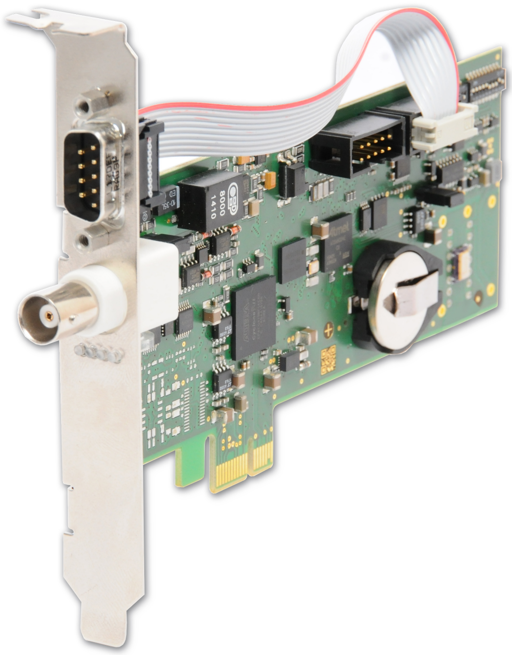

MANUAL

TCR180PEX-EL

Time Code Reader

April 23, 2024

Meinberg Funkuhren GmbH & Co. KG

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1 Copyright and Liability Exclusion

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2 Imprint

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3 Safety instructions for Building-in Equipment

3.1 Important Safety Information and Safety Precautions

The following safety information must be observed whenever the device is being installed or operated. Failure to observe this safety information and other special warnings or operating instructions in the product manuals constitutes improper usage and may violate safety standards and the manufacturer's requirements.

Depending on the configuration of your device or installed options, some information may not specifically apply to your device.

The device satisfies the requirements of the following EU regulations: EMC Directive, Low Voltage Directive, RoHS Directive and—where applicable—the Radio Equipment Directive.

If a procedure is marked with the following signal words, you may only proceed with it if you have understood and fulfilled all requirements. Hazard notices and other relevant information are classified and indicated as such in this manual according to the following system:

DANGER!
This signal word indicates a hazard with a high risk level . Such a notice refers to a procedure or other action that will very likely result in serious injury or even death if not observed or if improperly performed.

WARNING!
This signal indicates a hazard with a medium risk level . Such a notice refers to a procedure or other action that may result in serious injury or even death if not observed or if improperly performed.

CAUTION!
This signal word indicates a hazard with a low risk level . Such a notice refers to a procedure or other action that may result in minor injury if not observed or if improperly performed.

ATTENTION!
This signal word refers to a procedure or other action that may result in product damage or the loss of important data if not observed or if improperly performed.

3.2 Used Symbols

The following symbols and pictograms are used in this manual. Pictograms are used in particular to indicate potential hazards in all hazard categories.

Symbol	Beschreibung / Description
	IEC 60417-5031 Gleichstrom / *Direct current*
	IEC 60417-5032 Wechselstrom / *Alternating current*
	IEC 60417-5017 Erdungsanschluss / *Earth (ground) terminal*
	IEC 60417-5019 Schutzleiteranschluss / *Protective earth (ground) terminal*
	ISO 7000-0434A Vorsicht / *Caution*
	IEC 60417-6042 Vorsicht, Risiko eines elektrischen Schlages / *Caution, risk of electric shock*
	IEC 60417-5041 Vorsicht, heiße Oberfläche / *Caution, hot surface*
	IEC 60417-6056 Vorsicht, Gefährlich sich bewegende Teile / *Caution, moving parts*
	IEC 60417-6172 Trennen Sie alle Netzstecker / *Disconnect all power connectors*
	IEC 60417-5134 Elektrostatisch gefährdete Bauteile / *Electrostatic Discharge Sensitive Devices*
	IEC 60417-6222 Information generell / *General information*
	2012/19/EU Dieses Produkt fällt unter die B2B Kategorie. Zur Entsorgung muss es an den Hersteller übergeben werden. *This product is handled as a B2B-category product. To ensure that the product is disposed of in a WEEE-compliant fashion, it must be returned to the manufacturer.*

3.3 Product Documentation

Extensive documentation for the product is provided on the Meinberg Customer Portal – https://www.meinberg.support

The manuals can also be downloaded from the Meinberg website at https://www.meinbergglobal.com/english/docs/. On our website you can enter your system name into the search box at the top of the page to find the desired manual. If you have any questions or problems, our support team will be pleased to help you.

This manual contains important safety instructions for the installation and operation of the device. Please read this manual thoroughly before using the device.

This device may only be used for the purpose described in this manual. In particular, the specified operating limits of the device must be heeded. The person setting up the device is responsible for safety matters in relation to any larger system in which the device is installed!

Failure to observe these instructions may have an adverse impact on device safety!

Please keep this manual in a safe place.

This manual is only intended to be used by qualified electricians, or by persons who have been appropriately instructed by a qualified electrician and who are familiar with applicable national standards and with safety rules & regulations. This device may only be installed, set up, and operated by qualified personnel.

3.4 Safety Hints TCR180PEX-EL

This building-in equipment has been designed and tested in accordance with the requirements of Standard DIN EN 62368-1 "Audio/video, information and communication technology equipment - Part 1: Safety requirements).

During installation of the building-in equipment in an end application (i.e. PC) additional requirements in accordance with Standard DIN EN 62368-1 have to be taken into account.

General Safety instructions

- The building-in equipment has been evaluated for use in office environment (pollution degree 2) and may be only used in this environment. For use in rooms with a higher pollution degree more stringent requirements are applicable.
- The equipment/building-in equipment was evaluated for use in a maximum ambient temperature of 50°C.
- Protection against fire must be assured in the end application.

3.5 Prevention of ESD Damage

ATTENTION!

An ESDS device (electrostatic discharge-sensitive device) is any device at risk of damage or malfunction due to electrostatic discharges (ESD) and thus requires special measures to prevent such damage or malfunction. Systems and modules with ESDS devices usually bear the following symbol:

Symbol Indicating Devices with ESDS Components

The following measures will help to protect ESDS components from damage and malfunction.

When preparing to dismantle or install devices:
Ground your body (for example, by touching a grounded object) before touching sensitive devices.

Ensure that you wear a grounding strap on your wrist when handling such devices. These straps must in turn be attached to an uncoated, non-conductive metal part of the system.

Use only tools and devices that are free of static electricity.

When transporting devices:
Devices must only be touched or held by the edges. Never touch any pins or conductors on the device.

When dismantling or installing devices:
Avoid coming into contact with persons who are not grounded. Such contact may compromise your connection with the earth conductor and thus also compromise the device's protection from any static charges you may be carrying.

When storing devices:
Always store devices in ESD-proof ("antistatic") bags. These bags must not be damaged in any way. ESD-proof bags that are crumpled or have holes cannot provide effective protection against electrostatic discharges.

ESD-proof bags must have a sufficient electrical resistance and must not be made of conductive metals if the device has a lithium battery fitted on it.

3.6 Cabling

WARNING!

Danger of death from electric shock! Never work on cables while the power is live!
Always disconnect the cables from the devices at **both** ends before working on
the plugs and terminals of connected cables!

3.7 Replacing the Lithium Battery

Skilled/Service-Personnel only: Replacing the Lithium Battery
The life time of the lithium battery on the receiver boards is at least 10 years. If the need arises to replace the battery, the following should be noted:

There is a Danger of explosion if the lithium battery is replaced incorrectly. Only identical batteries or batteries recommended by the manufacturer must be used for replacement.

The waste battery has to be disposed as proposed by the manufacturer of the battery.

4 Important Product Information

4.1 CE Marking

This product bears the CE mark as is required to introduce the product into the EU Single Market.

The use of this mark is a declaration that the product is compliant with all requirements of the EU directives effective and applicable as at the time of manufacture of the product.

These directives are listed in the EU Declaration of Conformity, appended to this manual as Chapter 15.

4.2 UKCA Marking

This product bears the British UKCA mark as is required to introduce the product into the United Kingdom (excluding Northern Ireland, where the CE marking remains valid).

The use of this mark is a declaration that the product is in conformity with all requirements of the UK statutory instruments applicable and effective as at the time of manufacture of the product.

These statutory instruments are listed in the UK Declaration of Conformity, appended to this manual as Chapter 16.

4.3 Maintenance and Modifications

Important!

Before performing any maintenance work on or authorized modification to your Meinberg system, we recommend making a backup of any stored configuration data (e.g., to a USB flash drive using Meinberg Device Manager).

