MOUNTING AND INSTRUCTION MANUAL

DMU 160

Self-setting minute movement

Certification of the Producer

STANDARDS

The DMU 160 was developed and produced in accordance with the EU Guidelines:

1999/5/EC
EMV guideline 2004/108/EC $C\,\epsilon$
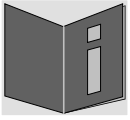
References to the Instruction Manual

1. The information in this Instruction Manual can be changed at any time without notice.
   The current version is available for download on www.mobatime.com.
2. This Instruction Manual has been composed with the utmost care, in order to explain all details in re-spect of the operation of the product. Should you, nevertheless, have questions or discover errors in this Manual, please contact us.
3. We do not answer for direct or indirect damages, which could occur, when using this Manual.
4. Please read the instructions carefully and only start setting-up the product, after you have correctly understood all the information for the installation and operation.
5. The installation must only be carried out by skilled staff.
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1 Safety

1.1 Safety instructions

Read this chapter and the entire instruction manual carefully and follow all instructions listed. This is your assurance for dependable operations and a long life of the device.

Keep this instruction manual in a safe place to have it handy every time you need it.

1.2 Symbols and Signal Words used in this Instruction Manual

	Danger! Please observe this safety message to avoid electrical shock! There is danger to life!
	Warning! Please observe this safety message to avoid bodily harm and injuries!
	Caution! Please observe this safety message to avoid damages to property and devices!
	Notice! Additional information for the use of the device.

1.3 Intended Use

The **DMU 160** is a self-setting minute movement for clocks with a diameter of up to 160 cm. It is synchronized by MOBALine or DCF current loop. The DMU 160 is suited for the use in façade clocks with unprotected hands.

1.4 Observe operating safety!

Vorsicht!

- Disconnect the device from its power supply before opening it.

- Only connect the power supply after connecting all other cables.

- The device is not intended for use by persons (including children) with limited physical, sensory, or mental capacities or a lack of experience and/or knowledge.

- Keep packaging such as plastic films away from children. There is the risk of suffocation if misused.

1.5 Consider the installation site!

Danger! Make sure
that you wait before using the device after any transport until the device has reached the ambient air temperature. Great fluctuations in temperature or humidity may lead to moisture within the device caused by condensation, which can cause a short.

1.5.1 Housing

Vorsicht!

The cover of the housing does not close completely. Make sure that the slit for opening the cover is located on the 6 o'clock position, so that moisture trapped in the device can escape (protection class: IP 54). If the housing cover is directly exposed to the weather, it must either be sealed with silicone or the housing must be protected with a hood.

1.6 Please observe the electromagnetic compatibility!

Vorsicht!

This device complies with the requirements of the EMC guideline 2004/108/EG

2   Maintenance

2.1   Troubleshooting: Repairs

Please carefully read chapter 11 if you encounter technical problems with your device.

If you cannot rectify the problems, contact your supplier from whom you have purchased the device.

Any repairs must be carried out at the manufacturer's plant.

Disconnect the power supply immediately and contact your supplier, if …

- liquid has entered your device

- the device does not properly work and you cannot rectify this problem yourself.

2.2   Cleaning

- Please make sure that the device remains clean especially in the area of the connections, the control elements, and the display elements.

- Clean your device with a damp cloth only.

- Do not use solvents, caustic, or gaseous cleaning substances.

2.3   Disposing

Device
At the end of its lifecycle, do not dispose of your device in the regular household rubbish. Return your device to your supplier who will dispose of it correctly.

Packaging
Your device is packaged to protect it from damages during transport.
Packaging is made of materials that can be disposed of in an environmentally friendly manner and properly recycled.

3   General Information: Introduction

3.1   Scope of Delivery

Please check your delivery for completeness and notify your supplier within 14 days upon receipt of the shipment, if it is incomplete.

The package you received contains:

- DMU 160 movement
- 2 hand bushings

The operation of the movement requires a MOBALine master clock, an NMI or a feed unit 24 VDC / 200 mA and a DCF or GPS receiver.

Available accessories

- DCF 4500
- GPS 4500
- Surge protection SP 4500
- Power supply unit 24 VDC
- Flush-mounting box for concrete
- Front mounting plate
- Hands

The surge protection is mounted between antenna and receiver box.

3.2   Technical data

See chapter 13.

3.3   Device Description in this Manual

This instruction manual was written for the **self-setting minute movement DMU 160**. In the following chapters, the designations **DMU 160** or simply **movement** are used for better readability.

3.4   Device description

The **DMU 160** is a self-setting facade movement for outdoor clocks with diameter 60-160 cm. It is available for front mounting or rear-sided wall mounting. Synchronization takes place via MOBALine or DCF/GPS receiver. If the DMU 160 is synchronized via GPS receiver, it is possible to set a time zone.

