

The Synchronization Experts.



SETUP GUIDE

GEN182 with Display

May 11, 2023

Meinberg Funkuhren GmbH & Co. KG

Table of Contents

1	Imprint	1
2	Change Log	2
3	Copyright and Liability Exclusion	3
4	Presentation Conventions in this Manual 4.1 Conventions for the Presentation of Critical Safety Warnings 4.2 Secondary Symbols Used in Safety Warnings 4.3 Conventions for the Presentation of Other Important Information 4.4 Generally Applicable Symbols	4 4 5 5
5	Important Safety Information5.1Appropriate Usage5.2Product Documentation5.3Safety when Installing the Device5.4Electrical Safety5.5Safety when Maintaining and Cleaning the Device5.6Battery Safety	6 7 8 9 11 11
6	Important Product Information6.1CE Marking6.2UKCA Marking6.3Ensuring the Optimum Operation of Your Device6.4Prevention of ESD Damage6.5Disposal	12 12 12 12 13 14
7	Introduction	15
8	General Information about DCF77	16
9	Operating elements and Indicators GEN182 9.1 LEDs GEN182 9.2 LC Display 9.3 CLR/ACK Key 9.4 MENU Key 9.5 INC Key 9.6 NEXT Key	17 17 18 18 18 18 19
10	Defore you start 10.1 Scope of delivery 10.2 Disposal of Packaging Materials 10.3 Selecting the 10 MHz reference	20 20 20 21
11	Installation 11.1 Powering Up the System	22 22
12	Performance Performance	23 23 24 24 24

	12.2.3 SETUP TIME ZONE12.2.4 SETUP DAYLIGHT SAV ON/OFF12.2.5 SETUP LEAP SECOND12.2.6 SERIAL PORT PARM12.2.7 SETUP SERIAL STRING TYPE12.2.8 SETUP SERIAL STRING MODE12.2.9 SETUP TIME CODE OUT12.2.10 INIT USER PARMS12.2.11 Resetting Factory Defaults	24 25 26 27 27 28 28 28
13 Appe	endix Technical Data	29
13.1	Technical Specifications GEN182	29
13.2	Available Time Strings	30
	13.2.1 Format of the Meinberg Standard Time String	30
13.3	Time Code	31
	13.3.1 Abstract of Time Code	31
	13.3.2 Block Diagram Time Code	31
	13.3.3 IRIG Standard Format	32
	13.3.4 AFNOR Standard Format	33
	13.3.5 Structure of CF Segment in IEEE1344 Code	34
	13.3.6 Generated Time Codes	35
	13.3.7 Selection of Generated Time Code	36
	13.3.8 Outputs	37
	13.3.9 Technical Data	37
13.4	Signal Description GEN182	38
13.5	Firmware Update	40
14 RoH	S Conformity	41

14 RoHS Conformity

1 Imprint

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

Phone: + 49 (0) 52 81 / 93 09 - 0 Fax: + 49 (0) 52 81 / 93 09 - 230

Website: https://www.meinbergglobal.com Email: info@meinberg.de

Date: May 11, 2023

2 Change Log

Version	Date	Revision Notes
1.0	05/11/2023	Initial Version

3 Copyright and Liability Exclusion

Except where otherwise stated, the contents of this document, including text and images of all types and translations thereof, are the intellectual property and copyright of Meinberg Funkuhren GmbH & Co. KG ("Meinberg" in the following) and are subject to German copyright law. All reproduction, dissemination, modification, or exploitation is prohibited unless express consent to this effect is provided in writing by Meinberg. The provisions of copyright law apply accordingly.

Any third-party content in this document has been included in accordance with the rights and with the consent of its copyright owners.

A non-exclusive license is granted to redistribute this document (for example, on a website offering free-ofcharge access to an archive of product manuals), provided that the document is only distributed in its entirety, that it is not modified in any way, that no fee is demanded for access to it, and that this notice is left in its complete and unchanged form.

At the time of writing of this document, reasonable effort was made to carefully review links to third-party websites to ensure that they were compliant with the laws of the Federal Republic of Germany and relevant to the subject matter of the document. Meinberg accepts no liability for the content of websites not created or maintained by Meinberg, and does not warrant that the content of such external websites is suitable or correct for any given purpose.

While Meinberg makes every effort to ensure that this document is complete, suitable for purpose, and free of material errors or omissions, and periodically reviews its library of manuals to reflect developments and changing standards, Meinberg does not warrant that this specific document is up-to-date, comprehensive, or free of errors. Updated manuals are provided at www.meinbergglobal.com.

You may also write to **techsupport@meinberg.de** to request an updated version at any time or provide feedback on errors or suggested improvements, which we are grateful to receive.

Meinberg reserves the right to make changes of any type to this document at any time as is necessary for the purpose of improving its products and services and ensuring compliance with applicable standards, laws & regulations.

4 Presentation Conventions in this Manual

4.1 Conventions for the Presentation of Critical Safety Warnings

Warnings are indicated with the following warning boxes, using the following signal words, colors, and symbols:



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.



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.



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.

4.2 Secondary Symbols Used in Safety Warnings

Some warning boxes may feature a secondary symbol that emphasizes the defining nature of a hazard or risk.



The presence of an "electrical hazard" symbol is indicative of a risk of electric shock or lightning strike.



The presence of a "fall hazard" symbol is indicative of a risk of falling when performing work at height.



Das Symbol "laser hazard" symbol is indicative of a risk relating to laser radiation.

