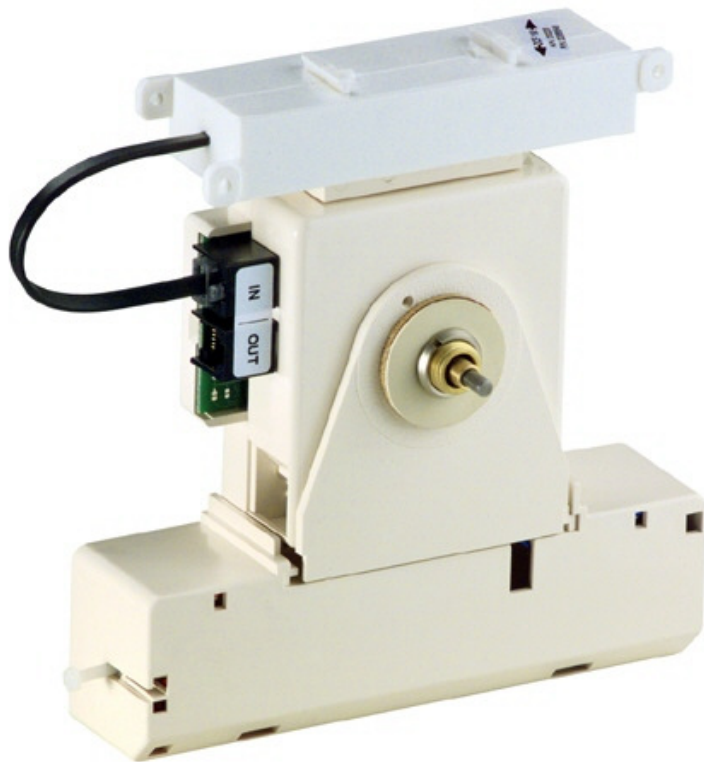


MOUNTING AND INSTRUCTION MANUAL

**Movements Model FU 192 (t) WWVB
for North America Continent**



Certification of the producer

Standards:

All movements of Series 192 have been developed and produced in accordance with the EU-Standards 89 / 336 / EWG.

Applied Standards: EN 50081-1 EN 50082-2



References to the Instruction Manual

1. The information in this Instruction Manual can be changed at any time without previous notice.
2. We do not answer for direct or indirect damages, which could occur when using this Manual.
3. Please read the instructions carefully and start the setting-up of the Series 192 only once you have correctly understood all information for the installation and operation.
4. The installation must be carried out by skilled staff only.

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1. Introduction, Overview

Movements	FU 192(t) WWVB
Type of movement	Radio movement
Synchronization	WWVB 60 Hz Radio Antenna
t → Long shaft	See Fig. 2: 192t for illuminated clocks

Movement for self-setting indoor and outdoor clocks for dials up to 80 cm of diameter. Without illumination series 192, with illumination series 192 t. Up to 3 slave movements BU 192(t) can be connected in cascade, Fig. 8, p. 8.

2. Dimensions

	192	192t
A	18.9	34.0
B	11.9	27.0
C	8.4	23.5
D	---	8.0
E	5.0	8.0

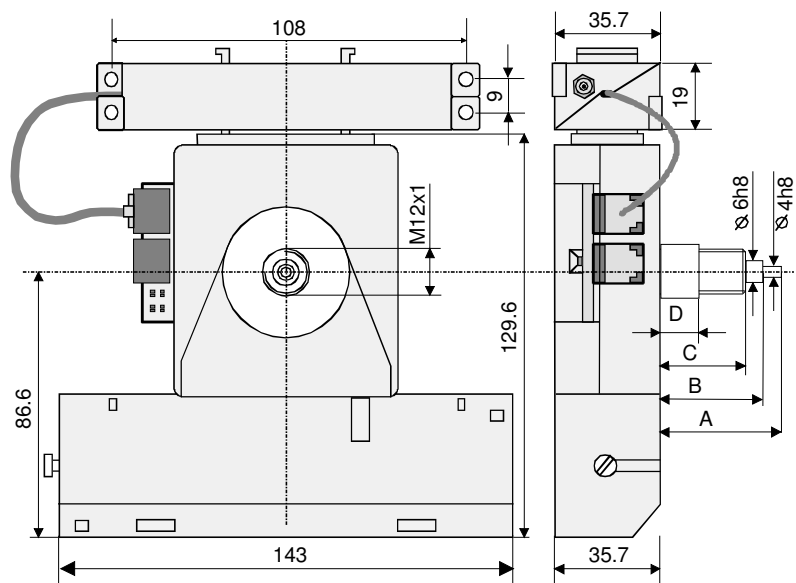


Fig. 1

3. Fixing of Movement

The dial must be sufficiently stable. The fixing hole must have a diameter of 12,3 mm. The movement must be fixed in vertical position.

