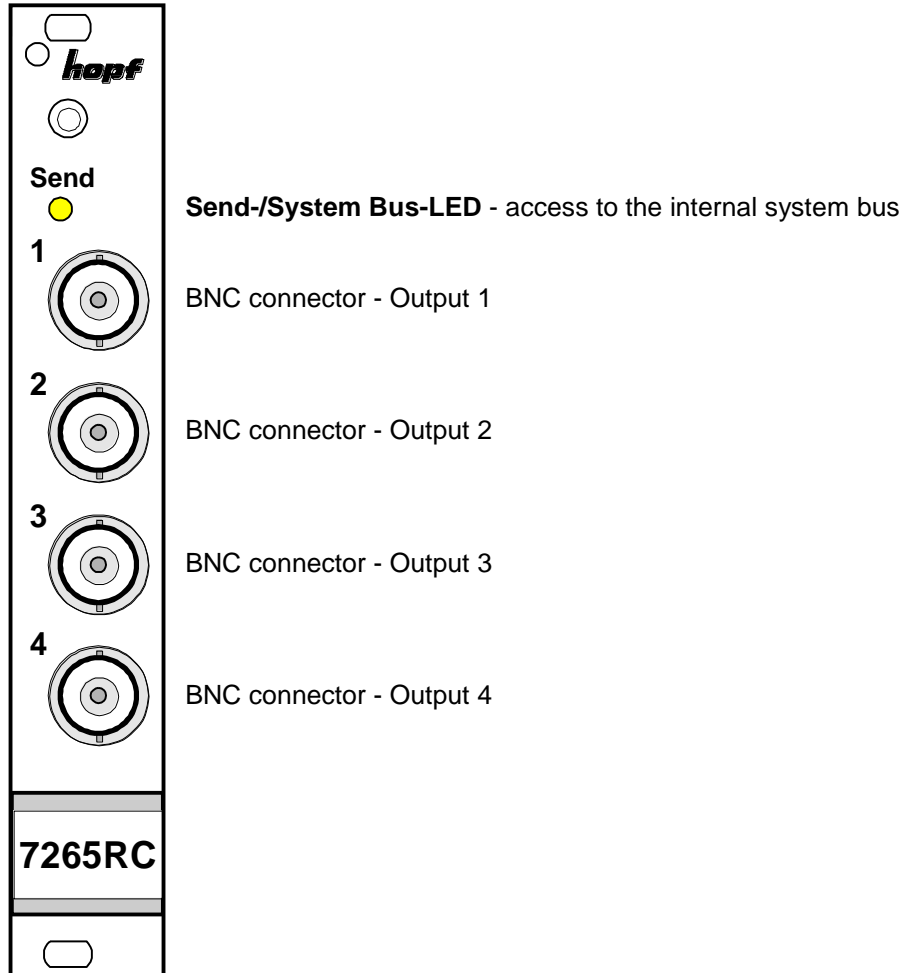
7265RC

2.1.1 SEND-LED

The different states of the board are displayed by the LED:

SEND-LED (yellow)	Meaning
blinking / flicker	**Normal operating**, access to the internal system bus. Board 7265RC is integrated correctly into the system 7001RC.
off	Board 7265RC is not ready for operation.
on	Error on the Board 7265RC.

2.1.2 BNC Output 1-4

BNC connector for output of individual adjusted analogue / digital signals.