4 Installation

4.1 MOBALine operation, power supply from MOBALine

1. Mount movement at destination (see chapter 5)

2. Remove cover

3. Switch 1.1 to ON (12 o'clock position). Switch 1.4 to ON (MOBALine supply)

4. Using the switches 1.2 and 1.3, select the minute hand mode

5. Connect the control cables (see chapter 9.1)

6. Turn on MOBALine

7. The movement will now run to the 12 o'clock position in advance mode. If the shafts were already set to the 12 o'clock position, they will first move counter-clockwise , then run back to the 12 o'clock position in advance mode. Wait until the position is successfully detected

8. Mount hands to the shafts in the 12 o'clock position (see chapter 5)

9. Switch 1.1 to OFF

10. Mount cover (opening slit at the 6 o'clock position)

11. After successful synchronization, the clock runs to the correct time and goes into normal operation

4.2 DCF or MOBALine operation, powered by 24VDC power supply unit

1. Mount movement at destination (see chapter 5)

2. Remove cover

3. Switch 1.1 to ON (12 o'clock position). Switch 1.4 to OFF (ext. supply)

4. Using the switches 1.2 and 1.3, select the minute hand mode

5. Connect the control cables (see chapter 9.1)

6. Turn on the power supply 24VDC

7. The movement will now run to the 12 o'clock position in advance mode. If the shafts were already set to the 12 o'clock position, they will first move counter-clockwise , then run back to the 12 o'clock position in advance mode. Wait until the position is successfully detected

8. Mount hands to the shafts in the 12 o'clock position (see chapter 5)

9. Switch 1.1 to OFF

10. Mount cover (opening slit at the 6 o'clock position)

11. After successful synchronization, the clock runs to the correct time and goes into normal operation

4.3   Instructions for DCF GPS operation, 24VDC power supply

1.   Install movement at destination (see chapter 5).

2.   Remove cover.

3.   Set switch 2.1 to ON (12:00 position). Set switch 2.4 to OFF (ext. power supply).

4.   Select the minute hand mode using the switches 2.2 and 2.3.

5.   Connect the external 24V power supply and the GPS receiver (s. chapter 9.1).

6.   Switch on power supply 24VDC.

7.   The movement will now run to the 12:00 position. If the shafts are already set to the 12:00 position, the movement will first run backwards and then back to the 12:00 position. Wait until the position is successfully detected.

8.   Mount hands to shafts in the 12:00 position (see chapter 5).

9.   Set switch 2.1 to OFF (hands run to current time).
Notice:
Take-over of the time from GPS can take several minutes. If no time zone is set, the movement displays either UTC or MET (depending on connection of the GPS receiver).

10.   Set time zone (see also chapter 7.2 Push-button and 10 Time zone table):
- Hold red push-button on the lower print longer than 5s (see also chapter 9).
- Press push-button briefly to set the desired time zone.

11.   When the desired time zone is set, hold the push-button for longer than 5s again. The time zone is saved and the movement runs to the current time.

12.   Mount cover (opening slit at bottom).

13.   After successful synchronization, the clock runs to correct time again and is now in normal operation.

5 Mounting guidelines

5.1 Rear-sided wall mounting

The rear-sided wall mounting is done according to Illustration 1: Wall mounting.
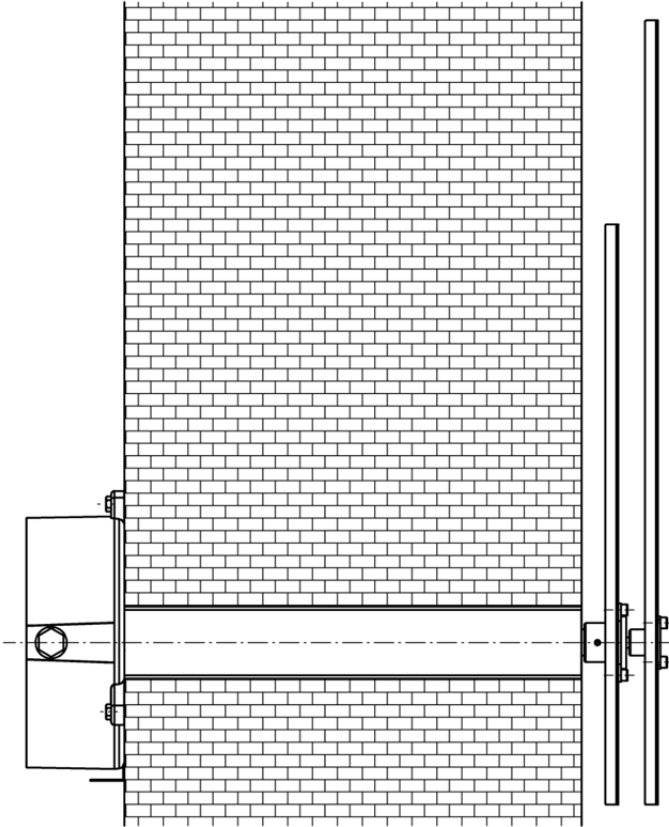
Illustration 1: Wall mounting
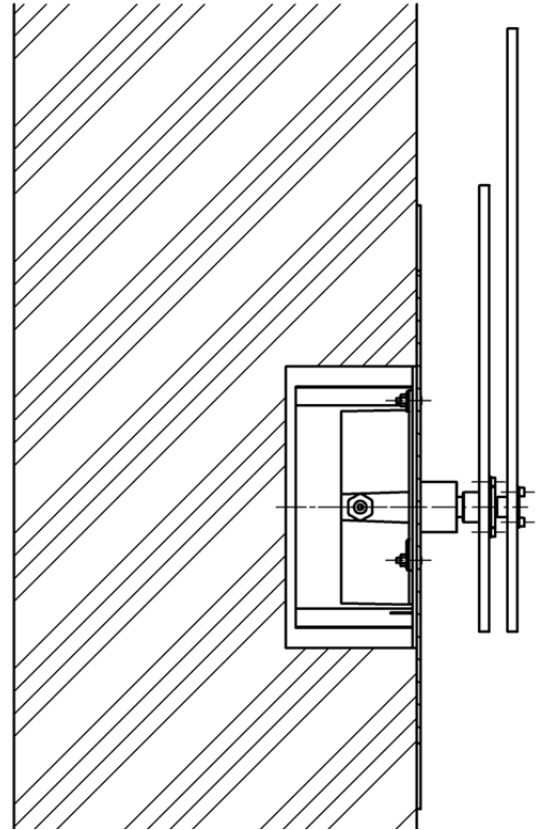
Illustration 2: front mounting

