
# MANUAL

## MSF600USB

### USB CLOCK

29th July 2011

Meinberg Radio Clocks GmbH & Co. KG

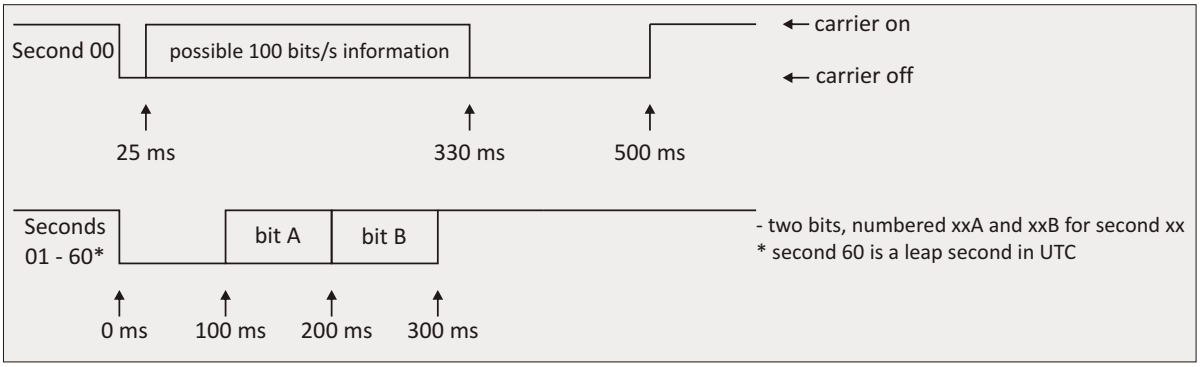
# Table of Contents

# 1 General information about Anthorn MSF

The MSF transmission from Anthorn is used to spread the UK national standards of time and frequency which are maintained by the National Physical Laboratory. The signal provides adequate field strength throughout the UK and it can be received widely in northern and western Europe. A simple on-off modulation of the carrier frequency (60kHz) is used to transmit BCD-coded informations about time and date. Every UTC second is marked by an off stage of carrier of at least 100ms. This second marker has an accuracy better than +/- 1ms.

The time code format is a one minute time frame, which is used to transmit data applied to the following minute. To broadcast the informations, bits 'A' and 'B' of each second are used (see code format below). If the carrier is on a logical '0' is transmitted, otherwise a logical '1'.The first second of a minute nominally contains a period of 500ms with carrier off to serve as a minute marker. However, there may be on/off carrier modulation between 25ms and 330ms during second 00 to distribute information of hour, minute, day and month with a fast 100 bits/s code. Seconds 01B to 16B are used to transmit the difference between UTC and UT1 (which is closely equivalent to GMT), called DUT1. Seconds 17A to 51A are used to transmit the local time and date. Seconds 52A to 59A include informations about change of BST/UTC, BST status and some parity bits.

## Code format:




### DUT Code

The DUT1 is signaled to the nearest 100ms in the range of +/-800ms. A positive figure means that GMT is at a higher count than UTC. Bits 01B to 16B are used to signal the DUT code in the following way.

| DUT1 | positive | DUT1 | negative |
|---|---|---|---|
| 0ms | no bits set to '1' | 0ms | no bits set to '1' |
| +100ms | bit 01B '1' | -100ms | bit 09B set to '1' |
| +200ms | bits 01B and 02B '1' | -200ms | bits 09B and 10B '1' |
| +300ms | bits 01B to 03B '1' | -300ms | bits 09B to 11B '1' |
| +400ms | bits 01B to 04B '1' | -400ms | bits 09B to 12B '1' |
| +500ms | bits 01B to 05B '1' | -500ms | bits 09B to 13B '1' |
| +600ms | bits 01B to 06B '1' | -600ms | bits 09B to 14 B '1' |
| +700ms | bits 01B to 07B '1' | -700ms | bits 09B to 15B '1' |
| +800ms | bits 01B to 08B '1' | -800ms | bits 09B to 16B '1' |

### Time and date codes

Time and date informations are transmitted and coded in the following way.