2.2 Assembly Overview of Board 7265RC
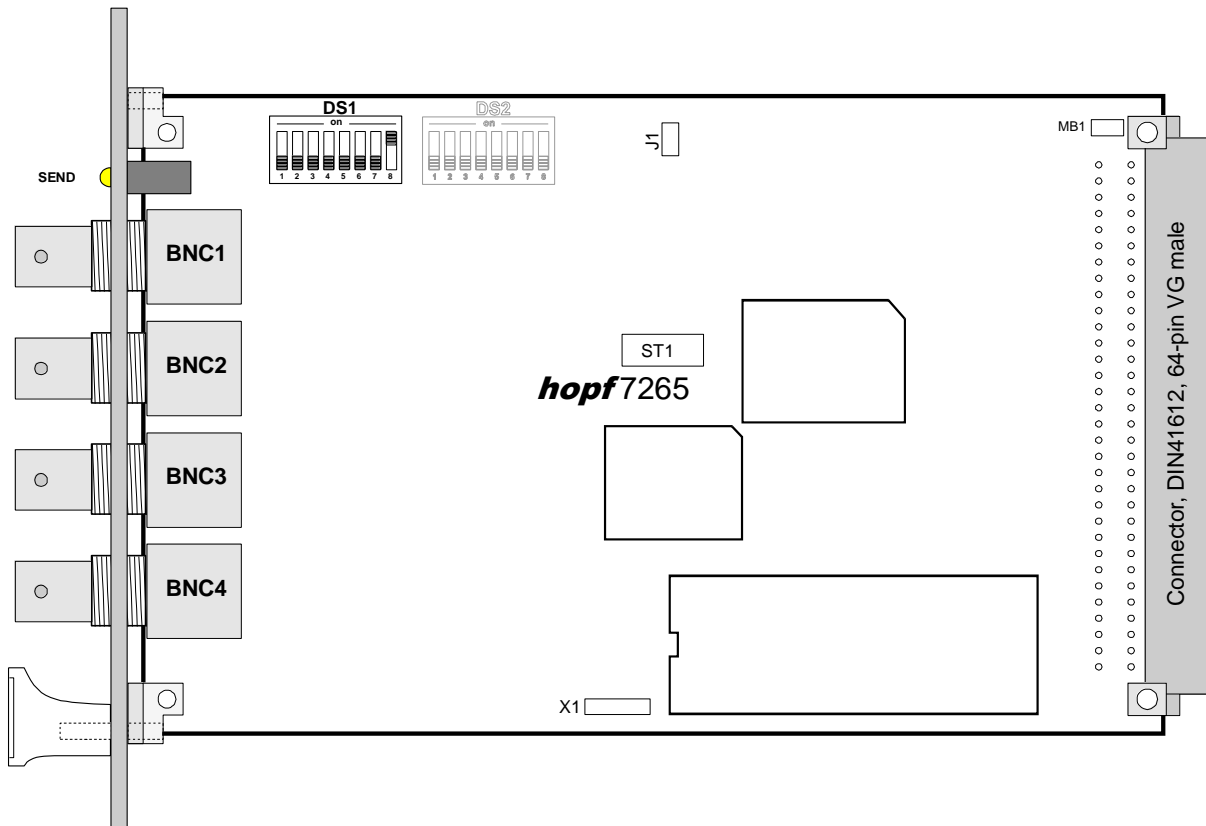
2.2.1 DIP-Switch DS1 / DS2

With DIP-Switch DS1 the system board number is adjusted.

DIP-Switch DS1	Function
8	
7	
6	board number (1-31) in system 7001RC (see chapter *3.1 Identification of the Board Numbers available*)
5	
4	
3	free
2	free
1	free

DIP-Switch DS2 without any function at this time.

2.2.2 Service Plug ST1, X1, J1, MB1

Only for factory use.

2.3 VG Ledge 64-pin male (DIN 41612)
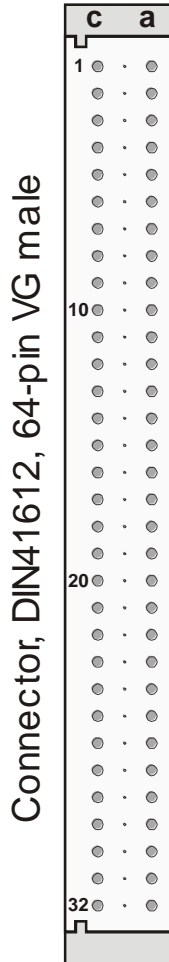
Connector, DIN41612, 64-pin VG male

pin	c		a	pin
1				1
2				2
3	IO01			3
4	IO02			4
5	ERRO			5
6	/IRIG B out TTL			6
7	IRIG B out TTL			7
8	/PPS out TTL			8
9	PPS out TTL			9
10				10
11	GND			11
12				12
13	IN C12			13
14	IN C13			14
15	IN C14			15
16	GND			16
17	IN C17			17
18	IN C18			18
19	GND			19
20				20
21				21
22				22
23				23
24			PPS	24
25				25
26				26
27				27
28				28
29				29
30				30
31	GND		GND	31
32	+5V DC		VCC / 5Volt	32

Row B not in use!