5.2 Front mounting

For the front mounting, a front mounting plate is required. See Illustration 2: front mounting. See also chapter 13, under accessories.

5.3   Hand mounting

The hands are mounted according to the drawing below.
The fixation screws (1) for the hand bushings must be spot-drilled on the 12 o'clock position of the hands on the shaft so that the hands will not shift (e.g. due to strong winds).
The hands contain elongated holes that allow for a later fine adjustment.
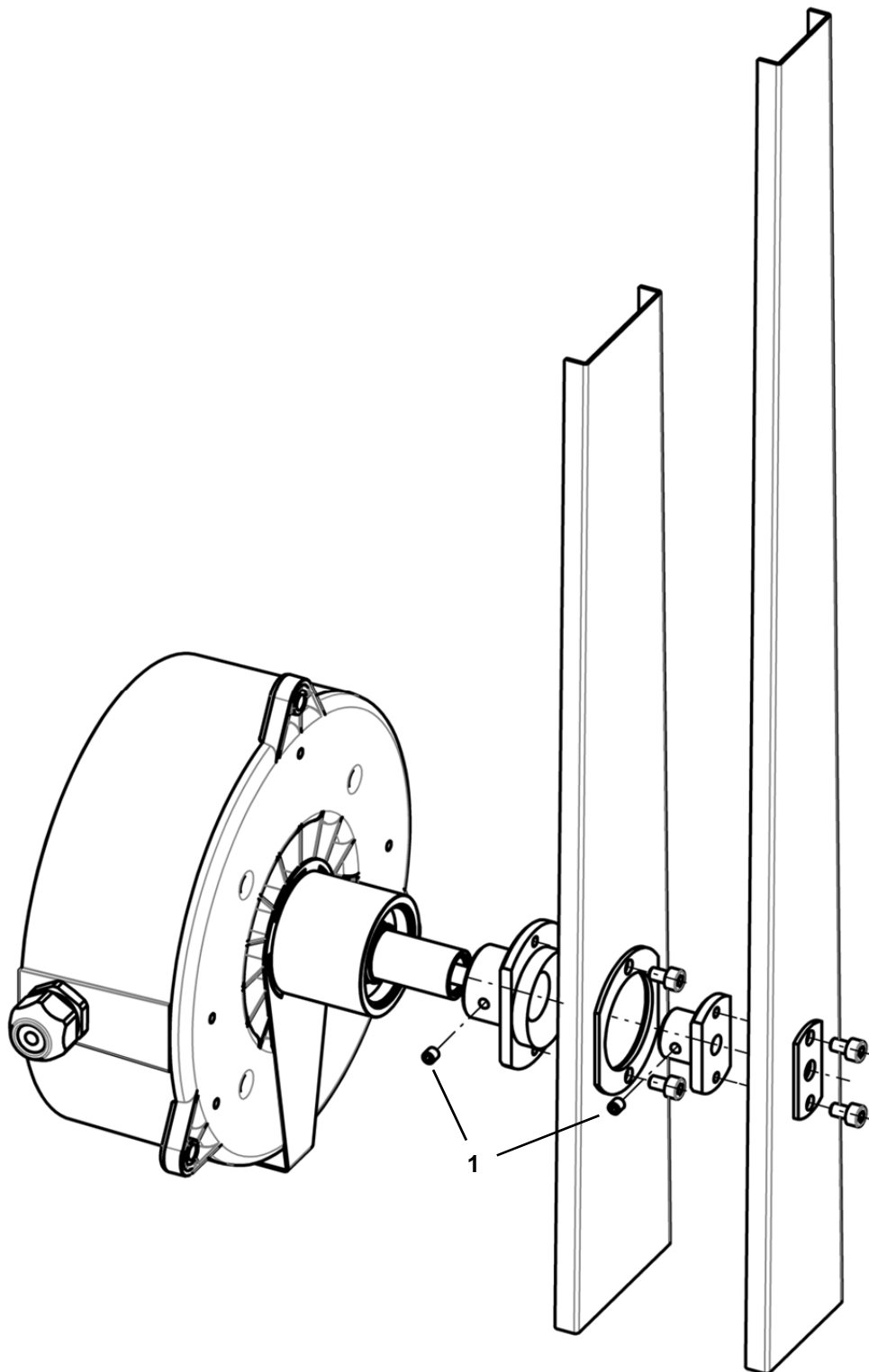
6 Status display and monitoring