4.3 Conventions for the Presentation of Other Important Information

Beyond the above safety-related warning boxes, the following warning and information boxes are also used to indicate risks of product damage, data loss, and information security breaches, and also to provide general information for the sake of clarity, convenience, and optimum operation:



Important!

Warnings of risks of product damage, data loss, and also information security risks are indicated with this type of warning box.



Information:

Additional information that may be relevant for improving efficiency or avoiding confusion or misunderstandings is provided in this form.

4.4 Generally Applicable Symbols

The following symbols and pictograms are also used in a broader context in this manual and on the product.



The presence of the "ESD" symbol is indicative of a risk of product damage caused by electrostatic discharge.



Direct current (DC) (symbol definition IEC 60417-5031)



Alternating current (AC) (symbol definition IEC 60417-5032)



Ground connection (symbol definition IEC 60417-5017)



Protective earth connection (symbol definition IEC 60417-5019)

5 Important Safety Information

The safety information provided in this chapter as well as specific safety warnings provided at relevant points in this manual must be observed during every installation, set-up, and operation procedure of the device, as well as its removal from service.

Any safety warnings affixed to the device itself must also be observed.

Any failure to observe this safety information, these safety warnings, and other safety-critical operating instructions in the product documentation, or any other improper usage of the device may result in unpredictable behavior from the product, and may result in injury or death.

Depending on your specific device configuration and installed options, some safety information may not be applicable to your device.

Meinberg accepts no responsibility for injury or death arising from a failure to observe the safety information, warnings, and safety-critical instructions provided in the product documentation.

It is the responsibility of the operator to ensure that the product is safely and properly used.

Should you require additional assistance or advice on safety-related matters for your product, Meinberg's Technical Support team will be happy to assist you at any time. Simply send a mail to **techsupport@meinberg.de**.

5.1 Appropriate Usage



The device must only be used appropriately in accordance with the specifications of the product documentation! Appropriate usage is defined exclusively by this manual as well as any other relevant documentation provided directly by Meinberg.

Appropriate usage includes in particular compliance with specified limits! The device's operating parameters must never exceed or fall below these limits!

5.2 Product Documentation

The information in this manual is intended for readers with an appropriate degree of safety awareness. The following are deemed to possess such an appropriate degree of safety awareness:

- skilled persons with a familiarity with relevant national safety standards and regulations,
- instructed persons having received suitable instruction from a skilled person on relevant national safety standards and regulations



If there is any safety information in the product documentation that you do not understand, **do not** continue with the set-up or operation of the device!

Read the product manual carefully and completely before you set the product up for use.

Safety standards and regulations change on a regular basis and Meinberg updates the corresponding safety information and warnings to reflect these changes. It is therefore recommended to visit the Meinberg website at https://www.meinbergglobal.com regularly to download up-to-date manuals.

Please keep all product documentation, including this manual, in a safe place in digital or printed format to ensure that it is always easily accessible.

Meinberg's Technical Support team is also always available at **techsupport@meinberg.de** if you require additional assistance or advice on safety aspects of your system.

5.3 Safety when Installing the Device

This rack-mounted device has been designed and tested in accordance with the requirements of the standard IEC 62368-1 (*Audio/Video, Information and Communication Technology Equipment—Part 1: Safety Requirements*). Where the rack-mounted device is to be installed in a larger unit (such as an electrical enclosure), additional requirements in the IEC 62368-1 standard may apply that must be observed and complied with. General requirements regarding the safety of electrical equipment (such as IEC, VDE, DIN, ANSI) and applicable national standards must be observed in particular.

The device has been developed for use in industrial or home environments and may only be used in such environments. In environments at risk of high environmental conductivity ("high pollution degree" according to IEC 60664-1), additional measures such as installation of the device in an air-conditioned electrical cabinet may be necessary.

If the unit has been brought into the usage area from a cold environment, condensation may develop; in this case, wait until the unit has adjusted to the temperature and is completely dry before setting it up.

When unpacking & setting up the equipment, and before operating it, be sure to read the information on installing the hardware and the specifications of the device. These include in particular dimensions, electrical characteristics, and necessary environmental conditions.

Fire safety standards must be upheld with the device in its installed state.

The device with the highest mass should be installed at the lowest position in the rack in order to position the center of gravity of the rack as a whole as low as possible and minimize the risk of the rack tipping over. Further devices should be installed from the bottom, working your way up.

The device must be protected against mechanical & physical stresses such as vibration or shock.

Never drill holes into the device to mount it! If you are experiencing difficulties with rack installation, contact Meinberg's Technical Support team for assistance!

Inspect the device housing before installation. The device housing must be free of any damage when it is installed.

5.4 Electrical Safety

This Meinberg product is operated at a hazardous voltage.

This system may only be set up and connected by a skilled person, or by an instructed person who has received appropriate technical & safety training from a skilled person.

Custom cables may only be assembled by a qualified electrician.

Never work on cables carrying a live current!

Never use cables or connectors that are visibly damaged or known to be defective! Faulty, defective, or improperly connected shielding, connectors, or cables present a risk of injury or death due to electric shock and may also constitute a fire hazard!

Before operating the device, check that all cables are in good order. Ensure in particular that the cables are undamaged (for example, kinks), that they are not wound too tightly around corners, and that no objects are placed on the cables.

Cables must be laid in such a way that they do not present a tripping hazard.

Never connect or disconnect power, data, or signal cables during a thunderstorm! Doing so presents a risk of injury or death, as cables and connectors may conduct very high voltages in the event of a lightning strike!

The device cables must be connected or disconnected in the order specified in the user documentation for the device. Connect all cables only while the device is de-energized before you connect the power supply.