4.3.1 Replacing the Battery

Your device's clock module is fitted with a lithium battery (type CR2032) that is used to locally storage almanac data and sustain operation of the real-time clock (RTC) in the reference clock.

This battery has a life of at least ten years. However, if the device exhibits the following unexpected behaviors, the voltage of the battery may have dropped below 3 V, and the battery will need to be replaced:

- The reference clock has the wrong date or wrong time when the system is started.
- The reference clock repeatedly starts in Cold Boot mode (i.e., upon starting, the system has no ephemeris data saved whatsoever, resulting in the synchronization process taking a very long time due to the need to rediscover all of the visible satellites).
- Some configuration options relating to the reference clock are lost every time the system is restarted.

In this case, you should not replace the battery on your own. Please contact the Meinberg Technical Support team, who will provide you with precise guidance on how to perform the replacement.

4.4 Disposal

Disposal of Packaging Materials

The packaging materials that we use are fully recyclable:

Material	Use for	Disposal
Polystyrene	Packaging frame/filling material	Recycling Depot
PE-LD (Low-density polyethylene)	Accessories packaging, bubble wrap	Recycling Depot
Cardboard	Shipping packaging, accessories	Paper Recycling

For information on the proper disposal of packaging materials in your specific country, please inquire with your local waste disposal company or authority.

Disposal of the Device

This product falls under the labeling obligations of the Waste Electrical and Electronic Equipment Directive 2012/19/EU ("*WEEE Directive*") and thus bears this WEEE symbol. The presence of this symbol indicates that this electronic product may only be disposed of in accordance with the following provisions.

Important!

Do not dispose of the product or batteries via the household waste. Inquire with your local waste disposal company or authority on how to best dispose of the product or battery if necessary.

This product is considered to be a "**B2B**" product for the purposes of the WEEE Directive and is also classified as "**IT and Telecommunications Equipment**" in accordance with Annex I of the Directive.

It can be returned to Meinberg for disposal. Any transportation expenses for returning this product (at end-of-life) must be covered by the end user, while Meinberg will bear the costs for the waste disposal itself. If you wish for Meinberg to handle disposal for you, please get in touch with us. Otherwise, please use the return and collection systems provided within your country to ensure that your device is disposed of in a compliant fashion to protect the environment and conserve valuable resources.

Disposal of Batteries

Please consult your local waste disposal regulations for information on the correct disposal of batteries as hazardous waste.

5 TCR180PEX-EL Features

The board TCR180PEX-EL has been designed as a "low profile" board for computers with PCI Express interface. Data transfer to the computer is done via a single PCI Express lane (x1 board). The TCR180PEX-EL card decodes modulated (AM) and unmodulated (DC Level Shift, DCLS) IRIG-A/B, AFNOR NF S87-500, IEEE C37.118, or IEEE 1344 time codes. AM codes are transmitted by modulating the amplitude of a sine wave carrier, unmodulated codes by variation of the width of pulses.

The TCR180PEX-EL is equipped with a TCXO oscillator which is disciplined as log as an input signal is available, and provides accurate time in holdover mode if the input signal is disconnected.

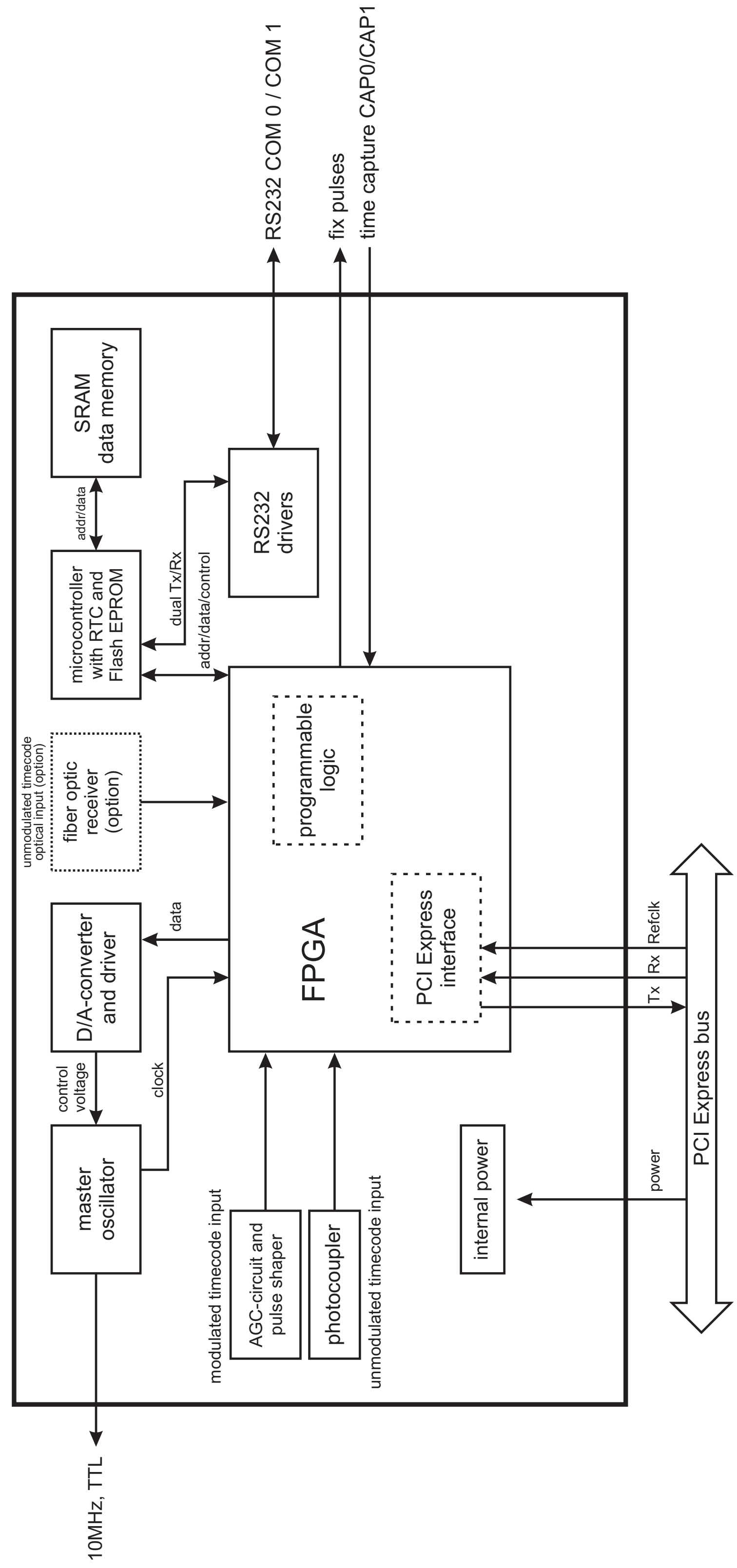
Receiver:
Automatic gain control within the receive circuit for unmodulated codes allows decoding of IRIG-A/B, AFNOR NF S87-500, IEEE C37.118 or IEEE 1344 signals with a carrier amplitude of 600 mVpp to 8 Vpp. The input stage is electrically insulated and has an impedance of either 50 Ω, 600 Ω or 5 kΩ, selectable by a jumper. Modulated input signals can be supplied via BNC connector in the TCR180PEX-EL's bracket.

Unmodulated (DC Level Shift, DCLS) time codes have to supplied via the card's 9 pin D-Sub connector. The receive circuit is insulated by an onboard photocoupler which can be driven by TTL or RS-422 signals for example. When the card is shipped the contacts of the D-Sub connector are not wired to the photocoupler. Two DIP switches have to be set to the 'ON' position to make the inputs available via the connector.

Optionally the TCR180PEX-EL can be delivered with an optical input. The card provides two configurable serial interfaces (RS-232) COM. COM0 is available via the Sub-D connector, COM1 is accessible via an extra ribbon cable connector on the board.

The extra ribbon cable connector on the board also provides two TTL inputs (CAP0 and CAP1) that can be used to time stamp external, asynchronous trigger slopes. The captured time stamps can be retrieved via the PCI-bus, or can be emitted as ASCII string via one of the serial interfaces.

6 Block Diagram TCR180PEX-EL



7 Master Oscillator

By default the TCR180PEX-EL is equipped with a TCXO (Temperature Compensated Xtal Oscillator) as master oscillator to provide a good time accuracy and frequency stability. As long as an input signal is supplied the frequency of the oscillator is adjusted from the input signal, and if the input signal is disconnected afterwards the card can still provide accurate time for a certain holdover interval.