See Fig. 2 for the position of mounting parts. The disc nut (7*) M12 x 1 has to be tightened with a special wrench tool (Art. No. 36761) and a torque wrench with a torque of 4.5 Nm +/- 0.2 Nm..

Attention:

Using the movement 192t the ring nut (5), and the compensation ring (6) must not be removed..

On a movement with short shaft (192) the rubber washer (3) must in no case touch the clock case. In case of damage of the clock case the movement can be blocked. Always use syntactic ring first (2).

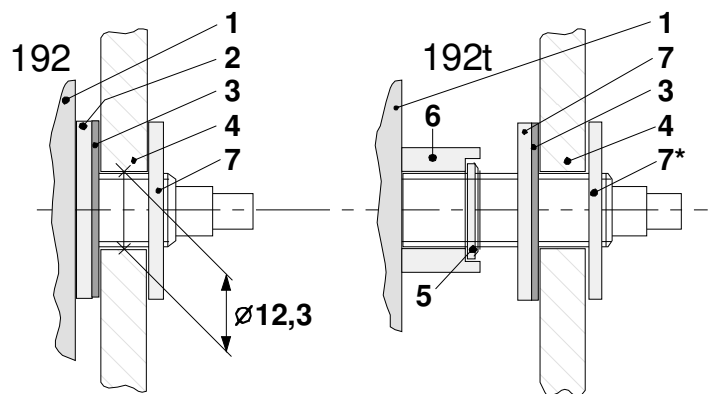


Fig. 2

- 1 Movement
- 2 Synthetic ring
- 3 Rubber washer
- 4 Dial
- 5 Ring nut
- 6 Distance ring
- 7 Disc nut

4. Mounting and Starting-up

4.1 Starting-up of a completely assembled clock with FU 192(t) WWVB

- Install the power supply as per Chapter 4.2.3
- At the foreseen clock place align the antenna and check the reception, vide Chapter 5.1 p. 7.

4.2 Mounting of hands and Starting-up

4.2.1 Mounting of hands

The shafts of the hour and minute hands are positioned ex-work on the reference position (12 o'clock). The hands shall be carefully fixed and tightened on the shafts. Enough space must be foreseen between the hands.

The position 12 o'clock must be checked on each movement after the mounting (Chap. 4.2.2).

4.2.2 Starting-up and check of the hand position

- Pull out the **IN** plug (the 12 o'clock position must be separately checked in case of cascade connected movements).
Install the power supply as per Chap. 4.2.3 → The clock runs to 12 o'clock position
→ Position of hands OK?
- If the hand position is wrong, carefully loosen the hands, adjust and tighten.
→ Check the 12 o'clock position again (initialising by a short interruption of the power supply).
- Insert the **IN** plug (data connection)
- Check the reception, vide Chap. 5 p. 7.

Attention:

- After a correct adjustment the hands must not be turned manually any more!
- If the clock in the meantime has been once synchronized, the movement will behave as per 4.3.1.

4.2.3 Mounting of Power Supply

To open the battery box lift the cover with a screwdriver, which is placed in the foreseen space, and press lightly downwards (Fig. 4). The battery box is foreseen for the following power supply :

Lithium battery 3.6V 27Ah 250394

Attention:

Please pay attention to the polarity of the power supply!
As soon as the movement is under power, the hands will start moving.

Advice:

The electric contact can be improved through a slight tightening of the synthetic screw.
The lithium battery shall be connected by using the corresponding connection wires.

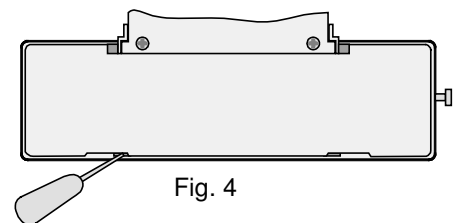


Fig. 4

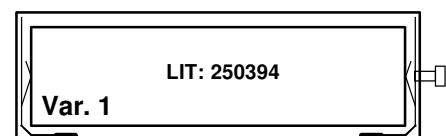


Fig. 4a

4.3 Function of the operating key (Fig. 5)

4.3.1 FU 192 (t) WWVB in normal operation

The clock has been synchronized once at least !