6.1 Function and status display via LEDs

The DMU 160 movement control contains 2 LEDs for function and status display (see also chapter 9):

DCF LED   Shows the connected DCF signal. The LED stays off when no signal is connected.

State LED   Shows the current state of the movement according to the table below. In case of an error, the error code (number of impulses) is sent out every two seconds. Only the error with the highest value (amount of impulses) is displayed

State	Meaning
Permanently off	Movement has no active power supply
Permanently on	Movement works without error and is synchronized
Flashes 1x	Movement has no valid time[*1]
Flashes 2x	The power supply voltage is too low for correct operation
Flashes 3x	Mechanism of the minute hand is blocked[*2]
Flashes 4x	Mechanism of the hour hand is blocked[*2]
5x	Internal error. Contact service.

[*1]   If the movement is operated via DCF current loop, it may take several minutes for the movement to get synchronized.

[*2]   It may take some time to detect a blocked mechanism.

6.2 Feedback via MOBALine

With the aid of suitable master clocks with the ability to receive MOBALine feedback, DMU 160 movements can be monitored for their correct function.

The monitoring runs via an identification. The ID can be set in the MOBALine ID Mode using a push-button. Standard value is 0 = no clock ID and feedback. If the highest ID (12) is reached, increasing the ID again results in 0 (no ID). Similarly, decreasing while on 0 switches to the ID 12.

7 Configuration and operation

7.1 DIP switch
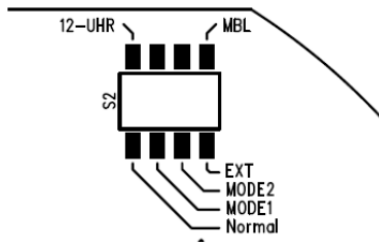
The movement can be configured via the four DIP switches S2.1 to S2.4.

Switch	State	Description
S2.1	ON	Movement runs to 12 o'clock position
	OFF	Movement in normal operation
S2.2		Configuration of the minute hand mode
S2.3		
S2.4	ON	Movement power supply via MOBALine
	OFF	Movement power supply via external supply

Setting the minute hand mode

Using the switches S2.2 and S2.3, the minute hand mode of the movement can be set depending on the synchronization source.

S2.2	S2.3	MOBALine	DCF current loop
OFF	OFF	MOBALine[1]	Minute step
OFF	ON	Minute step[2]	Minute step
ON	OFF	Half-minute step[2]	Half-minute step
ON	ON	Continuous (1 / 10s)[2]	Continuous (1 / 10s)

[1] The minute hand mode sent over MOBALine is adapted
[2] The manual modes cannot be overwritten via MOBALine

7.2   Push-button

The following settings can be modified using the push-button (see also chapter 9).

7.2.1 Set time zone

If the push-button is held down for longer than 5 seconds, the movement goes into the time zone mode. In this mode, the desired time zone can be set using the push-button:

- 1x short push (< 1 second):   Increase time zone by 1
- 2x short push (within 1 second):   Decrease time zone by 1
- 1x long push (> 1 sec., < 5 sec.):   Reset time zone
                                                 (set time zone to UTC)
- 1x long push (> 5 seconds):   Save time zone and exit setup
                                                 mode

The currently set time zone is displayed using the clock hands (for a list of possible time zones, see chapter 10 Time zone table). Per default, the movement is set to UTC.

Attention: This time zone is followed only if the movement is synchronized with DCF.

7.2.2 Set MOBALine clock ID

If the DMU 160 is in the MOBALine clock ID configuration mode, the clock ID can be set using the push-button:

- 1x short push (< 1 second):   ID increases by 1
- 2x short pushes (within 1 second):   ID decreases by 1
- 1x long push (> 1 second):   ID reset (ID to 0)

The clock ID can be set to a value from 0-12. If the maximum ID is reached (12), the next increase of the ID will change it to 0 (no ID). The clock hands show the currently set clock ID.

8 Operation

8.1 Operating mode minute hand

The operating mode of the minute hand can be switched between continuous (1 / 10s), minute step (1 / min) or half minute step mode (2 / min) using the switches S2.2 and S2.3. The hand mode can be switched during operation. The operating mode of the minute hand can be set via MOBALine when synchronized. For more detailed information see chapter 7.1.

8.2 Accuracy / Time-keeping

Deviation without synchronization: <5 sec/d (Quartz: 12MHz, 50ppm @ 0..40°C).