All internal timing as well as the output signals are derived from the oscillator. The last known good oscillator adjustment value is stored in non-volatile memory, and is used as default after power-up. The oscillator's 10 MHz output frequency is also available with TTL level via at a ribbon cable connector.

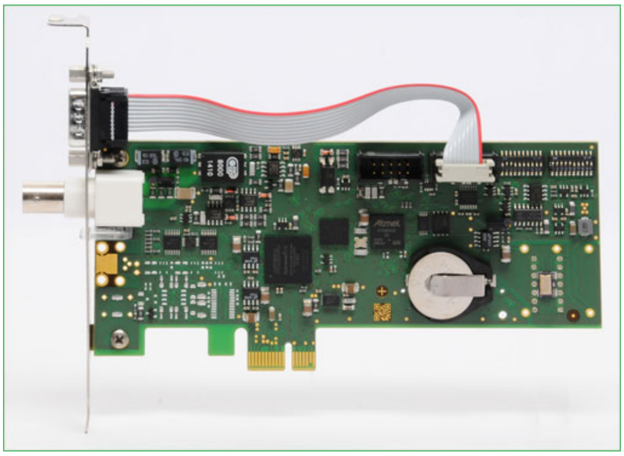


Figure: TCR180PEX-EL with TCXO oscillator

8 Functional Description of Receiver

After the received time code has passed a consistency check, the TCR180PEX-EL's on-board software clock and battery buffered real time clock are synchronized according to the external time reference. If an error or inconsistency is detected in subsequent time code frames, or the input signal is disconnected, the on-board clock switches to holdover mode, where the time is derived from the on-board high quality oscillator which has been disciplined before.

All IRIG and similar time codes provide the time-of-day, and a day-of-year number (1...365/366). When converting the day-of-year number from the incoming time code to a calendar date then the result is ambiguous unless the year number is not known: the day after February 28 can be March 1, but can also be February 29 in case the year is a leap year.

Unfortunately, most of the commonly used IRIG code formats don't include a year number, in which case the year number used for the computation of the calendar date is retrieved from the battery buffered on-board real time clock.

So care must be taken that the on-board clock has been set to the correct date. The on-board date and time can be adjusted by sending a Meinberg Standard Time string to the serial interface COM0, or via the PCI bus by using the utility programs included in the driver software package.

If the configured time code format does provide a year number (e.g. IEEE 1344, IEEE C37.118, IRIG-Bxx6/Bxx7) then the year number from the time code is used instead of the year number from the on-board real time clock, and the on-board date is set accordingly.

Most of the commonly used IRIG code formats also don't provide an indicator whether the transported time is UTC, or local time with some offset from UTC. However, the TCR180PEX-EL always needs to derive UTC time from the incoming time code since the card's on-board time is expected to run on UTC.

If no UTC offset is provided by the time code then a UTC offset parameter on the card first needs to be configured, depending on the time provided by the input signal. When the TCR180PEX-EL is shipped then the UTC parameter is set to "unconfigured", and as long as this is the case the card does not synchronize to the input signal. So the UTC offset has to be configured first when the card is put into operation. The tools that come with the driver software package given an appropriate hint if this is the case.

Only if the used time code format provides the UTC offset (e.g. IEEE 1344, IEEE C37.118) the card uses the UTC offset from the time code, and thus even synchronizes to the input signal if the card's UTC parameter is still set to "unconfigured".

Care must be taken, however, if one of the IEEE 1344 or IEEE C37.118 codes is used: The main difference between these formats is the way the UTC offset is to be applied: subtracted or added. Unfortunately there are 3rd party IRIG devices out there which claim to use a IEEE 1344 code, but in fact handle the UTC offset as specified in IEEE C37.118. This may result in a wrong UTC time derived from the time code if local time is transported. A simple fix is usually to switch the card from one of the IEEE codes to the other one.

The TCR180PEX-EL can automatically convert its on-board UTC time to some local time, including automatic switching to and from DST year by year according to configurable rules. This is independent from the

UTC offset of the incoming time code. The derived local time can be transmitted via the outgoing time code, the serial time strings, or can be read via the PCI interface.

The time zone is entered as offset of seconds from UTC, e.g. for Germany:
MEZ = UTC + 3600 sec, MESZ = UTC + 7200 sec

The specific date of beginning and end of daylight saving can be generated automatically for several years. The receiver calculates the switching times using a simple scheme, e.g. for Germany:

Beginning of daylight saving is the first sunday after March, 25th at two o'clock => MESZ
End of daylight saving is the first sunday after October, 25th at three o'clock => MEZ

The parameters for time zone and switching to/from daylight saving can be set by using the included monitor program. If the same values for beginning and end of daylight saving are entered then no switching to DST is made.

The associated settings can be changed using the configuration software shipped with the driver packages.

Most IRIG codes don't include an announcement flag for the DST change, or for the for the insertion of a leap second, so the TCR180PEX-EL will switch into free wheeling mode on such event, and resynchronize a few seconds later.

The board TCR180PEX-EL decodes the following formats:
Please note: all "**A**" Time Codes are only available **after** warmed up phase of the oscillator!

A002:	1000pps, DC Level Shift pulse width coded, no carrier BCD time of year
A132:	1000pps, amplitude modulated sine wave signal, 10 kHz carrier frequency BCD time of year
A003:	1000pps, DC Level Shift pulse width coded, no carrier BCD time of year, SBS time of day
A133:	1000pps, amplitude modulated sine wave signal, 10 kHz carrier frequency BCD time of year, SBS time of day
B002:	100pps, DC Level Shift pulse width coded, no carrier BCD time of year
B122:	100pps, amplitude modulated sine wave signal, 1 kHz carrier frequency BCD time of year
B003:	100pps,DC Level Shift pulse width coded, no carrier BCD time of year, SBS time of day
B123:	100pps, amplitude modulated sine wave signal, 1 kHz carrier frequency BCD time of year, SBS time of day
B006:	100 pps, DC Level Shift, no carrier BCD time-of-year, Year
B126:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, Year
B007:	100 pps, DC Level Shift, no carrier BCD time-of-year, Year, SBS time-of-day
B127:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, Year, SBS time-of-day
AFNOR:	Code according to NF S-87500, 100 pps, wave signal, 1kHz carrier frequency, BCD time-of-year, complete date, SBS time-of-day, Signal level according to NF S-87500
IEEE 1344:	Code according to IEEE 1344-1995, 100 pps, AM sine wave signal, 1kHz carrier frequency, BCD time-of-year, SBS time-of-day, IEEE 1344 extensions for date, timezone, daylight saving and leap second in control functions (CF) segment. (also see table 'Assignment of CF segment in IEEE 1344 mode')
IEEE C37.118:	Like IEEE 1344 - with UTC offset to be applied reversely

8.1 Input Signals

The time code format has to be configured using the monitor software: if an amplitude-modulated signal (IRIG-A/B, AFNOR NF S-87500, IEEE C37.118 oder IEEE 1344) is configured then the input signal has to be supplied to the upper BNC connector in the TCR180PEX-EL's bracket. A coaxial, shielded or twistet pair cable should be used.

A pulse width modulated (DC Level Shift, DCLS) signal has to be supplied via the 9-pin D-SUB connector. Two DIP switches have to be set to the "ON" position to wire the contacts of the D-Sub connector to the onboard photocoupler, and an appropriate DCLS time code format has to be configured using the monitor program.

Optionally an optical input can be equipped instead of the modulated input. It is available as ST-connector for GI 50/125 μm or GI 62,5/125 μm gradient fiber.

The board TCR180PEX-EL can't be used to decode amplitude modulated and DC Level Shift signals simultaneously. Depending on the selected code format, only the signal at the BNC-connector or the D-Sub connector is decoded.

8.2 Input impedance for modulated signals

Except the AFNOR NF S87-500 standard there are no time code specifications for modulated signals which define the output impedance of a generator, or the input impedance of a receiver, so care must be taken that the specifications of this card meet the requirements of 3rd party devices.

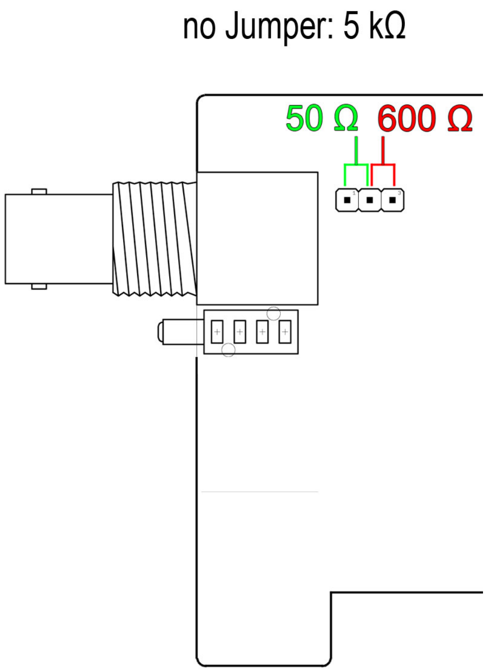
The TCR180PEX-EL provides a jumper to set the input impedance for modulated codes to 50 Ω, 600 Ω, or 5 kΩ.