Key touch < 5s Switch on radio signal reception
Key touch > 5s Positioning onto reference position 12 o'clock

When the hands have been set on 12 o'clock with a key touch > 5s, they remain in this position during 10 minutes and will then start running autonomously to the correct time.

With a brief key touch the hands will run to correct time **immediately**.

If the clock has to be disassembled or the hands adjusted anew, it is recommended to remove the power supply, after that the hands have stopped at 12 o'clock.

This will prevent, that the hands suddenly will start running after 10 minutes.

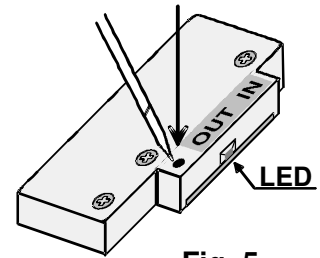


Fig. 5

4.4 Remote control by means of external key (Fig. 5a)

The functions with external key are identical with those of the internal operation key (Chap. 4.3.1).

The external key will be connected on the plug position **OUT**. For the connection of the plug vide Chap. 10, p. 11.

An external key including 5 m cable is available (KEY 192).

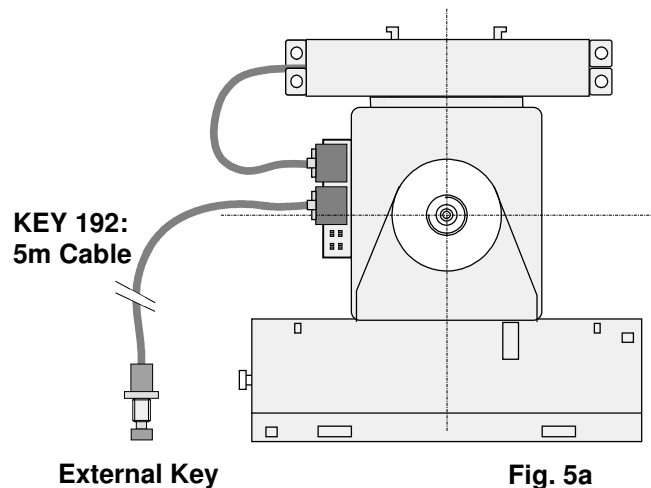


Fig. 5a

5. Synchronization

5.1 Synchronization by Antenna AW 192 (WWVB-60kHz)

Check radio signal reception → Orientation of the antenna:

The antenna should be oriented towards the site of the emitter (Fort Collins, Colorado).

Check the reception quality by the side-positioned LED (Fig. 5, p. 6).

The LED should flash regularly in second pulses.

Activate reception by a brief key touch (Fig. 5, p. 6).

- At bad reception push the antenna backwards from the fixing device and turn it round its own axle (Fig. 6). This will change the orientation of about 40°.
- Should the reception quality, in spite of the turning round the own axle, not has improved much, the antenna can be optimally placed and oriented by means of an extension cable CAB 192.

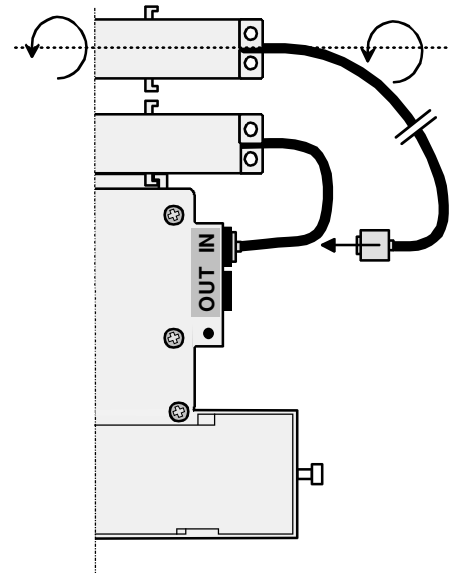


Fig. 6

A weatherproof (IP54) antenna (AW 192.5) for outdoor use is available for especially difficult cases.

The radio signal reception is on as long as two valid telegrams are picked up. At good reception conditions the movement should move to actual time after about 2 - 3 minutes.

For further information concerning the radio signal reception, vide Chap. 8.2 p. 10.