Always pull cable connectors out at both ends before performing work on connectors! Improperly connecting or disconnecting this Meinberg system may result in electric shock, possibly resulting in injury or death!

When pulling out a connector, **never** pull on the cable itself! Pulling on the cable may cause the plug to become detached from the connector or cause damage to the connector itself. This presents a risk of direct contact with live components.

Ensure that all plug connections are secure. In particular, when using plug connectors with lock screws, ensure that the lock screws are securely tightened. This is especially important for power supply connectors where 3-pin or 5-pin MSTB connectors with lock screws are used (see illustration).

Before the device is connected to the power supply, the device housing must be grounded by connecting a grounding conductor to the grounding terminal of the device.

When installing the device in an electrical enclosure, it must be ensured that adequate clearance is provided, minimum creepage distances to adjacent conductors are maintained, and that there is no risk of short circuits.



If the device malfunctions or requires servicing (for example, due to damage to the housing, power supply cable, or the ingress of liquids or objects), the power supply may be cut off. In this case, the device must be isolated immediately and physically from all power supplies! Electrical isolation must be performed and confirmed in accordance with the following procedure:

- Disconnect the power supply plug from the power source.
- Pull the power supply plug from the power supply.
- Contact the person responsible for your electrical infrastructure.
- If your device is connected to one or more uninterruptible power supplies (UPS), the direct power supply connection between the device and the UPS solution must be first be disconnected.



5.5 Safety when Maintaining and Cleaning the Device

Only use a soft, dry cloth to clean the device.

<u>Never</u> use liquids such as detergents or solvents to clean the device! The ingress of liquids into the device housing may cause short circuits in the electronic circuitry, which in turn can cause a fire or electric shock!



Neither the device nor its individual components may be opened. The device or its components may only be repaired by the manufacturer or by authorized personnel. Improperly performed repairs can put the user at significant risk!

In particular, **never** open a power supply unit or module, as hazardous voltages may be present within the power supply device even after it is isolated from the upstream voltage. If a power supply unit or module is no longer functional (for example due to a defect), it can be returned to Meinberg for repair.

Some components of the device may become very hot during operation. Do not touch these surfaces!

If maintenance work is to be performed on the device and the device housing is still hot, switch off the device beforehand and allow it to cool.

5.6 Battery Safety

The CR2032 lithium battery on the receiver module has a service life of at least 10 years.

Should it be necessary to replace the battery, please note the following:

- The battery may only be replaced by the same type or a comparable type recommended by the manufacturer.
- The battery may only be replaced by the manufacturer or authorized personnel.
- The battery must not be exposed to air pressure levels outside of the limits specified by the manufacturer.

Improper handling of the battery may result in the battery exploding or in leakages of flammable or corrosive liquids or gases.

- <u>Never</u> short-circuit the battery!
- <u>Never</u> attempt to recharge the battery!
- Never throw the battery in a fire or dispose of it in an oven!
- <u>Never</u> dispose of the battery in a mechanical shredder!



6 Important Product Information

6.1 CE Marking

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

CE

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 ??.

6.2 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 effect 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 **??**.

6.3 Ensuring the Optimum Operation of Your Device

- Ensure that ventilation slots are not obscured or blocked by dust, otherwise heat may build up inside the device. While the system is designed to shut down automatically in the event of temperature limits being exceeded, the risk of malfunctions and product damage following overheating cannot be entirely eliminated.
- The device is only deemed to be appropriately used and EMC limits (electromagnetic compatibility) are only deemed to be complied with while the device housing is fully assembled in order to ensure that requirements pertaining to cooling, fire safety, electrical shielding and (electro)magnetic shielding are upheld.

6.4 Prevention of ESD Damage



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

Precautionary measures should be taken to protect ESDS components from damage and malfunction.

- Before removing or installing ESDS components, ground your body first (for example, by touching a grounded object) before touching ESDS modules.
- Ensure that you wear a grounding strap on your wrist when handling such ESDS components. These straps must in turn be attached to an uncoated, non-conductive metal part of the system.
- Use only tools and equipment that are free of static electricity.
- Ensure that your clothing is suitable for the handling of ESDS components. In particular, do not wear garments that are susceptible to electrostatic discharges (wool, polyester). Ensure that your shoes enable a low-resistance path for electrostatic charges to dissipate to the ground.
- Only touch or hold ESDS components by the edges. Never touch any pins or conductors on the ESDS components.
- When removing or installing ESDS components, avoid coming into contact with persons who are not grounded. Such contact may compromise your connection with the grounding conductor and thus also compromise the ESDS component's protection from any static charges you may be carrying.
- Always store ESDS components 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 ESDS component has a lithium battery fitted on it.

6.5 Disposal

Disposal of Packaging Materials



The packaging materials that we use are fully recyclable:

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

<u>Do not</u> 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. In this case, the shipping costs are to be borne by the customer, while Meinberg will cover the costs for disposal. 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.

7 Introduction

This Setup Guide is a systematically structured guideline to assist you with the set-up of your Meinberg product.

The time code generator GEN182 has been designed to generate all signals required to control or simulate a DCF77 compatible long wave transmitter, or provide the reference time for an NTP server:

- 77.5 kHz carrier frequency
- second marks to modulate the carrier's amplitude
- PZF sequence and PZF window to modulate the carrier's phase
- Pulse-Per-Second (PPS) output

Additionally, an IRIG or an AFNOR time code signal are generated, and a serial time string which includes the generated absolute date and time, can be transmitted.