Time code outputs provided by Meinberg devices provide a 50 Ω output impedance to match the transmission requirements with coaxial cable, so the receiver should be set to 50 Ω input impedance if only a single receiver is connected to a generator.

If T-connectors are used to provide several receivers with a single output signal from a generator then the resulting load impedance for the generator may be too low if all receivers have a low input impedance, so it's more appropriate to set the input impedance of all receivers to 600 Ω. This also meets the requirement of the AFNOR standard, so this is the default setting when the TCR180PEX-EL is shipped.

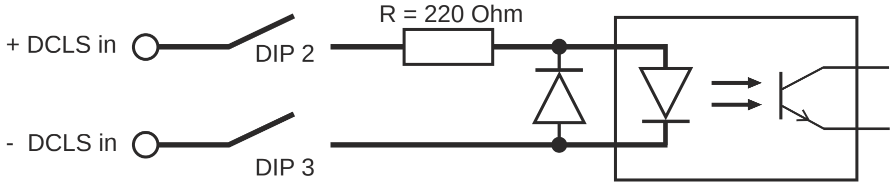
Only if the external time code generator has a high output impedance (see specifications of the external time code generator) it may be required to set the input impedance to 5 kΩ.

The driver software shows a bar chart for evaluation of the signal level at the receiver input. The following detail of the TCR180PEX-EL's placeplan of shows the possible jumper settings and the associated input impedance:



8.3 Photocoupler Input

Pulse width modulated (DC Level Shift) codes are insulated by an onboard photocoupler. The connection scheme is shown below:



MultiRef-Port: Pin Assignment of the D-SUB 9 connecor
(see chapter D-SUB Pin Assignment of MultiRef Port)

The internal series resistance allows direct connection of input signals with a maximum high level of +12 V (TTL or RS-422 for example). If signals with a higher amplitude are used, an additional external series resistance has to be applied to not exceed the limit of the forward current of the input diode (60 mA). The forward current should not be limited to a value of less than 10 mA to ensure safe switching of the photocoupler.

8.4 Pulse outputs

PO0:	Pulse each second (PPS), active HIGH, pulse duration 200 msec
PO1:	Pulse each minute (PPM), active HIGH, pulse duration 200 msec

8.5 Asynchronous Serial Port

The TCR180PEX-EL has two serial interfaces COM0 (standard port) and COM1 (multi ref. port). At delivery the (COM0) is provided on the slot bracket. The interface (COM1) can optionally be used via a second D-SUB-9 connector.

By default, both interfaces remain inactive after the system is switched on, until the receiver is synchronized. By using the monitor program, however, the TCR180PEX-EL can be configured so that the interfaces are activated immediately after switch-on.

Transmission speed, framing and mode of operation can be configured individually for each port. Both of the ports can be configured to transmit either time strings (once per second, once per minute, or on request with ASCII "?" only), or to transmit capture strings (automatically when available, or on request). The format of the output strings is ASCII, see the technical specifications at the end of this document for details.

Please note:

```
If a serial interface sends capture events automatically, they can't be
read via PCI-bus, because they are deleted from the buffer memory after
transmission.
```

8.6 Enabling of outputs

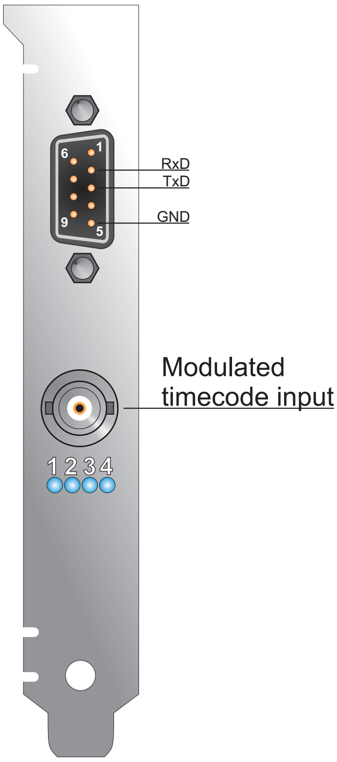
By default the pulse outputs and the the serial outputs are disabled after power up until the receiver is synchronized. However, the monitor software can be used to configure each group of outputs so that they are always enabled immediately after power-up.

8.7 Time Capture Inputs

Capture 0 (CAP0) and Capture 1 (CAP1) of the standard port can be enabled by using the DIP switch for the D-SUB9 connector in the slot bracket. This allows any events to be recorded at any time. If a falling TTL edge is detected at one of these inputs, the microprocessor stores the number of the input and the current time in a buffer memory which can hold up to 500 entries. The capture events can be displayed using the monitor program or sent via the serial interface COM1.

The buffer memory can be used to record either a time-limited, fast sequence of events (interval down to 1.5 msec) or a continuous sequence of events with a lower repetition time (depending on the transmission rate of COM1). The output string consists of ASCII characters, a detailed description can be found in the back of this manual. If the buffer memory overflows, a message ("** capture buffer full" is output, if the time interval between two events at the same input is too short, the message "** capture overrun" is displayed and sent.

9 Connectors and LEDs in the Bracket



The bracket of the board includes the BNC connector for the amplitude modulated time codes, four LEDs and a 9 pin D-Sub-plug.

Pressing the hidden key BSL is required for activating the Bootstrap-Loader before updating the firmware.

The 9 pin D-Sub-connector is wired to the board's serial port. Pin assignment can be seen from the figure below. This port can not be used as serial port for the computer. Instead, the clock uses the port to send out Meinberg's standard time string in order to control an external display or some other external device. The string is sent out once per second, once per minute or if requested by an incoming ASCII "?".

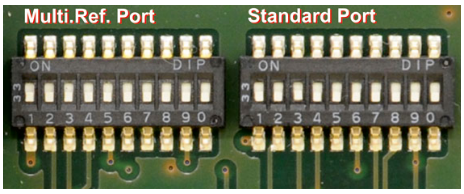
It is also possible to change the board time by sending such a string towards the clock. Transmission speed, framing and mode of operation can be modified using the monitor software. The string format is described in the section 'Technical Specifications' at the end of this manual.

LED Indicators

1.	blue:	During the TCR180PEX-EL initialization phase
	off:	Oscillator not warmed up
	green:	Oscillator warmed up
2.	green:	Correct time code detected
	red:	No correct time code detected
	yellow:	TCR180PEX-EL synchronized by Multi.Ref. source
	yellow/green (flashing):	Holdover mode (Multi.Ref.), Time Code available
	yellow/red (flashing):	Holdover mode (Multi.Ref.), Time Code not available
3.	green:	Telegramm consistent
	red:	Telegramm inconsistent
	yellow (flashing):	Jitter to large
4.	red:	The internal timing of TCR180PEX-EL is in holdover mode
	off:	The internal timing of TCR180PEX-EL is synchronized to the received time code (Lock)

9.1 Pin assignments of the D-Sub-connector

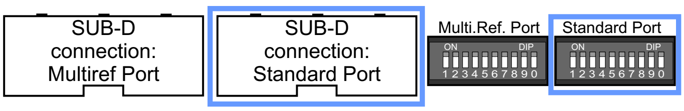
By default only the signals needed for the serial port COM0 are mapped to the pins of the connector. Whenever one of the additional signals is to be used the signal must be wired to a pin by putting the appropriate lever of a DIP switch to the ON position.