5.2 Time zone settings

Switch 2..4 (Fig. 7) are used to set the time zone. The following time zones can be set:

	Time zone UTC - 10
	Time zone UTC - 9 Alaska
	Time zone UTC - 8 Pacific (PT)
	Time zone UTC - 7 Mountain (MT)
	Time zone UTC - 6 Central (CT)
	Time zone UTC - 5 Eastern (ET)
	Time zone UTC - 4
	Time zone UTC - 3

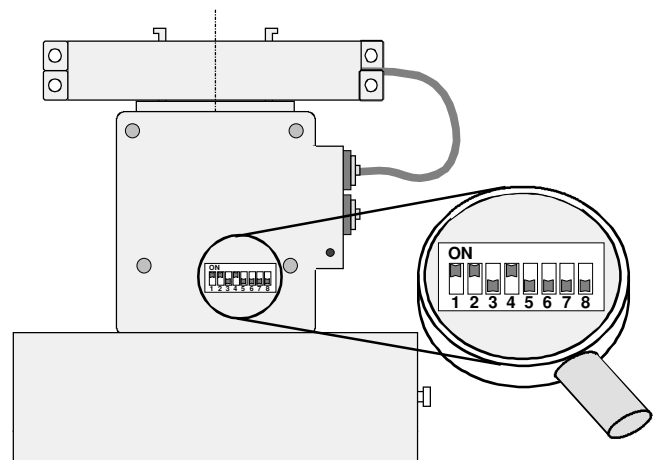
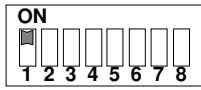


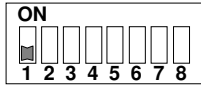
Fig. 7

5.3 Daylight Saving Time settings

Switch 1 (Fig. 7, p. 7) is used to control the automatic daylight saving time change.



no Daylight Saving Time



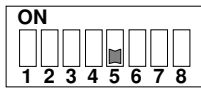
Automatic Daylight Saving Time switch active

5.4 "Run to 12.00 Position" behaviour

Switch 5 (Fig. 7, p. 7) is used to choose, whether the movement shall run to 12.00 position after 7 days of no WWVB code reception or go on running on its own quartz time base (if reception from time to time is possible, it will synchronize again to correct time).



Never run to 12.00 position (after 7 days of no reception)



Run to 12.00 position after 7 days of no reception

Caution: If reception of WWVB code is not possible over a long time period, especially during daylight saving time change, the clock will not change the time !

The switches 6..8 are currently not used !

6. Cascade

Cascading means that a number of movements will be connected in series.

Up to three slave movements BU192 can be connected to one master movement (Fig. 8).

As master movement the following type can be used:

- FU 192 (t) WWVB

The cascading is done by means of a cascade cable COM 192 (length 1m), enabling to synchronize 4 movements with only one reference signal. After starting-up the time synchronization for all movements will follow in a few seconds only. Should the time for the master movement change during the normal operation, the time take-over for each connected movement will take about 2 minutes, which means totally about 8 minutes. This is also valid for the daylight saving time change.

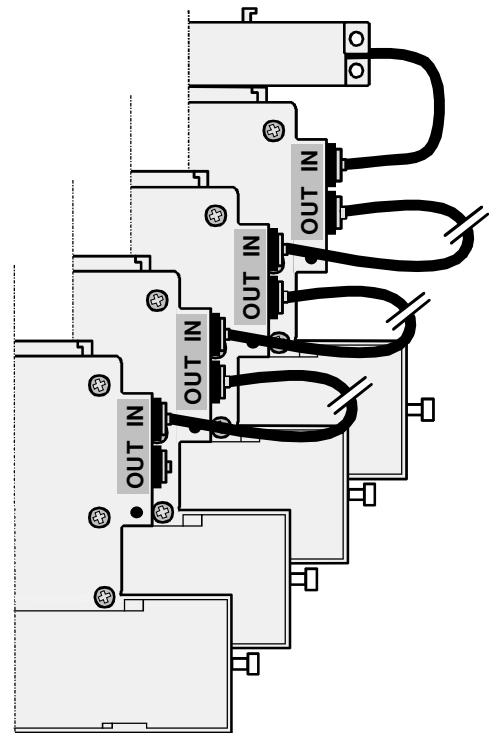


Fig. 8

6.1 Starting-up of cascaded movements

As master movement should be used a **FU 192 (t) WWVB** with radio signal reception:

Connecting of the power supply → movements run to the reference position (12 o'clock).