Functionality

All signals are derived from a 10 MHz reference frequency. This frequency can either be generated by a high quality on-board oscillator, or it can be supplied externally. The frequency source is selected by a jumper on the printed circuit board. The leading edge of the second marks can be synchronized by an external PPS input signal.

Internal date and time is always based on UTC (Universal Time, Coordinated; formerly GMT, Greenwich Mean Time). A configurable time offset can be applied to the UTC time base to compute a local standard time. The beginning and the end of a period of daylight saving time can either be computed year by year based on a simple, configurable algorithm, or can be configured for the current year. GEN170 generates the proper changeover announcement flags as required by the DCF77 coding scheme.

Additionally, a date for insertion of a leap second can be configured. Actually, leap seconds are only inserted at UTC midnight. GEN170 automatically generates the coding sequences to announce the leap second as required for DCF77 and NTP, and also inserts the leap second correctly.

16 TTL level inputs are provided to configure the length of the AM marks transmitted in seconds 0 through 15 of a minute in DCF77 emulation. These second marks can be used to transmit operating data – but most DCF77 receivers ignore these signals.

Compatibility

The GEN182 can also be installed as a plug-in unit in a BGT or TGP housing.

8 General Information about DCF77

The DCF radio-controlled clocks manufactured by Meinberg receive their signal from the DCF77 long-wave transmitter, which is installed in Mainflingen, near Frankfurt am Main in Germany, and transmits the reference time of the Federal Republic of Germany. This time reference will either be Central European Time (CET) or Central European Summer Time (CEST), depending on the time of year.

The transmitter is controlled by the atomic clocks of the PTB, Germany's national metrology institute located in Braunschweig, and transmits the current time of day, date of the month, and day of the week in coded pulse signals once a second. A complete record of the current time is transmitted once each minute as a 59-bit signal.

This signal is transmitted over the high-precision 77.5 kHz carrier frequency. At the start of each second, the amplitude of the carrier wave is lowered to around 15 % for 0.1 or 0.2 seconds. These amplitude reductions constitute one-per-second markers that contain the binary-coded time information; a marker lasting 0.1 seconds represents a binary "0", while a marker lasting 0.2 seconds represents a binary "1". The information on the time of day and the date as well as a number of parity and status bits are provided in the markers from 17 seconds to 58 seconds in each minute. The absence of the 59-second marker is used to signal the start of a new minute.

The radio-controlled clocks that we produce can receive this high-accuracy time information from anywhere in Germany, and also wholly reliably in Germany's neighboring countries, with reception documented as far afield as Bilbao in Spain or the town of Umeå in northern Sweden. DCF77 clock modules adjust to summertime and wintertime changes (Daylight Saving Time) automatically. The provision of this time signal is a public service that does not require payment of a license fee or registration.

You should generally ensure that the receiver antenna is positioned in such a way as to receive the best possible signal. It should be pointed at a 90 degree angle from the direction of the transmitter (Frankfurt) and be placed at least 1 meter away from your computer and 30 cm away from any steel structures, metal plates, etc.



9 Operating elements and Indicators GEN182





Information:

The numbering in the drawing above relates to the relevant subsection in this chapter.

9.1 LEDs GEN182

LED "FAIL"

The red LED labeled FAIL is turned on after power-up and stays on until the current time has either been acknowledged via the ACK key in the front panel, or the time has been set via the serial interface.

The red LED labeled FAIL is turned on after power-up and stays on until the current time has either been confirmed via the ACK key in the front panel, or the time has been set via the serial interface.



LED "LOCK"

The green LOCK LED reflects the generated DCF77 compatible AM time marks.

9.2 LC Display

The backlit 4 x 16 character LC display is used to show the system's time and status and let the user edit parameters. The keys described below let the user select the desired menu. The next chapter lists all available menus in detail. A quick reference of the available menus and submenus can be found at the end of this document.

DCF GENERATOR Mon. 08.05.2023 MEZ 12:00:00 000000000000000000

9.3 CLR/ACK Key

This key has to be used when parameters are to be modified. When this key is pressed the parameters that have been edited are saved in the battery buffered memory. If the menu is left without pressing CLR/ACK all changes are discarded.

9.4 MENU Key

This key lets the user step through several display menus showing specific data.

9.5 INC Key

This key changes the digit or the letter at the cursor position when entering data.







9.6 NEXT Key

When editing parameters (LCD cursor is visible) this key moves the cursor to the next digit rsp. to the next parameter to be edited. If the current menu just displays data (cursor not visible) pressing this key switches to a submenu (if available).

NEXT	
	~

10 Before you start

10.1 Scope of delivery

Carefully unpack the system and all accessories and put them aside. Check the scope of delivery with the packing list to ensure that no parts are missing. If any of the listed contents are missing, please contact Meinberg Funkuhren.

Check the system for shipping damage. If the system is damaged or cannot be put into operation, contact Meinberg Funkuhren immediately. Only the recipient (the person or company receiving the system) can assert a claim against Freight Forwarder for shipping damage.

Meinberg recommends that you keep the original packaging materials for possible future transport.

10.2 Disposal of Packaging Materials



The packaging materials we use are fully recyclable:

Material	Used for	Disposal
Cardboard	Shipping, packaging of accessories	Paper recycling
Plastic Wrapping	Shipping, packaging of accessories	Household waste or recycling depot

10.3 Selecting the 10 MHz reference

Before connecting to the power supply, make sure that the respective jumper for the 10 MHz reference is inserted. This ensures that the time of the internal RTC (Real Time Clock) can be set correctly.