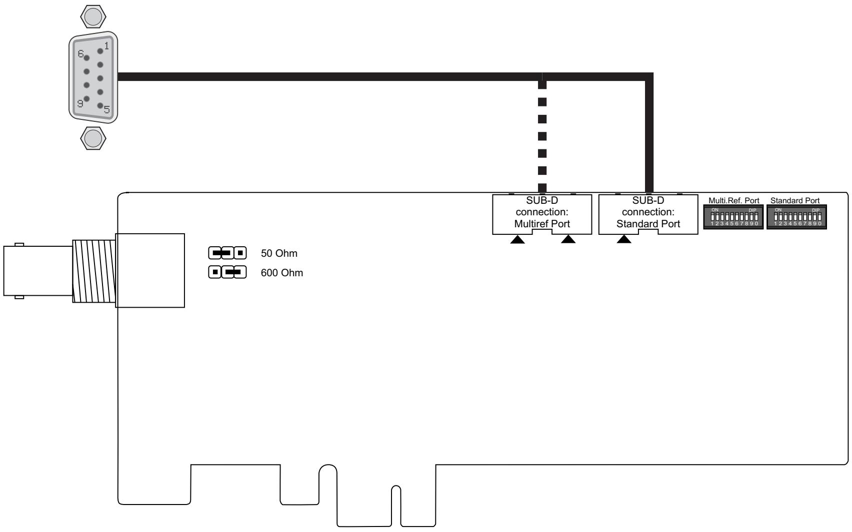
The table below shows the pin assignment of the connector and the assignment of the individual switches in the "Standard Port" block. Please note that **Pin 1 and Pin 4** of the connector can be assigned to two different signals. Only one switch at a time may then be set to the ON position:

Standard Port

9pin D-SUB	Signal	Signal Level	DIP-Switch ON	
1	VCC out	+5 V	**1**	*DIP 8 must be OFF*
1	PO_0 (PPS) out	RS232	**8**	*DIP 1 must be OFF*
2	RxD 0 in	RS232	-	
3	TxD 0 out	RS232	-	
4	PO_1 (PPM) out	TTL	**5**	*DIP 10 must be OFF*
4	10 MHz out	TTL	**10**	*DIP 5 must be OFF*
5	GND	-	-	
6	CAP 0 in	TTL	**2**	
7	CAP 1 in	TTL	**3**	*DIP 7 must be OFF*
8	PO_0 (PPS) out	TTL	**4**	
9	not used	-	-	*only PEX-EL version*



9.2 D-SUB Pin Assignment of MultiRef Port

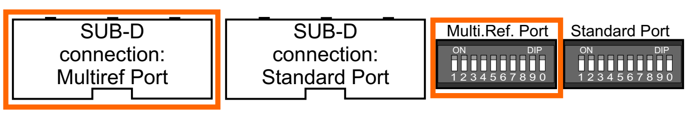


Connection of ribbon cable
To lead the "Multiref" signals through the SUB-D connector, the ribbon cable must be plugged to the appropriate boxed header:

The table below shows the pin assignment of the connector and the assignment of the individual switches in the "Multiref Port" block. Please note that **pin 4** of the connector can be assigned with two different signals. Only one switch at a time should be set to the ON position:

Multiref Port

9pin D-SUB	10-pol. Wannenst.	Signal	Signal Level	DIP-Switch ON	
1	9	VCC out	+5V	**1**	*DIP 7 must be OFF*
2	7	RxD1 in	RS232	-	
3	5	TxD1 out	RS232	-	
4	3	PO_1 (PPM) out	TTL	**5**	*DIP 10 must be OFF*
4	3	10MHz out	TTL	**10**	*DIP 5 must be OFF*
5	1	GND	-	-	
6	8	+ DCLS in	optocoupler	**3**	
7	6	- DCLS in	optocoupler		
8	4	PO_0 (PPS) out	TTL	**4**	
9	2	not used	-	-	*only PEX-EL Version*



10 Putting into Operation

To achieve correct operation of the board, the following points must be observed.

10.1 Installing the TCR180PEX-EL in Your Computer

Every PCI Express board is a plug & play board. After power-up, the computer's BIOS assigns resources like I/O ports and interrupt numbers to the board, the user does not need to take care of the assignments. The programs shipped with the board retrieve the settings from the BIOS.

The computer has to be turned off and its case must be opened. The radio clock can be installed in any PCI Express slot not used yet. The rear plane must be removed before the board can be plugged in carefully. The computer's case should be closed again and the time code signal can be connected to the coaxial plug at the clock's rear slot cover. After the computer has been restarted, the monitor software can be run in order to check the clock's configuration. The computer's case should be closed again and the time code signal must be connected to the appropriate connector.

After the board has been mounted and connected, the system is ready to operate. About 10 seconds after power-up the receiver's TCXO operates with the required accuracy.

10.2 Power Supply

All power supplies needed by TCR180PEX-EL are delivered by the PCI-(Express) bus.

10.3 Configuration of TCR180PEX-EL

The selection of the time code, configuration of the serial interface and a possible offset of the received time to UTC must be set up by the monitor software via the PCIExpress bus. In contrast to AFNOR NF S87-500 the IRIG telegram containes only the day of year (1...366) instead of a complete date. To ensure correct function of TCR180PEX-EL, the date stored in the realtime clock of the board must be set when using IRIG codes therefore. This setting can be done by a terminal software also.

If the time zone of the received time code is not UTC, the local offset to UTC must be configured to ensure correct function of the driver software. If the local time zone is MEZ for example, the board must be set to a local offset of '+60min' (MEZ = UTC + 1 h).

The serial interface COM0 can be configured to send a time telegram with reference to UTC or to the received local time.

11 Firmware Update of the TCR180PEX-EL.

On slot cards, with flash program memory, the firmware update is being performed using the Meinberg flash program "mbgflash" via the serial port COM0 of the slot card.

The update requires a specific firmware image that matches the the slot card type. To install the "mbgflah" program download and execute the EXE file.

Download of mgbflash program:
https://www.meinbergglobal.com/download/utils/windows/mbgflash-1.13.exe

The update process can be performed as often as needed when faults occur, since it is independent from contents of the program memory. The current content of the program memory is kept until the update process sends the command to clear the program memory. In this case, the slot card is ready for operation after the computer is switched on again.

12 Technical Specification TCR180PEX-EL

RECEIVER INPUT:	AM-input (BNC-connector): insulated by a transformer impedance settable 50 Ω, 600 Ω, 5 kΩ input signal: 600 mV_{pp} to 8 V_{pp} (Mark) other ranges on request	
	DC Level Shift input (D-Sub-connector): insulated by photocoupler	
	internal series resistance:	220 Ω
	maximum forward current:	60 mA
	diode vorward voltage:	1.0 V...1.3 V
	optional input(option):	
	optical receive power:	min. 3μW
	optical connector:	ST-connector for GI 50/125μm or GI 62,5/125μm gradient fiber
DECODING:	decoding of the following telegrams possible: IRIG-A002 / A132 / A003 / A133 / A006 / A136 / A007 / A137 IRIG-B002 / B122 / B003 / B123 / B006 / B126 / B007 / B127 AFNOR NF S87-500 IEEE C37.118 IEEE 1344	
ACCURACY OF TIME BASE:	± 750 nsec compared to IRIG reference marker	
REQUIRED ACCURACY OF TIME CODE SOURCE:	± 100ppm	
HOLDOVER MODE:	automatic switching to crystal time base accuracy approximately $1*10^{-8}$ if decoder has been synchronous for more than 1h	
BACKUP-BATTERY:	if the power supply fails, an onboard realtime clock keeps time and date information important system parameters are stored in the RAM of the system lifetime of the Lithium battery at least 10 years	
PULSE OUTPUTS:	active only 'if sync'	
	PO_0:	change of seconds (PPS) pulse duration 200 msec valid on rising edge
	PO_1:	change of minute (PPM) pulse duration 200 msec valid on rising edge
ACCURACY OF PULSES:	better than ± 1 μsec after synchronization and 20 minutes of operation	
SERIAL PORT:	configurable RS-232 interface	
	baudrates:	300 Bd...115200 Bd
	framing:	7E2, 8N1, 8N2, 8E1