3 Embedding the Board 7265RC in the System 7001RC

All RC function boards are individually parameterized from the system 7001RC.

> **i** Every RC function board is uniquely identified via the board type and an assigned board number (1-31)

The following requirements and steps are necessary for implementation:

- A free extension slot must be available in the basis system
- Not more than 30 boards of this type implemented in the system
- Setting up a free board number with the DIP switch on the board 7265RC
- Installation of the board 7265RC in the system 7001RC (hot-plug)
- Parameterization of the board 7265RC by the HMC remote software
- Activation of the board 7265RC via the system 7001RC

3.1 Identification of the Board Numbers available

The board numbers allocated so far can be displayed via the **SHOW ALL ADDED SYSTEM-BOARDS** menu. The board numbers that are not listed for this board type are available for the new board.

> **!** Boards that are available in terms of hardware, but which have not yet been activated via the system menu, are **not** listed in the **SHOW ALL ADDED SYSTEM-BOARDS** menu. (The "SEND" LED of these boards does not flash when in operation.)
>
> In order to identify the set board number, these boards must be made available externally, in order to identify the set board number from the DIP switch setting.

3.2 Set the Board Number

In order to clearly identify and configure the different boards 7265RC in the basis system, they must be set to a system board number.

> ⚠ **Under no circumstances** may two boards of the same type with the same board number be embedded in one system 7001RC. This leads to undefined errors on both boards.

The board number must be defined via the (**DS1**) DIP switch bank of board 7265RC.

DS1

 ⇨ **Board 01**
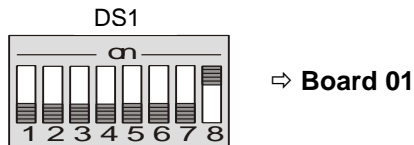
DS1 Pos 4	DS1 Pos 5	DS1 Pos 6	DS1 Pos 7	DS1 Pos 8	board number in System 7001RC
off	off	off	off	off	-
off	off	off	off	on	1
off	off	off	on	off	2
off	off	off	on	on	3
off	off	on	off	off	4
off	off	on	off	on	5
off	off	on	on	off	6
off	off	on	on	on	7
off	on	off	off	off	8
off	on	off	off	on	9
off	on	off	on	off	10
off	on	off	on	on	11
off	on	on	off	off	12
off	on	on	off	on	13
off	on	on	on	off	14
off	on	on	on	on	15
on	off	off	off	off	16
on	off	off	off	on	17
on	off	off	on	off	18
on	off	off	on	on	19
on	off	on	off	off	20
on	off	on	off	on	21
on	off	on	on	off	22
on	off	on	on	on	23
on	on	off	off	off	24
on	on	off	off	on	25
on	on	off	on	off	26
on	on	off	on	on	27
on	on	on	off	off	28
on	on	on	off	on	29
on	on	on	on	off	30
on	on	on	on	on	31

3.3 Installation of a new Board 7265RC in the System 7001RC

In order to install a new board 7265RC, a free extension slot (slot with board conductor and VG ledge installed in the system bus) must be available. This information can be obtained from the associated specific system drawing.

If no free extension slot is available, this can usually be retrofitted. Please contact **hopf** Elektronik GmbH.

3.4 Parameterize/activating Board 7265RC in the System 7001RC

The following steps are required to activate the board:

> ⚠ To avoid undesirable output behaviour of the board it is first parameterized and then activated by switching it into the monitoring system.

- In **BOARD-SETUP** menu, sub-heading **ADD SYSTEM-BOARDS**, log on the newly installed board.

- In **BOARD-SETUP** menu, sub-heading **SET SYSTEM BOARDS PARAMETER** parameterize the board (see *chapter 4.1 Input Functions for the Board 7265RC in the System 7001RC*).

- In **BOARD-SETUP** menu, sub-heading **SET SYSTEM BOARDS TO MONITORING-MODE OR IDLE-MODE** integrate the newly installed board into the monitoring system.