After successful synchronization with DCF current loop, time-keeping during power down mode with 32.768kHz clock for at least 10 hours. The movement itself has no active running reserve and stands still.

During synchronization with DCF current loop, the quartz drift is compensated via software trimming. This results in deviations of <1 sec/d. If only the time signal drops out, the clock keeps running for 7 days when synchronized via DCF or for 24h when synchronized via MOBALine.

8.3 Types of synchronization

MOBALine

Synchronization on MOBALine code for self-setting movements. The line configuration of the master clock such as 12 o'clock command and operating mode of minute hand are adopted automatically.

DCF-Current Loop

Synchronization on DCF current loop time signal, can be combined with time zone setting.

8.4 Monitoring

If the DMU 160 is synchronized via MOBALine, it sends a status report via MOBALine that can be received and displayed by suitable devices (e.g. NMI).
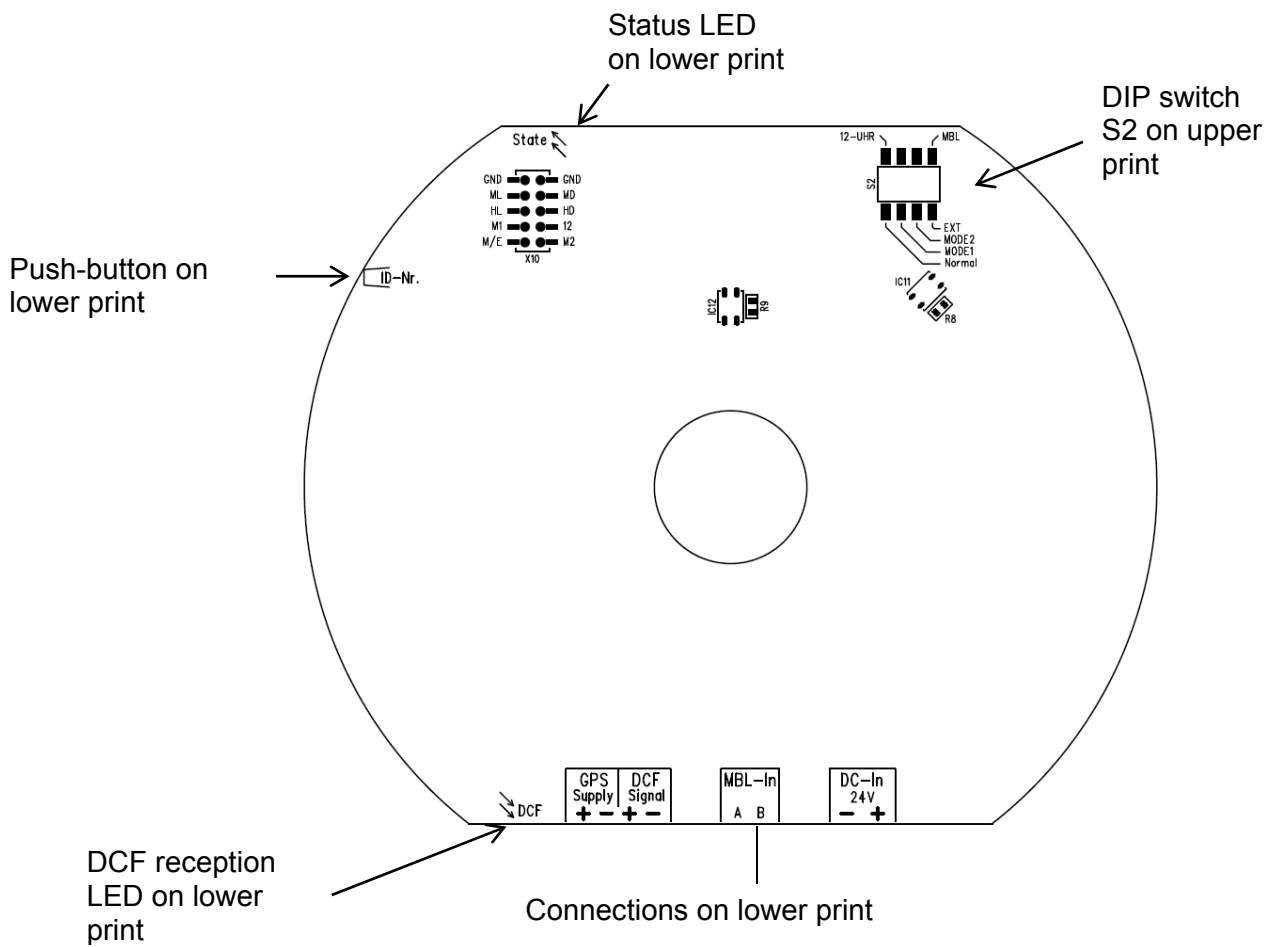
8.5 Position detection

Two light barriers responsible for the positioning of the minute and hour shaft periodically check for correct hand position.

The clock does not detect displaced hands ➔ fixation screws must be spot-drilled on the shaft!