	7N2, 7E1, 8O1	
	mode of operation:	string per second string per minute string on request
	time telegram:	Meinberg Standard Uni Erlangen, SAT
	Meinberg Capture, ION Computime, SPA, RACAL	
CAPTURE INPUTS:	triggered by falling TTL slope	
	pulse repetition time:	1.5 msec min.
	resolution:	800 nsec
	output of trigger event via PCI-bus or serial interface	
MASTER OSCILLATOR:	TCXO (Temperature Compensated Xtal Oscillator)	
	accuracy compared to IRIG-reference:	
	sync. and 20 min. of operation:	$\pm$ 5(10 $^{-9}$)
	first 20 min. after sync.:	$\pm$ 1(10 $^{-8}$)
	accuracy of oscillator:	
	holdover, 1 day:	$\pm$ 1(10 $^{-7}$)
	holdover, 1 year:	$\pm$ 1(10 $^{-6}$)
	short term stability:	
	$\leq$ 10 sec, synchronized:	$\pm$ 2(10 $^{-9}$)
	$\leq$ 10 sec, holdover:	$\pm$ 5(10 $^{-9}$)
	temperature dependant drift:	
	holdover:	$\pm$ 1(10 $^{-6}$)
RELIABILITY OF OPERATION:	microprocessor supervisory circuit provides watchdog timer, power supply monitoring and backupbattery switchover software watchdog monitors correct program flow and generates a reset in case of error detection	
INITIALIZATION:	software and realtime clock can be set by a serial Meinberg Standard Telegram via COM0 or the PCI-Express bus	
BUS-INTERFACE:	Single lane (x1) PCI Express (PCIe) Interface compatible to PCI Express specification r1.0a	
DATA FORMAT:	binary, byte serial	
POWER REQUIREMENT:	+3.3V: $\approx$ 250 mA +12V : $\approx$ 90 mA power supplies provided by PCI Express interface	
Board DIMENSION:	"low profile" slot card (69 mm x 150 mm)	
AMBIENT TEMPERATURE:	0 ... 50°C	
HUMIDITY:	max. 85 %	

13 Technical Appendix TCR180PEX-EL

13.1 Abstract of Time Code

The transmission of coded timing signals began to take on widespread importance in the early 1950´s. Especially the US missile and space programs were the forces behind the development of these time codes, which were used for the correlation of data. The definition of time code formats was completely arbitrary and left to the individual ideas of each design engineer. Hundreds of different time codes were formed, some of which were standardized by the "Inter Range Instrumentation Group" (IRIG) in the early 60´s.

The TCR180PEX-EL supports decoding and generating of IRIG-A, IRIG-B, AFNOR NF S87-500, IEEE C37.118 and IEEE 1344.

13.1.1 Description of IRIG-Codes

Format:

Format A	1 k pps
Format B	100 pps
Format D	1 ppm
Format E	10 pps
Format G	10 k pps
Format H	1 pps

Modulation Frequency:

0	Pulse width code
1	Sine wave, amplitude modulated
2	Manchester modulated

Frequency/Resolution:

0	No carrier/index count interval
1	100 Hz/10 ms
2	1 kHz/1 ms
3	10 kHz/0.1 ms
4	100 kHz/10 ms
5	1 MHz/1ms

Coded Expressions:

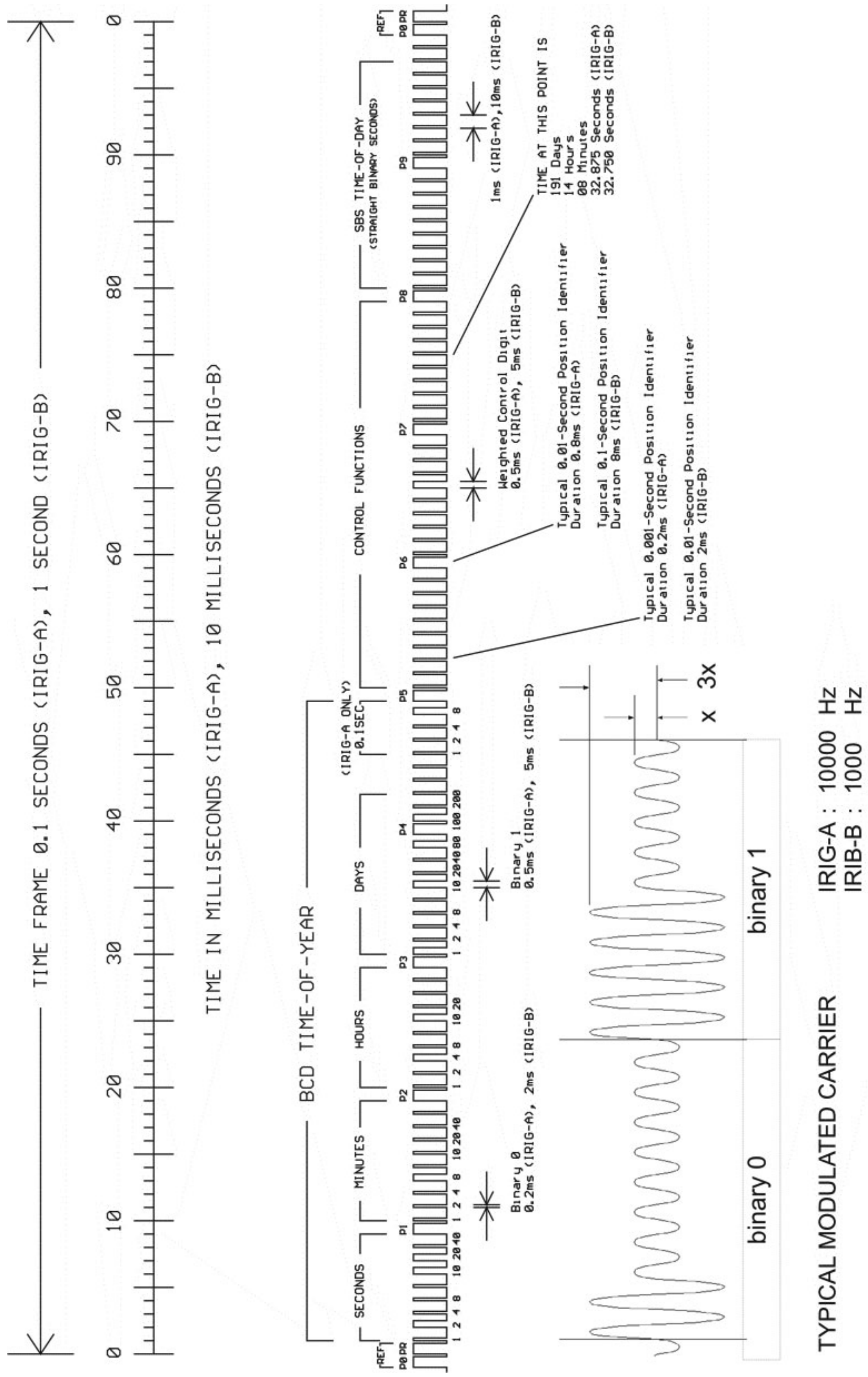
0	BCD_{TOY}, CF, SBS
1	BCD_{TOY}, CF
2	BCD_{TOY}
3	BCD_{TOY}, SBS
4	BCD_{TOY}, BCD_{YEAR}, CF, SBS
5	BCD_{TOY}, BCD_{YEAR}, CF
6	BCD_{TOY}, BCD_{YEAR}
7	BCD_{TOY}, BCD_{YEAR}, SBS

A 1 3 7

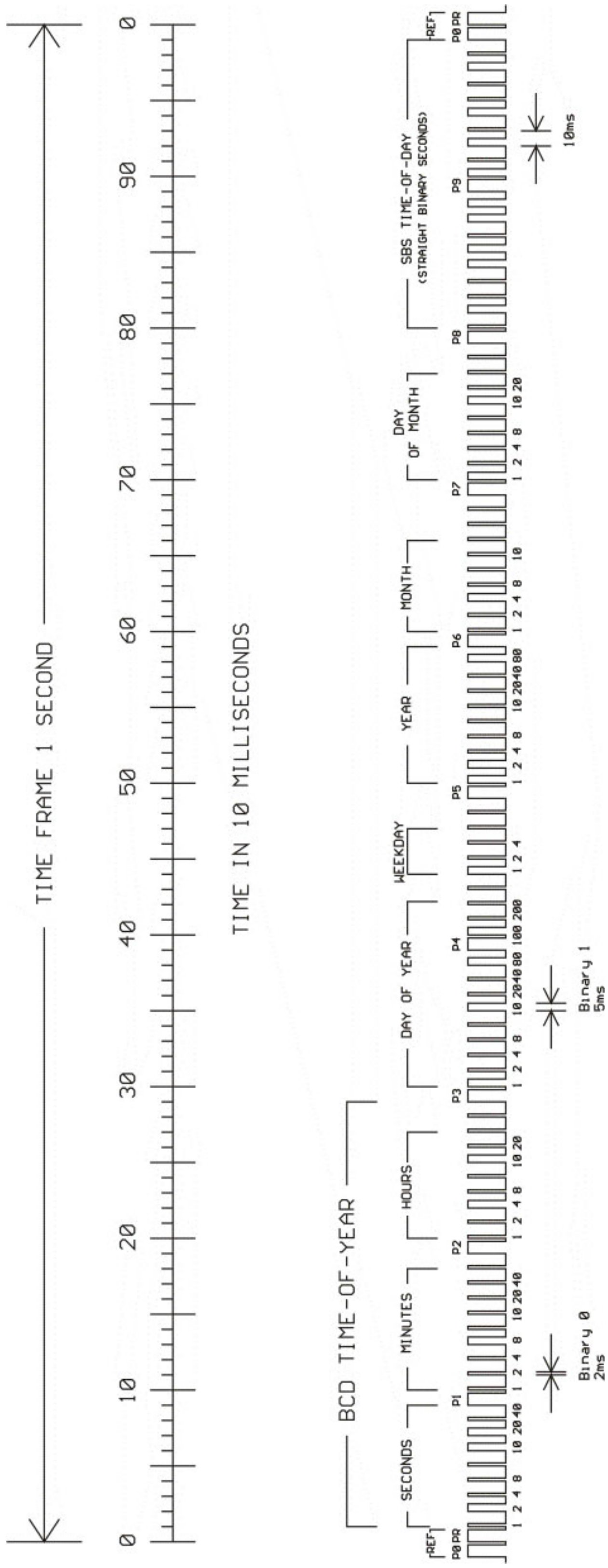
The signal designated as A137 is deciphered as follows: Format A, Sine wave (amplitude modulated), 10 kHz carrier/0.1 ms resolution, and Coded expressions BCD_{TOY}, BCD_{YEAR}, and SBS.