> ⚠ The menus:
> - **ADD SYSTEM-BOARDS** and
> - **SET SYSTEM BOARDS TO MONITORING-MODE OR IDLE-MODE**
>
> can be consulted in the technical specification of the system 7001RC.

4 Administration of the Board 7265RC

The technical manual of the System 7001RC is the basis for the configuration. Below only the input of values are described which are located in the menu **BOARD-SETUP**.

> **i** All parameters can be activated also in the system 7001RC with the associated HMC software (see technical manual *hopf* management console).

> **!** The menu **SET SYSTEM-BOARDS PARAMETER** has to be completely finished by pressing the | **ENT** | key so that the System 7001RC accepts the newly configured parameters.

4.1 Input Functions for the Board 7265RC in the System 7001RC

The input and display functions of the board parameters are polled in the menu heading **BOARD-SETUP:4**

with | **ENT** | key   ⇨ Main menu
with | **4** | key   ⇨ Board setup
with | **N** | key   ⇨ Scroll to menu heading:

```
SET  SYSTEM-BOARDS  PARAMETER   Y/N
```

Select with key | **Y** |

Search for board to be parameterized with key | **N** | and select with key | **Y** |

Example:

```
PARAMETER  BOARD  03  OF  25    7265  NO.:01
STATUS:I/E    BOARDNAME:"IRIG     "  SET>Y/N
```

PARAMETER BOARD 03 OF 25   ⇨ Board 03 of a total of 25 implemented boards

7265 NR.: 01   ⇨ board type **7265RC** with board number **01**

STATUS: M /-   ⇨ **M** = monitoring / **–** = without error operating - **or**

       I/**E**   ⇨ **I** = no monitoring / **E** = board error

BOARDNAME: "IRIG_ _ _ _"   ⇨ Board name freely selectable by customer

4.1.1 Parameter Byte Input - Parameter Byte 01

Various board parameters are set using the parameter byte menu. A function is allocated to each bit. These functions are explained in the following tables. A function is activated with **1** and deactivated with **0**.

```
B.7265 NO.:01    OLD: BYTE 01 >00001111<
BYTE = BIT 7..0  NEW: BYTE 01 >01100000<
```

The current parameter byte is shown in the upper line with its number (01) and the preset values. The bits of the parameter byte are numbered in descending order:

```
BYTE 01 >7 6 5 4 3 2 1 0<
```

By pressing (**ENT**)er it is possible to jump straight to the next menu without making any changes.

To make a change the individual bits of the new byte are to be entered in the second line with **0** and **1**. The complete parameter byte (PB) must always be entered and confirmed with (**ENT**)er.

Parameter Byte 01		Function
Bit 7	**Bit 6**	**Signal B**
0	0	PPS pulse low active
0	1	PPS pulse high active
1	0	internal IRIG-B Format B00x (see PB01 bit 1, 2, 3)
1	1	internal IRIG-B Format B00x (see PB01 Bit 1, 2, 3)
Bit 5	**Bit 4**	**Signal A**
0	0	IRIG-B Bxxx format external input (VG ledge pin c12)
0	1	IRIG-B B12x format generated 1 KHz Sinus carrier with 3:1 modulation
1	0	IRIG-B B00x format generated TTL level
1	1	IRIG-B B12x format generated 1 KHz Sinus carrier with 3:1 modulation
Bit 3		**IRIG B format (internally generated)**
1		AFNOR NF S 87-500 standard 200-89 as subset
0		IEEE-1344-1995 standard 200-89 as subset
Bit 2		**IRIG B time basis (internally generated)**
1		UTC time basis
0		local time basis
Bit 1		**IRIG B binary 'seconds of day' (internally generated)**
1		output without binary 'seconds of day'
0		output with binary 'seconds of day'
Bit 0		**Signal C**
1		frequency source B (VG ledge pin c18)
0		frequency source A (VG ledge pin c17)

4.1.1.1 Bit 7/6, Selecting Signal B

With bit 7 and 6 of parameter byte 01 one of the following four signals will be assigned to Signal B.