9 Connections and control elements

Status LED
on lower print

DIP switch
S2 on upper
print

Push-button on
lower print

DCF reception
LED on lower
print

Connections on lower print

9.1 Connection diagram

9.1.1 DCF/GPS time signal receiver

GPS	DCF
Supply	Signal
+ −	+ −

MBL-In
A B

DC-In
24V
− +

we bn

DCF
4500

GPS 4500
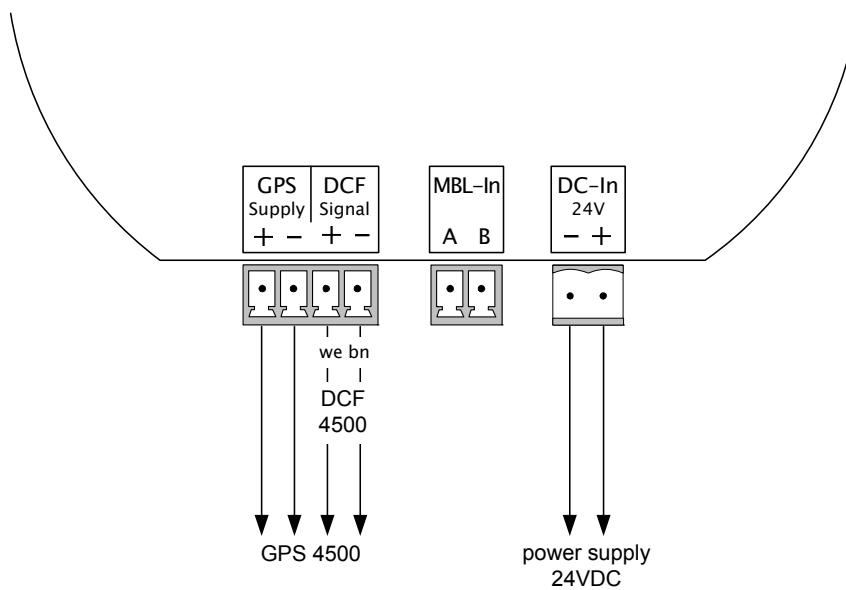
power supply
24VDC

9.1.2 MOBALine connection
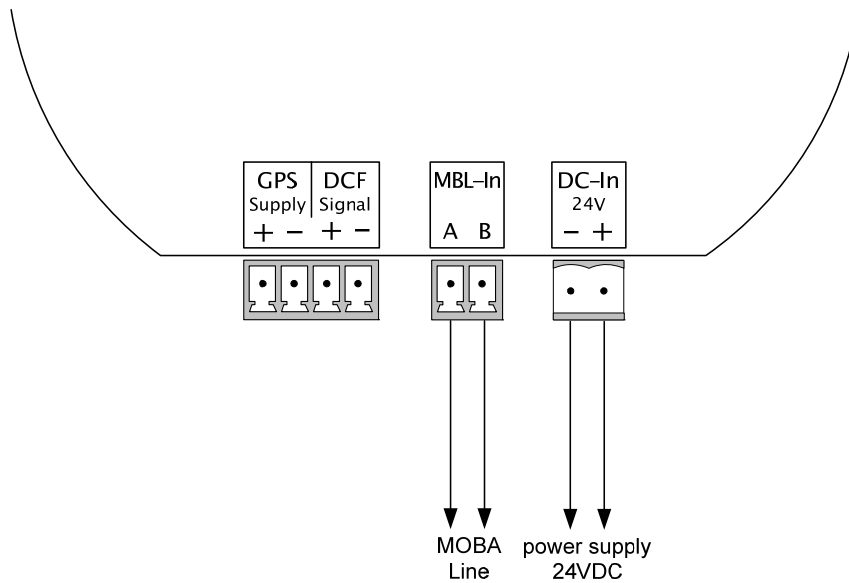
When synchronized via MOBALine, the power can be directly supplied from MOBALine (200mA). The polarity of the connectors is irrelevant.

9.2   Power supply

Using the switch S2.4, the movement's power supply can be switched between external and MOBALine supply. For the operation with DCF, the switch S2.4 must be set to external supply (OFF).