The figure below shows how the jumpers can be used to set whether an external 10 MHz frequency or the 10 MHz of the internal oscillator is used as the reference frequency.



Jumper setting for internal or external 10 MHz



Information:

In the delivery state, the jumper is set to 10 MHz externally.

11 Installation

11.1 Powering Up the System

Note:

Before connecting with power supply, make sure that the external 10 MHz and PPS reference signals are connected. This ensures that the time of the internal RTC (Real Time Clock) can be set correctly.

After the power supply has been connected, the device is ready for operation. Approximately 10 seconds (TCXO) to 3 minutes (OCXO-MQ / HQ) after power-on, the oscillator of the clock has reached its operating temperature. The operating temperature is required for the basic accuracy to ensure the initially time setting.

After a power-up, all output signals, such as DCF-SIM, time code, Meinberg Time Telegram, are immediately available.

12 The Menus in Detail

12.1 Root Menu

The root menu is displayed when the receiver has completed initialization after powerup. During power-down, the current date and time are kept in a battery buffered on-board real time clock (RTC). After a new power-up, the initial calendar date and time should be correct. However, the red FAIL LED is on and a message is displayed asking to confirm the initial time:

ACK T	O CONFIRM
Mon,	dd.mm.yyyy
UTC	12:00:00
000000	0000000000

Unless the initial time is acknowledged by either pressing the CLR/ACK key in the front panel or by setting the initial time via the RS-232 serial port the device stays in state "unsynchronized". This is to prevent the device from starting to distribute a wrong time after power-up, which could otherwise happen due to interferences between an incoming PPS pulse and the second changeover of the built-in RTC chip.

Once the initial time has been confirmed, the main menu is displayed. The first line simply shows the module's function:

DCF77	GENERATOR
Mon,	dd.mm.yyyy
UTC	12:00:00
000000	00000000000

The next two lines display the current day of week, date, the name of the time zone (just informational, as defined in the setup menu), and local time. The last line shows, from left to right, the input levels of the control lines for the AM second marks 0 through 15. If a '1' is displayed a long time mark is generated at the corresponding second of a minute, if a '0' is displayed, there will be a short mark at the corresponding second.

If the NEXT key is pressed in this menu, the display shows the module's firmware version:

Meinberg	GEN***
Rev.	*.**

12.2 Menu SETUP

One of the configurable parameters can be selected in this menu using the NEXT key. When the CLR/ACK key is pressed, a submenu which lets the user view or modify the selected parameter, is displayed. In each of these submenus the NEXT key lets the cursor move to the next digit or letter to be edited whereas the INC key increments the digit or letter under the cursor. If changes have been made, the CLR/ACK key **must** be pressed in order to save those changes in the battery buffered memory, otherwise all changes are discarded when the user presses the MENU key, in order to return to the SETUP display.

12.2.1 SETUP INITIAL TIME

Using this menu, GEN182's on-board real time clock can be set. When finally the CLR/ACK button is pressed the system date and time is set to the values shown in the display.



12.2.2 ADJUST SECONDS

If the system time differs from an external reference time in some seconds, this menu can be used to adjust the internal clock to the reference time. The second and third lines of the display show the system date and time, enabling the user to compare it to the external time. The last line includes the two fields SEC+ and SEC-. The NEXT key can be used to position the cursor on one of these fields. Each time the CLR/ACK key is pressed, the system time is adjusted by one second: if the cursor is placed on the SEC+ field, the time is incremented by one second, otherwise it is decremented.



ADJUST SECONDS	
Mon. dd.mm.yyyy	
MEZ 12:00:00	
SEC + SEC -	

12.2.3 SETUP TIME ZONE

This menu lets the user enter the names of the local time zone with daylight saving disabled and enabled, together with the zones' time offsets from UTC. The left part of the display shows the zone and offset if daylight saving is off whereas the right part shows name and offset if daylight saving is on. These parameters are used to convert UTC to local time, e.g. MEZ = UTC + 1h and MESZ = UTC + 2h for central Europe. The range of date daylight saving comes in effect and can be entered using the next two topics of the setup menu.

SETUP		
TIME	ZONE	

TIME ZONE	
OFF<-DAYL	_SAV->ON
IMEZI	IMESZI
+01:00h	+02:00h

12.2.4 SETUP DAYLIGHT SAV ON/OFF

The two topics let the user enter the range of date for daylight saving to be in effect. Concerning parameter input both topics are handled identically, so they are described together in this chapter. Beginning and ending of daylight saving may either be defined by exact dates for a single year or using an algorithm which allows the receiver to recompute the effective dates year by year. The figures below show how to enter parameters in both cases. If the number of the year is displayed as wildcards ('*'), a day-of-week must be specified. Then, starting from the configured date, daylight saving changes the first day which matches the configured day-of-week. In the figure below March 25, 2023 is a Saturday, so the next Sunday is March 26, 2023.

All changeover rules for the daylight saving like "the first/the second/the second to last/the last Sunday/Monday etc. in the x-th month," can be described by the used format "first specified day-of-week after a defined date".

If the number of the year is not displayed as wildcards the complete date exactly determines the day daylight saving has to change (March 28, 1999 in the figures below), so the day-of-week doesn't need to be specified and therefore is displayed as wildcards.