| | Binary-Coded-Decimal Year (00-99) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| order | 80 | 40 | 20 | 10 | 8 | 4 | 2 | 1 |
| bit | 17A | 18A | 19A | 20A | 21A | 22A | 23A | 24A |

| | BCD month (01-12) | | | | | BCD day-of-month (01-31) | | | | | | BCD day-of-week (0-6) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| order | 10 | 8 | 4 | 2 | 1 | 20 | 10 | 8 | 4 | 2 | 1 | 4 | 2 | 1 |
| bit | 25A | 26A | 27A | 28A | 29A | 30A | 31A | 32A | 33A | 34A | 35A | 36A | 37A | 38A |

| | BCD hour (00-23) | | | | | BCD minute (00-59) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| order | 20 | 10 | 8 | 4 | 2 | 1 | 40 | 20 | 10 | 8 | 4 | 2 | 1 |
| Bit | 39A | 40A | 41A | 42A | 43A | 44A | 45A | 46A | 47A | 48A | 49A | 50A | 51A |

# Other Codes

**Minute Identifier**

Bits 53A to 58A are all set permanently at '1' and are always preceded by bit 52A at '0' and followed by bit 59A at '0'. This sequence '01111110' never appears elsewhere in bit xxA, so it uniquely identifies the following second 00 minute marker. In minutes lengthened or shortened by a positive or negative leap second all these numbers are correspondingly increased or decreased by one (i.e. during these 61- or 59-second minutes the position of the time and date code is shifted by one second relative to the start of minute).

**Parity Bits**

The parity bits are providing and odd number of 1's.

Bit 54B taken with bits 17A to 24A
Bit 55B taken with bits 25A to 35A
Bit 56B taken with bits 36A to 38A
Bit 57B taken with bits 39A to 51A

**Summer Time**

When UK civil time is subject to an one-hour positive offset during part of the year, this period is indicated by setting bit 58B to '1'. Bit 53B is set to '1' during the 61 consecutive minutes immediately before a change, the last being minute 59, when bit 58B changes.

**Unused Bits**

The unused bits are currently set to '0', but may be used in the future.

# 2 Overview: MSF600USB

The radio remote clock MSF600USB has been designed for communication via the serial USB interface. The required power is provided via the USB cable as well, so there is no need for any external power supply.

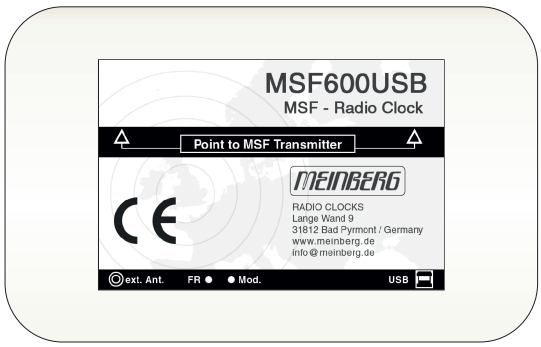
The DCF77 signal received by the internal antenna is passed to the on-board LF receiver where it is demodulated by a synchronous detector with automatic gain control. The demodulated time marks from the receiver circuit are filtered and decoded by the microprocessor. If no errors are detected in the current time message an additional plausibility check against the previous time message is performed. If that plausibility check passes, too, the real time clock on the board is adjusted corresponding to the decoded time and date.

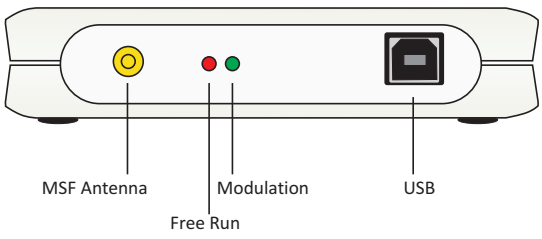
The MSF600USB module provides two integrated LEDs, which show the demodulated time marks (MOD LED) and the state of synchronisation (FR LED).

The scope of supply includes an USB cable with 3 mtrs. of length to connect the MSF600USB directly to a PC's USB port. Also included is the driver software for Windows 2000/XP/VISTA/WIN 7 ® operating systems that is used to set the system time of the computer and shows some important status information of the MSF600USB.

Driver software for other operating systems can be found on the Meinberg homepage for download:
http://www.meinberg.de/english/sw/index.htm

## 2.1 Installation




### 2.1.1 Power Supply

The MSF600USB is powered via the PC's USB port. After connecting the USB port the radio clock is ready to operate. For proper operation it is essential to pay attention to the following points.

### 2.1.2 General information about position of antenna

The antenna of MSF-receivers includes a ferrite rod which must be aligned to the transmitter. For best reception the longitudinal side of the antenna must point to the Anthorn MSF transmitter (latitude 540 55' N, longitude 30 15' W).