External supply: 24VDC max. 100mA
Supply via MOBALine: min. 12VAC max. 200mA

9.3   DC output

14 VDC, 200 mA max. for the power supply of a GPS 4500 time signal receiver, secured with a multifuse.

10　Time zone table

Time display in time zone mode	City / State	UTC Offset	DST Change	Standard → DST	DST → Standard
10:00	Midway Islands (US)	-11	No		
10:05	Adak (Aleutian Is.)	-10	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
10:10	Honolulu, Hawaii (US)	-10	No		
10:15	Anchorage, Alaska (US)	-9	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
10:20	Gambier Island	-9	No		
10:25	Los Angeles, Pacific Time	-8	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
10:30	Adamstown (Pitcairn Is.)	-8	No		
10:35	Denver, Mountain Time	-7	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
10:40	Phoenix, Arizona	-7	No		1st Sun. Nov. (02:00)
10:45	Mexico City, Mexico	-6	Yes	1st Sun. Apr. (02:00)	Last Sun. Oct. (02:00)
10:50	Chicago, Central Time (US & Canada)	-6	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
10:55	Tegucigalpa, Honduras	-6	No		
11:00	New York, Eastern Time (US & Canada)	-5	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
11:05	Bogota, Lima, Quito, Easter Island, Chile	-5	No		
11:10	Caracas	-4.5	No		
11:15	Atlantic Time (Canada)	-4	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
11:20	La Paz	-4	No		
11:25	Newfoundland, Labrador	-3.5	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
11:30	Qaanaaq, Greenland, Nuuk, Greenland	-3	Yes	Last Sat. Mar. (22:00)	Last Sat. Oct. (23:00)
11:35	Brasilia	-3	Yes	3rd Sun. Oct. (00:00)	3rd Sun. Feb. (00:00)
11:40	Buenos Aires, Santiago	-3	No		
11:45	Middle Atlantic	-2	No		
11:50	Scoresbysund, Greenland, Azores	-1	Yes	Last Sun. Mar. (00:00)	Last Sun. Oct. (01:00)
11:55	Praia, Cape Verde	-1	No		
12:00	**UTC (GMT), Monrovia, Casablanca**	**0**	**No**		
12:05	London, Dublin, Edinburgh, Lisbon	0	Yes	Last Sun. Mar. (01:00)	Last Sun. Oct. (02:00)
12:10	CET standard time	+1	No		
12:15	Brussels, Amsterdam, Berlin, Bern, Copenhagen, Madrid, Oslo, Paris, Rome, Stockholm, Vienna, Belgrade, Bratislava, Budapest, Ljubljana, Prague, Sarajevo, Warsaw, Zagreb	+1	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
12:20	Pretoria, Harare, Kaliningrad	+2	No		
12:25	Athens, Istanbul, Helsinki, Riga, Tallinn, Sofia, Vilnius, Bucharest, Romania	+2	Yes	Last Sun. Mar. (03:00)	Last Sun. Oct. (04:00)
12:30	Amman	+2	Yes	Last Thu. Mar. (23:59)	Last Fri. Oct. (01:00)
12:35	Kuwait City, Minsk, Moscow, St. Petersburg, Volgograd	+3	No		

				Standard → DST	DST → Standard
12:40	Abu Dhabi, Muscat, Tbilisi, Samara	+4	No		
12:45	Baku	+4	Yes	Last Sun. Mar. (04:00)	Last Sun. Oct. (05:00)
12:50	Kabul	+4.5	No		
12:55	Tashkent, Islamabad, Karachi, Yekaterinburg	+5	No		
13:00	Mumbai, Calcutta, Madras, New Delhi, Colombo	+5.5	No		
13:05	Astana, Thimphu, Dhaka, Novosibirsk	+6	No		
13:10	Bangkok, Hanoi, Jakarta, Krasnoyarsk	+7	No		
13:15	Beijing, Chongqing, Hong Kong, Singapore, Taipei, Urumqi, Western Australia: Perth, Irkutsk	+8	No		
13:20	Tokyo, Osaka, Sapporo, Seoul, Yakutsk	+9	No		
13:25	Northern Territory: Darwin	+9.5	No		
13:30	South Australia: Adelaide	+9.5	Yes	1st Sun. Oct (02:00)	1st Sun. Apr. (03:00)
13:35	Brisbane, Guam, Port Moresby, Magadan, Vladi-vostok	+10	No		
13:40	Sydney, Canberra, Melbourne, Tasmania: Hobart	+10	Yes	1st Sun. Oct. (02.00)	1st Sun. Apr. (03:00)
13:45	Honiara (Solomon Is.), Noumea (New Caledonia)	+11	No		
13:50	Majuro (Marshall Is.), Anadyr	+12	No		
13:55	Auckland, Wellington	+12	Yes	Last Sun. Sep. (02:00)	1st Sun. Apr. (03:00)

Legend:
UTC: Universal Time Coordinate equals GMT
DST: Daylight Saving Time
DST Change: Change to daylight saving time
Standard → DST: Time switch from standard time (wintertime) to daylight savings time
DST → Standard: Time switch from daylight savings time to standard time (wintertime)

Example:
2nd Last Sun. Mar. (02:00):   Time changes on the Sunday before the last Sunday in March at 2:00 local time.

⚠ **Attention:** This time zone is followed only if the movement is synchronized with DCF.

11   Troubleshooting

To signalize possible errors or problems, the DMU 160 possesses a status LED (see also chapter 6.1).