SETUP DAYLIGHT SAV ON	DAYLIGHT SAV ON Date: 26.03.2023 Day of week: *** Time: 2 : 00 : 00	DAYLIGHT SAV ON Date: 25.03.**** Day of week: SUN Time: 2 : 00 : 00
SETUP DAYLIGHT SAV OFF	DAYLIGHT SAV OFF Date: 29.10.2023 Day of week: *** Time: 3 : 00 : 00	DAYLIGHT SAV OFF Date: 25.10.**** Day of week: SUN Time: 3 : 00 : 00
	changeover the last Sunday in March/October each year	

If no changeover in daylight saving is wanted, an identical date and time must be configured in both of the submenus (see fig. below). In addition, identical offsets for DAYLIGHT SAV ON/OFF should be configured in the submenu TIMEZONE.

SETUP DAYLIGHT SAV ON	DAYLIGHT SAV ON Date: 26.03.2023 Day of week: *** Time: 2 : 00 : 00
SETUP DAYLIGHT SAV OFF	DAYLIGHT SAV OFF Date: 29.10.2023 Day of week: *** Time: 3 : 00 : 00
SETUP TIME ZONE	TIME ZONE OFF<-DAYLSAV->ON I TIME I I TIME I +08:00h +08:00h

Example: For a region without daylight saving time and with a local time offset of +8 hours to UTC.

12.2.5 SETUP LEAP SECOND

This menu can be used to enter the date of a leap second insertion. In order to adjust the world wide time (UTC) to the earth rotation, the International Earth Rotation Service (IERS) announces when a leap second must be inserted into the UTC time scale. The IERS prefers to insert a leap second after 23:59:59 UTC on December, 31 or on June, 30, if necessary.

SETUP	LEA	PSECOND
LEAP SECOND	Date: Time:	01C dd.mm.yyyy 23.59.59

12.2.6 SERIAL PORT PARM

Using this topic the user can enter transmission speed and framing of the serial ports. Default parameters are:

COM0: 19200 baud, 8N1 COM1: 9600 baud, 8N1

SETUP

SERIAL PORT PARM

SERIAL PORT PARM
COM0: 19200 8N1

COM1: 9600 8N1

12.2.7 SETUP SERIAL STRING TYPE

This menu lets the user select the time string formats sent via the serial ports. As of this writing the GEN182 supports sending the Meinberg standard string only on both ports.

COM0: Meinberg Standard COM1: Meinberg Standard



Technical details about the Meinberg time string are described in the chapter 13.2 ("Available Time Strings").

12.2.8 SETUP SERIAL STRING MODE

This menu lets the user select the serial ports' mode of operation. COM0 transmits the current date and time using Meinberg's standard string. This string can be sent automatically once per second, once per minute or on request by ASCII '?' only.



SERIAL S	TRING MODE
COM 0:	Per Second
COM 1:	Per Second

12.2.9 SETUP TIME CODE OUT

This menu lets the user configure the card's IRIG/AFNOR time code output. The CODE: parameter selects the desired code frame format (IRIG or AFNOR), and the TIME: parameter determines whether the transmitted code should carry UTC, or local time.



Since most time code formats do neither include the UTC offset of the transmitted time, nor a flag which reports the current DST status, the recommended setting is UTC in order to avoid unexpected time steps of the connected time code receivers.

TIMEC	ODE OUT
CODE:	IEEE1344
TIME:	UTC EN_T

The IEEE1344 signal frame also contains a Time Figure Of Merit (TFOM) flag which reflects whether the time code generator is synchronized, or not. If the IEEE1344 code is selected then an additional parameter is displayed in the lower right corner which determines whether the TFOM flag reports the real current synchronization status (EN_T), or whether it always reports the generator was synchronized (DI_T). The latter setting can be useful in testing scenarios.

12.2.10 INIT USER PARMS

This menu lets the user set all parameters back to the default settings. The user has to acknowledge this menu again before the initialization starts.



Are you su	re?
Press	
CLR/ACK	->YES
MENU	-> NO

12.2.11 Resetting Factory Defaults

If both the NEXT key and the INC key on the front panel are pressed while the system is powered up the battery buffered memory is cleared and user definable parameters are reset to factory defaults. The key should be held until the root menu is displayed on LC Display.

13 Appendix Technical Data

13.1 Technical Specifications GEN182

LC Display:	4 x 16 character, menu selectable by push buttons	
Input Signals:	1PPS in - pulse per second (TTL level, leading edge) 10 MHz in reference frequency (Sine wave) (only if configured for external reference) amplitude Veff: 1 V	
Output Signals:	10 MHz reference frequency (TTL level) 77.5 kHz carrier frequency (TTL-Pegel) AM second mark (TTL level, active high) PZF sequence (TTL level) PZF_CLK clock (TTL level) PZF_WIN window (TTL level, active high) IRIG_AC modulated IRIG sine wave output IRIG_DC unmodulated IRIG output P_SEC second pulse, duration 200 ms (TTL level) PPM minute pulse, duration 200 ms (TTL level)	
Accuracy of Pulses:	better than +-100 nsec	
Accuracy of internal XTAL:	1 day: +-1*10 ⁻⁷ 1 year: +-5*10 ⁻⁷ drift with temparature: +-2*10 ⁻⁷	
Serial Ports:	two asynchronous serial ports (RS-232) transmission speed: 300 through 19200 framing: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1 default setting: 19200, 8N1	
Power Requirements:	5 V +- 5% @ 300 mA	
Physical Dimension:	3U module in a closed 112 mm high x 102 mm wide aluminium case	
Front Panel:	3U / 21HP (128 mm high x 107 mm wide), Aluminium	
Rear Edge Connector:	according to DIN 41612, type C 64, rows a+c (male)	
Ambient Temperature:	0 60° C	
Humidity:	85% max.	