13.2 Time Code Format

13.2.1 Time Code Format According to IRIG Standard



13.2.2 Time Code Format According to AFNOR Standard



13.3 Time Strings

13.3.1 Meinberg Standard Time String

The Meinberg Standard Time String is a sequence of 32 ASCII characters starting with the <STX> (Start-of-Text) character and ending with the <ETX> (End-of-Text) character. The format is as follows:

```
<STX>D:dd.mm.yy;T:w;U:hh.mm.ss;uvxy<ETX>
```

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters as defined below:

<STX>	Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second		
dd.mm.yy	The date:		
	dd	Day of Month	(01–31)
	mm	Month	(01–12)
	yy	Year of the Century	(00–99)
w	The day of the week		(1–7, 1 = Monday)
hh.mm.ss	The time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
uv	Clock status characters (depending on clock type):		
	u:	'#'	GPS: Clock is in free-run mode (no exact synchronization) PZF: Time frame not synchronized DCF77: Clock has not synchronized since last reset
	' '	(space, 20h) GPS: Clock is synchronized (base accuracy is reached) PZF: Time frame is synchronized DCF77: Clock has synchronized since last reset	
	v:	'*' GPS: Receiver has not checked its position PZF/DCF77: Clock currently running off XTAL	
	' '	(space, 20h) GPS: Receiver has determined its position PZF/DCF77: Clock is synchronized with transmitter	
x	Time zone indicator:		
	'U'	UTC	Universal Time Coordinated, formerly GMT
	' '	CET	European Standard Time, daylight saving disabled
	'S'	(CEST) European	Summertime, daylight saving enabled
y	Announcement of clock jump during last hour before jump enters effect:		
		'!'	Announcement of start or end of Daylight Saving Time
		'A'	Announcement of leap second insertion
		' '	(Space, 20h) nothing announced
<ETX>	End-of-Text, ASCII code 03h		

13.3.2 Meinberg Capture String

The Meinberg Capture String is a sequence of 31 ASCII characters terminated by a `<CR><LF>` (Carriage Return/Line Feed) sequence. The format is as follows:

`CHx<SP>dd.mm.yy_hh:mm:ss.fffffff<CR><LF>`

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters as defined below:

`x`	0 or 1 corresponding on the number of the capture input		
`<SP>`	Space, ASCII code 20h		
`dd.mm.yy`	Capture date:		
	`dd`	Day of Month	(01–31)
	`mm`	Month	(01–12)
	`yy`	Year of the Century	(00–99)
`hh:mm:ss.fffffff`	Capture time:		
	`hh`	Hours	(00–23)
	`mm`	Minutes	(00–59)
	`ss`	Seconds	(00–59, or 60 during leap second)
	`fffffff`	Fractions of second, 7 digits	
`<CR>`	Carriage Return, ASCII code 0Dh		
`<LF>`	Line Feed, ASCII code 0Ah		

13.3.3 Uni Erlangen String (NTP)

The Uni Erlangen String (NTP) of a GPS clock is a sequence of 66 ASCII characters starting with the `<STX>` (start-of-text) character and ending with the `<ETX>` (end-of-text) character. The format is as follows:

`<STX>`*`dd.mm.yy; w; hh:mm:ss; voo:oo; acdfg i;bbb.bbbbn lll.lllle hhhhm`*`<ETX>`

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

`<STX>` Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second

`dd.mm.yy` The date:

dd	Day of Month	(01–31)
mm	Month	(01–12)
yy	Year of Century	(00–99)

`w` Day of the week (1–7, 1 = Monday)

`hh.mm.ss` The time:

hh	Hours	(00–23)
mm	Minutes	(00–59)
ss	Seconds	(00–59, or 60 during leap second)

`v` -/+ sign of the offset of local timezone relative to UTC

`oo:oo` Offset of local time zone relative to UTC in hours and minutes

`ac` Clock status characters:

a:	'#'	Clock has not synchronized since reset
	' '	(Space, 20h) Clock has synchronized since reset
c:	'*'	GPS receiver has not checked its position
	' '	(Space, 20h) GPS receiver has determined its position

`d` Time zone indicator:

'S'	CEST	European Summertime, Daylight Saving Time enabled
' '	CET	European Standard Time, Daylight Saving Time disabled

`f` Announcement of clock jump during last hour before jump enters effect:

'!'	Announcement of start or end of Daylight Saving Time
' '	(Space, 20h) nothing announced

`g` Announcement of clock jump during last hour before jump enters effect:

'A'	Announcement of leap second insertion
' '	(Space, 20h) nothing announced

`i` Leap second insertion

'L'	Leap second is currently to be inserted (only active in 60th second)
' '	(Space, 20h) No leap second to be inserted

`bbb.bbbb` Geographical latitude of receiver position in degrees
Leading characters padded by Space characters (20h)

`n` Latitudinal hemisphere, with the following characters possible:
- 'N' North of Equator
- 'S' South of Equator

`lll.llll` Geographical longitude of receiver position in degrees
Leading characters padded by Space characters (20h)

`e` Longitudinal hemisphere, with the following characters possible:
- 'E' East of Greenwich Meridian
- 'W' West of Greenwich Meridian

`hhhh` Altitude above WGS84 ellipsoid in meters
Leading characters padded by Space characters (20h)

`<ETX>` End-of-Text, ASCII code 03h

13.3.4 SAT Time String

The SAT Time String is a sequence of 29 ASCII characters starting with the `<STX>` (start-of-text) character and ending with the `<ETX>` (end-of-text) character. The format is as follows:

`<STX>`*dd.mm.yy/w/hh:mm:ssxxxxuv*`<ETX>`

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

`<STX>`	Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second		
`dd.mm.yy`	The date:		
	dd	Day of Month	(01–31)
	mm	Month	(01–12)
	yy	Year of the Century	(00–99)
`w`	The day of the week	(1–7, 1 = Monday)	
`hh:mm:ss`	The time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
`xxxx`	Time zone indicator:		
	'UTC'	Universal Time Coordinated, formerly GMT	
	'CET'	European Standard Time, daylight saving disabled	
	'CEST'	European Summertime, daylight saving enabled	
`u`	Clock status characters:		
	'#'	Clock has not synchronized since last reset	
	' '	(Space, 20h) Clock has synchronized since last reset	
`v`	Announcement of clock jump during last hour before jump enters effect:		
	'!'	Announcement of start or end of Daylight Saving Time	
	' '	(Space, 20h) nothing announced	
`<CR>`	Carriage Return, ASCII code 0Dh		
`<LF>`	Line Feed, ASCII code 0Ah		
`<ETX>`	End-of-Text, ASCII code 03h		

13.3.5 Computime Time String

The Computime time string is a sequence of 24 ASCII characters, starting with the character `T` and terminated with the character `<LF>` (Line Feed, ASCII code 0Ah). The format is as follows:

`T:`*`yy:mm:dd:ww:hh:mm:ss`*`<CR><LF>`

The letters printed in italics are replaced by ASCII numbers whereas the other characters are unaltérable parts of the time string. The groups of characters as defined below:

`T` Start character
Sent with 1-bit accuracy at the start of the second.