#	Errors / notes:	Possible causes / measurements
1	**Status LED blinks 1x:** DMU 160 does not adopt time when synchronized via DCF or GPS.	Check the following: • The GPS antenna must have unrestricted view to the sky. Check the LED on the bottom ➜ must blink every second. See GPS manual. • The DCF antenna must be correctly positioned (for the LED to not flicker) and blink every second. • Check the polarity of the DCF receiver at the connecting terminals.
2	**Status LED blinks 2x:** Input voltage too low.	For DC power supply: • Check the DC power supply with a voltmeter. The voltage must be at least 20 VDC. For MOBALine power supply: • The voltage must be at least 12 VAC.
3	**Status-LED blinks 3x:** The minute hand is blocked or has stopped running for another reason.	• Make sure the minute hand can move freely and does not touch the hour hand. • Make sure the lead weight on the minute hand is still present. The hand must be precisely balanced. • Remove the cover and check the big black gear. For this, let the clock run to the 12:00 position. In case of a defect, send in the movement for repairs.
4	**Status-LED blinks 4x:** The hour hand is blocked or has stopped running for another reason.	• Make sure the hour hand can move freely and does not touch the minute hand or the facade. • Make sure the lead weight on the minute hand is still present. The hand must be precisely balanced. • Remove the cover and check the hour gear underneath the big black gear. For this, let the clock run to the 12:00 position. In case of a defect, send in the movement for repairs.
5	**Status-LED blinks 5x:** Internal error.	Internal error. The device must be sent in for repairs.
6	Clock shows incorrect time	The hour or minute hand may have shifted on the shaft. • Remove cover and set DIP switch 1 to ON. If the hands don't stop at the 12:00 position, loosen the fixation screw from the hand bushing and carefully set the hands to the 12:00 position. If not done yet, tap into the shaft. Fasten the fixation screw. Set DIP switch 1 back to OFF. The time should now be displayed correctly.
7	Needed information to contact your MOBATIME service	**Device type, article, production and serial number:** These details are given on the adhesive type label.

12   Measurements
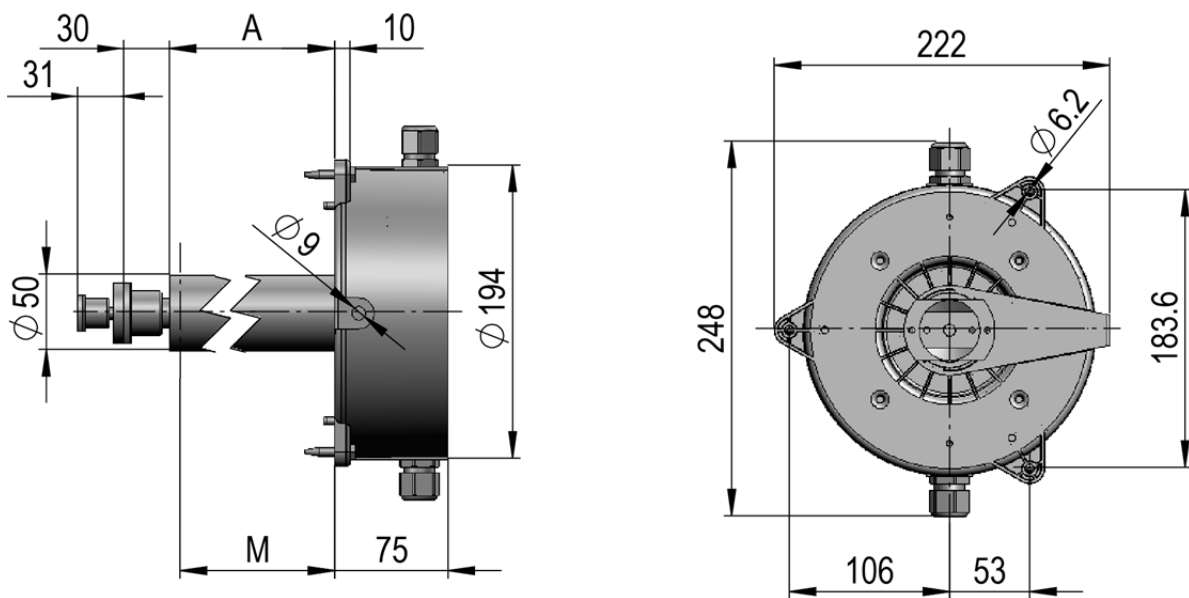
13   Technical data

Article no.	DMU 160F 206295 DMU 160S 206308 DMU 160M 206161 DMU 160V xxx 206302
Dial diameter	up to 1600 mm
Synchronization	- MOBALine (local time) (ETC, DTS, NMI...) - DCF (Current Loop, local time) (GPS/DCF 4500)
Power supply	24 VDC ± 20% or MOBALine
Consumption	DC supply: < 100 mA @ 24 VDC MOBALine: from NMI (1 movement) from ETC, DTS: < 200 mA
Operating mode minute shaft	minute, ½ minute or continuous (10 sec.) setting: DIP switch or via MOBALine
Operating mode hour shaft	continuous
Set-up time	Installation: <3 min. Daylight savings time change: <20 sec.
Temperature range	-30 ... +70 °C
Max. wall thickness	500 mm
Diameter hour shaft	20 mm
Diameter minute shaft	8 mm
Minute shaft torque	>500 mNm
Hour shaft torque	>500 mNm
Max. hand weight	Hour hand: 400 g Minute hand: 500 g
Accessories	- front mounting plate Ø 600 mm (art. no. 206 460) - flush-mounting box for front mounting (art. no. 702 622) (measurements: 390x280x120mm)