13.2 Available Time Strings

13.2.1 Format of the Meinberg Standard Time String

The Meinberg Standard Time String is a sequence of 32 ASCII characters starting with the $\langle STX \rangle$ (Start-of-Text) character and ending with the $\langle ETX \rangle$ (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></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 mm Month yy Year of the Century	(01–31) (01–12) (00–99)	
W	The day of the week	(1–7, 1 = Monday)	
hh.mm.ss	The time:hhHoursmmMinutesssSeconds	(00–23) (00–59) (00–59, or 60 during leap second)	
uv	Clock status characters (d u: '#' ' ' (space, 20h) GPS: Clock is PZF: Time fra DCF77: Clock v: '*' GPS: Receive PZF/DCF77: ' ' (space, 20h) GPS: Receive	epending on clock type): GPS: Clock is in free-run mode (no exact synchronization) PZF: Time frame not synchronized DCF77: Clock has not synchronized since last reset s synchronized (base accuracy is reached) me is synchronized c has synchronized since last reset r has not checked its position Clock currently running off XTAL r has determined its position	
x	PZF/DCF77: Time zone indicator: '''' UTC	Clock is synchronized with transmitter Universal Time Coordinated, formerly GMT	
	'' CET 's' (CEST) Europ	European Standard Time, daylight saving disabled bean Summertime, daylight saving enabled	
У	Announcement of clock jur '!' 'A' ' '	np during last hour before jump enters effect: Announcement of start or end of Daylight Saving Time Announcement of leap second insertion (Space, 20h) nothing announced	
<etx></etx>	End-of-Text, ASCII code 0	3h	

13.3 Time Code

13.3.1 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.

Except these "IRIG Time Codes", other formats like NASA36, XR3 or 2137 are still in use. The GEN182 however generates the IRIG-B, AFNOR NFS 87-500 code as well as IEEE1344 code which is an IRIG coded extended by information for time zone, leap second and date.



13.3.2 Block Diagram Time Code

13.3.3 IRIG Standard Format



13.3.4 AFNOR Standard Format



13.3.5	Structure	of (CF	Segment	in	IEEE1344	Code
--------	-----------	------	----	---------	----	-----------------	------

Bit No.	Designation	Description
49	Position Identifier P5	
50	Year BCD encoded 1	
51	Year BCD encoded 2	Low nibble of BCD-encoded year
52	Year BCD encoded 4	
53	Year BCD encoded 8	
54	empty, always zero	
55	Year BCD encoded 10	
56	Year BCD encoded 20	High nibble of BCD-encoded year
57	Year BCD encoded 40	
58	Year BCD encoded 80	
59	Position Identifier P6	
60	LSP - Leap Second Pending	Set until 59s before LS insertion
61	LS – Leap Second	$0 = Add \ leap \ second, \ 1 = Remove \ leap \ second \ 1.)$
62	DSP - Daylight Saving Pending	Set until 59s before Daylight Saving Time changeover
63	DST - Daylight Saving Time	Set during Daylight Saving Time
64	Timezone Offset Sign	Sign of TZ offset $0 = "+"$, $1 = "-"$
65	TZ Offset binary encoded 1	
66	TZ Offset binary encoded 2	Offset between IRIG time and UTC time.
67	TZ Offset binary encoded 4	Encoded IRIG time plus TZ offset equals UTC at all times!
68	TZ Offset binary encoded 8	
69	Position Identifier P7	
70	TZ Offset 0.5 hour	Set if additional half-hour offset
71	TFOM Time figure of merit	
72	TFOM Time figure of merit	TFOM represents approximate clock error 2.)
73	TFOM Time figure of merit	0x00 = Clock synchronized, $0x0F$ = Clock in free-run mode
74	TFOM Time figure of merit	
75	PARITY	Parity of all preceding bits

1.) Current firmware only supports insertion of leap seconds!

2.) TFOM is set to 0 if clock has been able to synchronize since power up. The firmware does not support other codes.

For more information, please refer to the time code specifications.

13.3.6 Generated Time Codes

Besides the amplitude modulated sine wave signal, the board also provides unmodulated DC-Level Shift TTL output in parallel. Thus six time codes are available.

a)	B002:	100 pps, DCLS signal, no carrier BCD time-of-year
b)	B122:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year
c)	B003:	100 pps, DCLS signal, no carrier BCD time-of-year, SBS time-of-day
d)	B123:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, SBS time-of-day
e)	B006:	100 pps, DCLS Signal, no carrier BCD time-of-year, Year
f)	B126:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, Year
g)	B007:	100 pps, DCLS Signal, no carrier BCD time-of-year, Year, SBS time-of-day
h)	B127:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, Year, SBS time-of-day
i)	AFNOR:	Code according to NFS-87500, 100 pps, wave signal, 1kHz carrier frequency, BCD time-of-year, complete date, SBS time-of-day, Signal level according to NFS-87500
j)	IEEE1344:	Code according to IEEE1344-1995, 100 pps, AM sine wave signal, 1kHz carrier frequency, BCD time-of-year, SBS time-of-day, IEEE1344 extensions for date, timezone, daylight saving and leap second in control functions (CF) segment. (also see table 'Assignment of CF segment in IEEE1344 mode')
k)	C37.118	Like IEEE1344 - with turned sign bit for UTC-Offset

13.3.7 Selection of Generated Time Code

The time code to be generated can be selected by Menu Setup IRIG-settings or by the used Monitorprogram (except Lantime models). DC-Level Shift Codes (PWM-signal) B00x and modulated sine wave carrier B12x are always generated simultaneously. Both signals are provided at the VG64-Connector, i.e. if code B132 is selected also code B002 is available. This applies for the codes AFNOR NFS 87-500 and IEEE1344 as well.