`yy:mm:dd` The current date:

`yy`	Year without century	(00–99)
`mm`	Month	(01–12)
`dd`	Day of the month	(01–31)
`ww`	Day of the week	(1–7, 1 = Monday)

`hh:mm:ss` The current time:

`hh`	Hours	(00–23)
`mm`	Minutes	(00–59)
`ss`	Seconds	(00–59, or 60 during leap second)

`<CR>` Carriage Return (ASCII code 0Dh)

`<LF>` Line Feed (ASCII code 0Ah)

13.3.6 Format of the SPA Time String

The ABB SPA Time String is a sequence of 32 ASCII characters starting with the characters ">900WD" and ending with the <CR> (Carriage Return) character. The format is:

>900WD:*jj-mm-tt_hh.mm;ss.fff:cc*<CR>

The letters printed in italics are replaced by ASCII numbers whereas the other characters are part of the time string. The groups of characters as defined below:

jj-mm-tt	the current date:		
	jj	year of the century	(00..99)
	mm	month	(01..12)
	tt	day of month	(01..31)
	_	Space	(ASCII-code 20h)
hh.mm;ss.fff	the current time:		
	hh	hours	(00..23)
	mm	minutes	(00..59)
	ss	seconds	(00..59, or 60 while leap second)
	fff	milliseconds	(000..999)
cc	Checksum. EXCLUSIVE-OR result of the previous characters, displayed as a HEX byte (2 ASCII characters 0..9 or A..F)		
<CR>	Carriage Return		ASCII Code 0Dh

13.3.7 RACAL Standard Time String

The RACAL Standard Time String is a sequence of 16 ASCII characters started by a `X` character and terminated by the `<CR>` (Carriage Return, ASCII code 0Dh) character. The format is as follows:

`XGU`*`yymmddhhmmss`*`<CR>`

The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters are as defined below:

`X`	Start character, ASCII code 58h Sent with one-bit accuracy at the change of each second		
`G`	Control character, ASCII code 47h		
`U`	Control character, ASCII code 55h		
`yymmdd`	Current date:		
	`yy`	Year of Century	(00–99)
	`mm`	Month	(01–12)
	`dd`	Day of Month	(01–31)
`hh:mm:ss`	Current time:		
	`hh`	Hours	(00–23)
	`mm`	Minutes	(00–59)
	`ss`	Seconds	(00–59, or 60 during leap second)
`<CR>`	Carriage Return, ASCII code 0Dh		

13.3.8 ION Time String

The ION time string is a sequence of 16 ASCII characters starting with the `<SOH>` (Start of Header, ASCII code 01h) ASCII control character and ending with the `<LF>` (Line Feed, ASCII code 0Ah) character. The format is as follows:

<SOH>*ddd:hh:mm:ssq*<CR><LF>

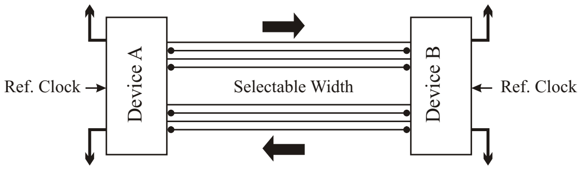
The letters printed in italics are replaced by ASCII-formatted numbers, whereas the other characters are directly part of the time string. The groups of characters as defined below:

<SOH>	Start of Header (ASCII code 01h) sent with one-bit accuracy at the change of each second			
ddd	Day of Year		(001–366)	
hh:mm:ss	Current time:			
	hh	Hours	(00–23)	
	mm	Minutes	(00–59)	
	ss	Seconds	(00–59, or 60 while leap second)	
	q	Quality		
		Indicator	Space (ASCII code 20h)	Time Sync (GPS Lock)
			"?" (ASCII code 3Fh)	No Time Sync (GPS Fail)
<CR>	Carriage Return (ASCII code 0Dh)			
<LF>	Line Feed (ASCII code 0Ah)			

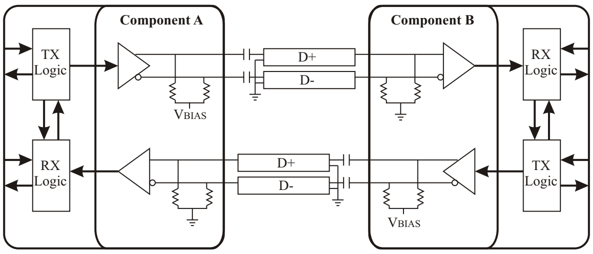
13.4 PCI Express (PCIe)

The main technical inovation of PCI Express is a serial data transmission compared to the parallel interfaces of other computer bus systems like ISA, PCI and PCI-X.

PCI Express defines a serial point-to-point connection, the so-called Link:



The data transfer within a Link is done via Lanes, representing one wire pair for sending and one wire pair for receiving data:



This design leads to a full duplex connection clocked with 2.5 GHz capable of transfering a data volume of 250 MB/s per lane in each direction. Higher bandwith is implemented by using multiple lanes silmutaneously. A PCI Express x16 slot for example uses sixteen lanes providing a data volume of 4 GB/s. For comparison: when using conventional PCI the maximum data transfer rate is 133 MB/s, PCI-X allows 1 GB/s but only in one direction respectively.

14 RoHS Conformity

Conformity with EU Directive 2011/65/EU (RoHS)

We hereby declare that this product is compliant with the European Union Directive 2011/65/EU and its delegated directive 2015/863/EU "Restrictions of Hazardous Substances in Electrical and Electronic Equipment" and that no impermissible substances are present in our products pursuant to these Directives.

We warrant that our electrical and electronic products sold in the EU do not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs), polybrominated diphenyl ethers (PBDEs), bis(2-ethylhexyl)phthalat (DEHP), benzyl butyl phthalate (BBP), dibutyl phthalate (DBP), or diisobutyl phthalate (DIBP) above the legal limits.

15 Declaration of Conformity for Operation in the European Union

EU-Konformitätserklärung

Doc ID: TCR180PEX-EL-April 23, 2024

Hersteller Meinberg Funkuhren GmbH & Co. KG
Manufacturer Lange Wand 9, D-31812 Bad Pyrmont

erklärt in alleiniger Verantwortung, dass das Produkt,
declares under its sole responsibility, that the product

Produktbezeichnung **TCR180PEX-EL**
Product Designation

auf das sich diese Erklärung bezieht, mit den folgenden Normen und Richtlinien übereinstimmt:
to which this declaration relates is in conformity with the following standards and provisions of the directives:

EMV – Richtlinie *EMC Directive* 2014/30/EU	EN 61000-6-2:2019 EN IEC 61000-6-3:2021 EN 55035:2017/A11:2020 EN 55032:2015 + AC:2016 + A11:2020 + A1:2020
Niederspannungsrichtlinie *Low-voltage Directive* 2014/35/EU	EN IEC 62368-1:2020 + A11:2020
RoHS – Richtlinie *RoHS Directive* 2011/65/EU + 2015/863/EU	EN IEC 63000:2018

EU-Declaration of Conformity
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Diese EU-Konformitätserklärung umfasst alle nachfolgend aufgeführten Gerätekonfigurationen:
This UKCA Declaration of Conformity further covers all the device configurations listed below:

Bad Pyrmont, den April 23, 2024

MEINBERG
Meinberg Funkuhren GmbH & Co. KG
Lange Wand 9
31812 Bad Pyrmont

Aron Meinberg
Quality Management

16 Declaration of Conformity for Operation in the United Kingdom

UKCA Declaration of Conformity

Doc ID: TCR180PEX-EL-April 23, 2024

Manufacturer	Meinberg Funkuhren GmbH & Co. KG Lange Wand 9 31812 Bad Pyrmont Germany

declares that the product

Product Designation	**TCR180PEX-EL**

to which this declaration relates, is in conformity with the following standards and provisions of the following regulations under British law:

Electromagnetic Compatibility Regulations 2016 (as amended) *SI 2016/1091*	EN IEC 61000-6-2:2019 EN IEC 61000-6-3:2021 EN 55035:2017/A11:2020 EN 55032:2015 + AC:2016 + A11:2020 + A1:2020
Electrical Equipment (Safety) Regulations 2016 (as amended) *SI 2016/1101*	EN IEC 62368-1:2020/A11:2020
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (as amended) *SI 2012/3032*	EN IEC 63000:2018

UKCA Declaration of Conformity
Doc ID: TCR180PEX-EL-April 23, 2024

This UKCA Declaration of Conformity further covers all the device configurations listed below:

Bad Pyrmont, Germany, dated April 23, 2024

MEINBERG
Meinberg Funkuhren GmbH & Co. KG
Lange Wand 9
31812 Bad Pyrmont

Aron Meinberg
Quality Management