- Wait until the master movement has taken over the time.
- The master movement has taken over the time:
 - Starts to run on correct time.
 - Starts to transmit serial telegrams over the OUT plug (Chap. 7.1)
- Some seconds later the slave movements start running to the time of the master movement.

Remark:

In the cascaded movements all the internal keys are connected in **parallel**.

On the OUT plug of the last movement an additional external key can be connected.

→ Each key touch influences all the movements.

7. Serial Telegrams

7.1 Time telegram transmitted with local time (through OUT plug)

This telegram is sent from the FU 192 (t) WWVB.

Definition: Time telegram (ASCII), terminating at the designed second in the telegram:
9600 bit/s, 7 data bits, even parity, 1 stop bit. Jitter < 50 ms.

Format:

Byte Nr.	Designation	Sign	HEX Code
1	Stat sign	O	4F
2	Supervision	A	41
3	Local time (displayed by the clock)	L	4C
4	Year tens	0 .. 9	30 .. 39
5	Year units	0 .. 9	30 .. 39
6	Month tens	0 or 1	31 or 31
7	Month units	0 .. 9	30 .. 39
8	Day tens	0 .. 3	30 .. 33
9	Day units	0 .. 9	30 .. 39
10	not used	F	46
11	Hours tens	0 .. 2	30 .. 32
12	Hours units	0 .. 9	30 .. 39
13	Minutes tens	0 .. 5	30 .. 35
14	Minutes units	0 .. 9	30 .. 39
15	Seconds tens	0 .. 5	30 .. 35
16	Seconds units	0 .. 9	30 .. 39
17	Telegram end	CR	0D

8. Detailed Function Description

8.1 Current saving mode of the movement, current consumption

"Run" mode: Microprocessor active during time reception and control of the motor
Current saving mode: Microprocessor in repose mode

Starting-up:

After the insert of the power supply the movement remains in "Run" mode until the time is received from WWVB time signal.

When the time has been taken over, the movement switches to the current saving mode at the next minute step at the latest → normal operation.

Operation:

In operation the movement awakes for a short time at each second change and checks, if it must remain in "Run" mode or if it can switch off again. At the same time the time will be adjusted.

In the second 59 the movement switches to the „Run“ mode, so that the minute step can follow correctly on second 0. In second 2 (at serial reception second 3) the movement will return to the current saving mode.

Average current consumption (measured over 24h):

Current saving mode	< 10 μ A
"Run" mode	< 3 mA
During motor step	ca. 50 mA
Max. current during motor step and LED	ca. 60 mA
FU 192(t) WWVB, when reception quality is good	ca. 280 μ A

8.2 Concept for the radio signal reception

The radio clock can receive time signals from the emitter WWVB in Fort Collins, Colorado, up to a distance of 3200 km from the emitter (as per reception quality on the installation site).

The radio clock receives the time signals through the antenna. The received time signals will be evaluated by the receiver module (situated in the antenna case), demodulated, amplified and re-transmitted as digital signals to the controller of the movement.

If the movement is once correctly adjusted by radio, it runs on its own 32 kHz quartz time base and synchronizes itself once every hour (at minute 56 second 20) from the radio signal from the emitter. In addition, twice every night the whole time information will be read in (01:56:20 and 02:56:20).

If the hourly synchronization cannot be executed within 40s because of interferences, the reception will be switched off and after an hour a new attempt will follow.

If the complete time telegram cannot be received in the night within 5 min. because of interferences, the receiver will be switched off and after an hour a new attempt will follow. This will be repeated until 2 complete telegrams have been received, then it will commute to second synchronization again.

After 7 days without time reception, the clock runs to 12 o'clock, stops and will remain there.

This function can be switched off by switch 5. See chap. 5.4, p. 8).

At each minute step an optic check of the hands position follows. If the 12 o'clock position will be identified by the clock and the internal time base is not on 12 o'clock, the hands will automatically be reset to the correct position in fast-running.

The daylight saving time changeover follows automatically.

This function can be switched off by switch 1. See chap. 5.3. p. 8).