The TFOM field in IEEE1344 code is set dependent on the 'already synced' character ('#') which is sent in the serial time telegram. This character is set, whenever the preconnected clock was not able to synchronize after power up reset. The 'time figure of merit' (TFOM) field is set as follows.

Clock synchronized once after power up:	TFOM = 0000
Clock not synchronized after power up:	TFOM = 1111

For testing purposes the output of TFOM in IEEE1344 mode can be disabled. The segment is set to all zeros then.

13.3.8 Outputs

The module GEN182 provides modulated (AM) and unmodulated (DCLS) outputs. The format of the timecodes is illustrated in the diagramms "IRIG-" and "AFNOR standard-format".

13.3.8.1 AM - Sine Wave Output

The carrier frequency depends on the code and has a value of 1 kHz (IRIG-B). The signal amplitude is 3 Vpp (MARK) and 1 Vpp (SPACE) into 50 Ohm. The encoding is made by the number of MARK-amplitudes during ten carrier waves. The following agreements are valid:

- a) binary "0": 2 MARK-amplitudes, 8 SPACE-amplitudes
- b) binary "1": 5 MARK-amplitudes, 5 SPACE-amplitudes
- c) position-identifier: 8 MARK-amplitudes, 2 SPACE-amplitudes

13.3.8.2 PWM DC Output

The pulse width DCLS signals shown in the diagramms "IRIG" and "AFNOR standard format" are coexistent to the modulated output and is available at the VG connector pin 13a with TTL level.

13.3.9 Technical Data

Outputs: Unbalanced AM-sine wave-signal: 3 V_{pp} (MARK) / 1 V_{pp} (SPACE) into 50 Ohm

DCLS signal: TTL

13.4 Signal Description GEN182

Name	Pin	Function
GND	32a+c	Ground
VCC in (+5V)	1a+c	+5 V supply
Vosc in $(+5V)$	2a+c	+5 V supply
10 MHz out	12a	10 MHz frequency output (TTL level)
2.25 MHz out	27c	2.25 MHz frequency output (TTL level)
77.5 kHz out	11a	77.5 kHz frequency output (TTL level)
DCF out	8c	AM time marks (TTL level, active high)
PZF_CLK out	10a	PZF clock (TTL level)
PZF_WIN out	7c	PZF window (TTL level, active high)
PZF out	6c	PZF sequence (TTL level)
P_SEC out	14c	Pulse once a second, duration 200 ms (TTL level)
PPM out	8c	Pulse once a minute, duration 200 ms (TTL level)
IRIG_AC out	ба	Modulated IRIG sine wave output
IRIG_DC out	7a	Unmodulated IRIG output
10 MHz in	4c	10 MHz reference input 1Veff into 50 Ohm
1PPS in	28c	sync. second (TTL, rising edge)
TTL_INxx in	13-28a	control inputs for AM marks 0 through 15 (TTL) long AM mark if input is high
COMx TxD out	24+26c	COMx RS-232 output
COMx RxD in	29+30c	COMx RS-232 input
/RESET in/out	9c	RESET signal, Open Drain pulled up to $+5~{ m V}$
(reserved)		reserved, do not connect

	а	с
1	VCC in (+5 V)	VCC in (+5 V)
2	Vosc in (+5 V)	Vosc in (+5 V)
3		
4		10 MHz in
5		
6	IRIG AC out	PZF out
7	IRIG DC out	PZF WIN out
8	PPM out	DCF out
9		/RESET in/out
10	PZF CLK out	
11	 77.5 kHz out	
12	10 MHz out	
13	TTL_IN0 in	
14	TTL_IN1 in	P_SEC out
15	TTL_IN2 in	reserve 0
16	TTL_IN3 in	reserve 1
17	TTL_IN4 in	reserve 2
18	TTL_IN5 in	
19	TTL_IN6 in	reserve 3
20	TTL_IN7 in	
21	TTL_IN8 in	
22	TTL_IN9 in	
23	TTL_IN10 in	
24	TTL_IN11 in	COM1 TxD out
25	TTL_IN12 in	
26	TTL_IN13 in	COM0 TxD out
27	TTL_IN14 in	2.25 MHz out
28	TTL_IN15 in	1 PPS in
29		COM1 RxD in
30		COM0 RxD in
31		
32	GND	GND

Steckerbelegung / Pin Assignment GEN182

13.5 Firmware Update

Whenever the on-board software must be upgraded or modified, the new firmware can be downloaded to the internal flash memory via the serial port COM0. There is no need to open the metal case and insert a new EPROM.

If the MENU key on the front panel is pressed while the system is powered up, a bootstrap-loader is activated and waits for instructions from the serial port COM0. The new firmware can be uploaded from any standard PC with serial interface. A loader program will be shipped together with the file containing the image of the new firmware.

The contents of the program memory will not be modified until the loader program has sent the command to erase the flash memory. So if the MENU key is pressed unintentionally while the system is powered up, the firmware will not be changed accidentally. After the next power-up the system will be ready to operate again.



Important!

The firmware of the GEN182 should be updated under the expert guidance of our support team, as an improperly performed update process can severely impair the proper function of your device.

Meinberg will provide you with quick expert assistance on updating the firmware of your GEN182. We provide free support for the entire service life of your Meinberg product.

Meinberg Technical Support

Telephone: +49 (0) 5281 – 9309- 888 **Email:** techsupport@meinberg.de

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".

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.