Bit 7	Bit 6	Function
1	1	On board 7265RC generated signal IRIG-B00x
1	0	On board 7265RC generated signal IRIG-B00x
0	1	PPS pulse, high active
0	0	PPS pulse, low active

4.1.1.2 Bit 5/4, Selecting Signal A

With bit 5 and 4 of parameter byte 01 one of the following signals will be assigned to Signal A.

Bit 5	Bit 4	Signal A
0	0	IRIG-B Bxxx format external input (VG ledge pin c12)
0	1	IRIG-B B12x format generated 1 KHz Sinus carrier with 3:1 modulation
1	0	IRIG-B B00x format generated TTL level
1	1	IRIG-B B12x format generated 1 KHz Sinus carrier with 3:1 modulation

4.1.1.3 Bit 3, Select IRIG-B Format IEEE-1344 or AFNOR

With bit 3 of parameter byte 01 the output format of the generated IRIG B signal of board 7265RC is set.

Bit 3	Function
1	AFNOR NF S 87-500
0	IEEE-1344-1995

> **i** In both modes the Standard **IRIG-B 200-1995** is contained as subset.

4.1.1.4 Bit 2, Time Basis of IRIG-B Signals

With bit 2 of parameter byte 01 the time base of the generated IRIG-B signal of board 7265RC is set.

Bit 2	Function
1	UTC time base
0	Local time base

4.1.1.5 Bit 1, Inserting 'Seconds of Day' in IRIG-B Signal

With bit 1 of parameter byte 01 the output of the binary 'seconds of day' from the generated IRIG-B signal will be inhibit.

Bit 1	Function
1	Output without binary 'seconds of day'
0	Output with binary 'seconds of day'

4.1.1.6 Bit 0, Selecting Signal C

With bit 0 of parameter byte 01 one of the following signals will be assigned to Signal C.

Bit 0	Signal C	
1	Frequency source B	(VG ledge pin c18)
0	Frequency source A	(VG ledge pin c17)

4.1.2 Enter Parameter Byte 02 - Selecting BNC Outputs 1 - 4

Parameter byte 02 is shown on the upper line with the currently set values.

```
B.7265 NO.:01    OLD:  BYTE 02 >00000000<
BYTE = BIT 7..0 NEW:  BYTE 02 >_         <
```

In order to make a change, the individual bits of the new byte are entered on the second line, using **"0"** and **"1"**. The complete parameter byte must always be registered and confirmed by pressing the ENT key.

The bits of the parameter byte are numbered in descending order:

```
BYTE 02 >7 6 5 4 3 2 1 0<
```

Parameter Byte 02		Selecting Signal Source for BNC Output
Bit 7	**Bit 6**	**BNC Output 1**
0	0	Signal A
0	1	Signal C
1	0	Signal D
1	1	Signal B
Bit 5	**Bit 4**	**BNC Output 2**
0	0	Signal A
0	1	Signal C
1	0	Signal D
1	1	Signal B
Bit 3	**Bit 2**	**BNC Output 3**
0	0	Signal A
0	1	Signal C
1	0	Signal D
1	1	Signal B
Bit 1	**Bit 0**	**BNC Output 4**
0	0	Signal A
0	1	Signal C
1	0	Signal D
1	1	Signal B

4.1.2.1 Bit 7/6, BNC Output 1

With bit 7 and 6 of parameter byte 02 one of the following signals will be assigned to the BNC output 1.

Bit 7	Bit 6	BNC Output 1
0	0	Signal A (see parameter byte 01 - bit 1-5)
0	1	Signal C (see parameter byte 01 - bit 0)
1	0	Signal D (VG ledge pin c13)
1	1	Signal B (see parameter byte 01 - bit 7/6)

4.1.2.2 Bit 5/4, BNC Output 2

With bit 5 and 4 of parameter byte 02 one of the following signals will be assigned to the BNC output 2.

Bit 5	Bit 4	BNC Output 2
0	0	Signal A (see parameter byte 01 - bit 1-5)
0	1	Signal C (see parameter byte 01 - bit 0)
1	0	Signal D (VG ledge pin c13)
1	1	Signal B (see parameter byte 01 - bit 7/6)

4.1.2.3 Bit 3/2, BNC Output 3

With bit 3 and 2 of parameter byte 02 one of the following signals will be assigned to the BNC output 3.