9. Problem removal

Nr.	Problems	Solutions
1	All movements: Clock shows suddenly wrong time → Hands are untied on axes	FU 192(t) WWVB: <ul style="list-style-type: none"> - Touch key > 5s. Clock runs to reference position (12 o'clock) - Check position of hands - Brief touch on key for running to actual time
2	FU 192(t) WWVB: After more than one night not run on actual time. → Bad reception conditions (In metal or steal premises, near to electrical devices as engines, TV, PCs or fluorescent lamps)	<ul style="list-style-type: none"> - Turn antenna axial for 180° - Extend cable by CAB 192 and mount antenna remotely - Use antenna AW 192.5 and mount it outdoors
3	FU 192(t) WWVB: After a normal operation hands stand on reference position. → Degrade of radio reception conditions. → Serial telegram missing. After 7 days without radio reception hands run on reference position.	<ul style="list-style-type: none"> - Turn antenna axial for 180° - Extend cable by CAB 192 and mount antenna remotely - Use antenna AW 192.5 and mount it outdoors

10. Connections

Plug IN

Antenna (Fig. 6, p. 7):

- 1 nc
- 2 GND
- 3 VCC Ant.
- 4 WWVB in
- 5 nc
- 6 nc

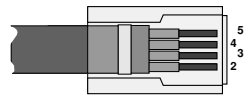


Fig 9

View from contact side

Plug OUT

Key remote control (Fig. 5a p. 6)

- 1 nc
- 2 Key
- 3 nc
- 4 nc
- 5 nc
- 6 Key

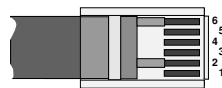


Fig. 10

View from contact side

General occupation

- 1 TxD
- 2 GND
- 3 nc
- 4 nc
- 5 nc
- 6 Key



Fig. 11

View from contact side

(nc: not connected)

11. Technical Data

Models 192 / 192t -	Description	FU 192 WWVB	FU 192t WWVB
Order Reference - Number		201440	201439
Operation	WWVB 60 (AW 192 adapted)	•	•
Type of reception WWVB 60	Total reception with diagonal built-in antenna, 180° axial turnable, approx. 30µV/m	•	•
Synchronization	Synchronization of second: each hour complete time reception: at starting, minimum. 2 x per night or by key touching	•	•
Control of hands position	1 x per 12 hours	•	•
Introduction to adjustment	Connection to power supply / key touching	•/•	•/•
Setting times:			
Starting position	12.00 o'clock (ex-works)	•	•
Running time to reference pos.	6 minutes maximum	•	•
Running time for new adjustment	5 ... 12 minutes (at perfect reception)	•	•
Changes of daylight saving time	5.5 minutes maximum	•	•
Power supply for in- and outdoors	1 x 3.6 V Lithium battery	•	•
For indoor only			
Life-span of batteries	2 x 1.5 V IEC LR 20 (Mono cells) 2 x 1.5 V LR 20 batteries approx. 3 years Lithium battery with one clock approx. 6-7 years	•	•
Actuation	1 motor for minute- and hour hands	•	•
Step frequency of minute hand motor	Normal operation mode: 1 step / min Setting mode 2 steps / sec.	•	•
Dimensions of hands max.	As per DIN 41092/3 for dial Ø up to 80 cm	•	•
Weight of hands max.	Balanced min.-hand 140 g, hour-hand 110 g	•	•
Fixing	Central nut M 12 x 1 mm	•	•
Operation and stocking temperature	-30°C up to +70°C	•	•
Dimensions of battery box (Chap. 2, p. 4)	B 143 x H 149 x T 35 mm	•	•
Colour	Cream white RAL 9001	•	•
Weight without batteries	gram	310	350

Radio reception		indoors		outdoors		Reference No..
Model	Description	Ex-works	Extendable by CAB 192	Ex-works	Extension	
AW 192	WWVB -Radio time signal receiver AM 192	•	4 / 8 m	•	—	201444
AW 192.5	WWVB -Radio time signal receiver AM 192.5	—	—	—	5 m	201625
Optional:						
CAB 192: Extension cable as a set, with connectors and plugs (Length = 4 m)		For indoor use only				700471 & 700469
COM 192: Cascade cable with connectors (Length = 1 m)						200045
KEY 192: External key with 5 m cable and connectors						201373
Long-life Lithium battery, 3.6 V, 27 Ah		Within a protected housing (IP 54)				250394



MOSER-BAER SA – EXPORT DIVISION
 CH-1228 PLAN-LES-QUATES
 Tel. +41 22 884 96 11 Fax. +41 22 884 96 90
 export@mobatime.com / www.mobatime.com

MOSER-BAER AG
 CH-3454 SUMISWALD
 Tel. +41 34 432 46 46 Fax. +41 34 432 46 99
 moserbaer@mobatime.com / www.mobatime.com