The antenna should be installed with a distance of at least 30cm to all metal objects because they would detune the antenna resonance. A distance of several meters to computer monitors must be kept. If they are running in a high screen resolution mode, their line frequency is close to the carrier frequency of the MSF transmitter, which would cause a worse or no reception.

### 2.1.3 Status LEDs

The two LEDs „Mod“ and „FR“ reflect the state of synchronisation of the decoded time marks of the USB5131. If the antenna is installed properly and the signal from MSF Radio Station can be received without strong distortions, the green LED labeled Mod starts blinking exactly once per second, corresponding to the time marks from MSF. If this LED flashes intermediately, there is some electrical noise around which prevents the microprocessor from decoding the time message. In this case, a better location for the antenna must be found. After start-up, the red LED labeled FR (free running) indicates that the clock is running on XTAL and has not synchronized with MSF yet. Due to the plausibility checks, it can take up to three minutes after power-up until the clock is synchronized and this LED is turned off. The state of this LED only changes when a new minute begins. Without or with a disturbed RF signal the clock runs on XTAL with an accuracy of 10-6 (after 24 hours of synchronous operation). If the clock have lost reception for more than 12 hours the FR LED starts blinking.

# 3 Technical Specifications MSF

| | |
|---|---|
| RECEIVER: | narrowband straight receiver with automatic gain control<br>bandwidth: approx. 40Hz<br>reception via internal or external ferrite antenna |
| MODULATION: | demodulated time marks indicated by LED |
| TIMECODE CHECK: | Multiple software check of the incoming timecode<br>Parity and consistency check over a period of two minutes |
| FREE RUNNING: | Without RF signal the clock runs on XTAL with an accuracy of 10-6 (after 24h of synchronous operation)<br>Disturbed reception indicated by LED |
| BATTERY BACKUP: | In case of supply voltage failure the on-board RTC keeps the time based on XTAL for more than 140 hours (buffer capacitor) |
| RELIABILITY OF OPERATION: | Microprocessor supervisory circuit provides watchdog timer, power supply monitoring and backup-battery switchover |
| INTERFACE: | USB 2.0 (Universal Serial Bus) |
| TIME ZONE: | UTC/BST (standard) |
| CONNECTORS: | USB connector type B<br>SMB antenna connector (male) |
| POWER SUPPLY: | 5V, via USB interface of the PC<br>current consumption: approx. 90 mA |
| HOUSING: | plastic housing, IP30 protected<br>73mm x 117mm x 24mm (width x depth x height) |
| AMBIENT TEMPERATURE: | 0 ... 50°C |
| HUMIDITY: max. | 85 % |

**CE Label**

CE

This device conforms to the directive 2004/108/EC on the approximation of the laws of the Member States of the European Community relating to electromagnetic compatibility.

# 4 Content of the USB stick

The included USB stick contains a driver program that keeps the computer´s system time synchronous to the received time. If the delivered stick doesn't include a driver program for the operating system used, it can be downloaded from:

http://www.meinberg.de/german/sw/


On the USB stick there is a file called "readme.txt", which helps installing the driver correctly.

# Konformitätserklärung

**Declaration of Conformity**

| | |
|---|---|
| Hersteller<br>Manufacturer | **Meinberg Funkuhren GmbH & Co. KG**<br>**Lange Wand 9**<br>**D-31812 Bad Pyrmont** |

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

| | |
|---|---|
| Produktbezeichnung<br>Product Name | **MSF Funkuhr** |
| Modell / Typ<br>Model Designation | **MSF600USB** |

auf das sich diese Erklärung bezieht, mit den folgenden Normen übereinstimmt
to which this declaration relates is in conformity with the following standards

| | |
|---|---|
| EN55022:2008-05, Class B | Grenzwerte und Meßverfahren für Funkstörungen von informationstechnischen Einrichtungen<br>Limits and methods of measurement of radio interference characteristics of information technology equipment |
| EN55024:2003-10 | Grenzwerte und Meßverfahren für Störfestigkeit von informationstechnischen Einrichtungen<br>Limits and methods of measurement of Immunity characteristics of information technology equipment |

gemäß den Richtlinien 2004/108/EG (Elektromagnetische Verträglichkeit), 2006/95/EG (Niederspannungsrichtlinie) und 93/68/EWG (CE Kennzeichnung) sowie deren Ergänzungen.
following the provisions of the directives 2004/108/EC (electromagnetic compatibility), 2006/95/EC (low voltage directive) and 93/68/EEC (CE marking) and its amendments.

Bad Pyrmont, den 28.07.2011

Günter Meinberg
Managing Director