Bit 3	Bit 2	BNC Output 3
0	0	Signal A (see parameter byte 01 - bit 1-5)
0	1	Signal C (see parameter byte 01 - bit 0)
1	0	Signal D (VG ledge pin c13)
1	1	Signal B (see parameter byte 01 - bit 7/6)

4.1.2.4 Bit 1/0, BNC Output 4

With bit 1 and 0 of parameter byte 02 one of the following signals will be assigned to the BNC output 4.

Bit 1	Bit 6	BNC Output 4
0	0	Signal A (see parameter byte 01 - bit 1-5)
0	1	Signal C (see parameter byte 01 - bit 0)
1	0	Signal D (VG ledge pin c13)
1	1	Signal B (see parameter byte 01 - bit 7/6)

4.1.3 Enter Parameter Byte 03 (No Function at Present)

Parameter byte 03 is shown on the upper line with the currently set values.

```
B.7265 NO.:01    OLD: BYTE 03 >00000000<
BYTE = BIT 7..0 NEW: BYTE 03 >_          <
```

In order to make a change, the individual bits of the new byte are entered on the second line, using **"0"** and **"1"**. The complete parameter byte must always be registered and confirmed by pressing the ENT key.

The bits of the parameter byte are numbered in descending order:

```
BYTE  03  >7 6 5 4 3 2 1 0<
```

Bit 7-0	Currently without a function
0	For compatibility reasons these bits must always be set to **"0"**.

5   IRIG-B Format

Serial output of time information with the 7265 board is in IRIG format. There are varying IRIG time codes which differ as to the repeatability frame and the number of bits transmitted. They are identified by means of the attachment of a letter in alphabetical order A, B, C, D etc.. The most frequently used time frame is the IRIG-B Code.

The implemented IRIG-B generator on board 7265RC in relation with different hardware interfaces provide the supply of different IRIG-B formats.

The IRIG-B output is possible as TTL signal (IRIG-B 00x) or as an analogue amplitude-modulated signal (for example IRIG-B 123).

5.1   IRIG Standard 200-98, Timing Diagram

The IRIG-B format consists of one time code with 74 bits and has a repeatability rate of one second. The bit frame is 10 msec. The rating of a bit is displayed by a pulse width modulation and is shown in multiples of a millisecond.

To synchronize to the beginning of a second a neutral logic status is required which is called the identifier.

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

The 74 time code bits are divided into

30 bits for the BCD value of seconds, minutes, hours and the current day of year

27 bits for the input of control information

17 bits for the binary value of the current 'seconds of day'

100 bit frames can be transmitted in one second. Unused bit frames are refilled with a logical zero.
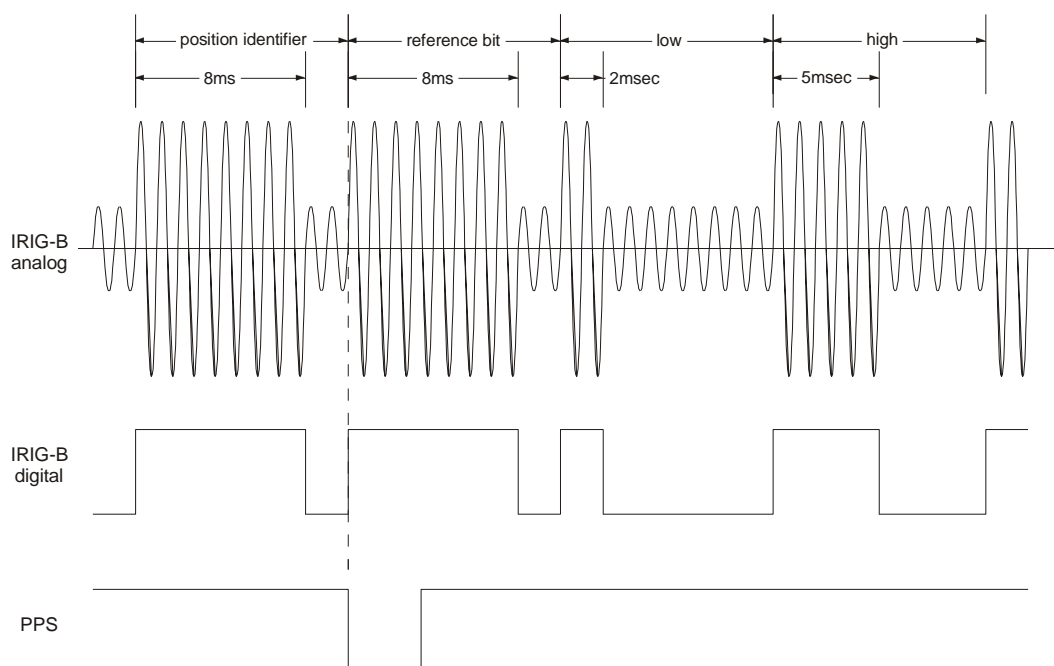
5.1.1 IRIG-B Signal Output digital/analogue

Serial output can be a TTL level (IRIG-B 00x) or an analogue amplitude-modulated signal.

With analogue output the positive zero cycle of a sinus oscillation is modulated with the rising edge of the IRIG-B signal.

The rate of modulation for the signal information of H/L level should be between 3:1 and 6:1.

5.2 Format Categories IRIG-Bxxx

Signal output can be digital or analogue and also with different data content. The variations are indicated by attaching a three-digit combination of figures.

The figures have the following meaning:

Figure 1	0	= digital output
	1	= analogue output via carrier
Figure 2	0	= no carrier
	1	= carrier 100 Hz
	2	= carrier 1000 Hz
Figure 3	0	= data content of complete time code with 74 bits
	1	= data content time information 30 bit + control information 27 bit
	2	= data content time information 30 bit
	3	= data content time information 30 bits + binary seconds of day 17 bit

e.g. **IRIG-B123** = analogue output, carrier 1000 Hz,
                 = data content time information and binary seconds of day

5.2.1 Extensions IRIG IEEE 1344-1995

This IRIG standard is based on IRIG Standard 200-98. Fixed data such as year, time offset etc. are assigned to the 27 bits of the control information field. The IRIG Standard 200-98 is contained as a subset in both modes.

5.2.2 Extension AFNOR NFS 87-500

This IRIG standard has been laid down by the French institute for standards. It is based on Standard IRIG-B 200. Fixed data such as year, month etc. are assigned to the 27 bits of the control information field. The IRIG Standard 200-98 is contained as a subset in both modes.

6 Technical Data

Board dimensions:	Euro board 100mm x 160mm, 3U / 4HP
Power supply:	+5V DC ± 5% (via system bus)
Charging rate:	approx. 400 mA
Temperature range	
Storage:	- 30 ... + 85 °C
Operation:	0 ... + 70 °C
Humidity:	95 %, no dew
Standards:	CE
Protection category:	none
MTBF:	> 440,000 hrs.
Electrical features (on VG plug connector):	
Inputs / outputs:	TTL compatible

Analogue Outputs

Load capacity:	$3.1V_{pp}$ to 50Ω
	$3.7V_{pp}$ to 600Ω

Digital Outputs (as TTL outputs)

Load capacity:	Output current Imax = 38mA
IRIG-B digital:	High active
PPS:	High active / low active

Frequency input analogue

Frequency:	from 1kHz to 10MHz
Amplitude:	max. $2V_{pp}$

Frequency input digital (TTL-compatible)

Frequency:	from 1kHz to 10MHz

Accuracy Board 7265RC	**to PPS of the control board**	
IRIG-B (analogue/digital)	offset	-40 µs ±10 µs
	jitter	±1 µs
PPS	offset	-40 ns ±10 ns

7   Glossary

GPS	Global Positioning System
UTC	Universal Time Coordinated with correction of the leap second
GPS-UTC	Continuous world time without correction of the leap second
IRIG	Inter Range Instrumentation Group
AFNOR	Association francaise de normalisation
PPS	Pulse per second
NTP	Network Time Protocol
3D	three dimensional determination of position, longitude, latitude and altitude
GHz	one billion Hertz
ppb	part per billion = 1E -9
ppm	part per million = 1E -6
msec	one thousandth second
µsec	one millionth second