

# How to use the SR250 Master Clock Impulse Unit

## Introduction

Thank you for buying this product. To avoid disappointment or damage please read these instructions carefully. *They are important!*

- Semiconductors are highly vulnerable to static electricity. When touching the printed circuit board or connectors wear cotton (not woollen) clothing and always touch something earthed such as a metal tap, water or gas pipe immediately before handling the unit.
- Power must never be connected when installing, connecting or making a change to the unit. Reconnect the power afterwards.
- There are two hardware options that are not fitted to all products. One is a receiver for the radio control transmitter DCF in Germany, HBG in Swiss, MSF in Britain or WWVB in the US. The second option is a time-backup to run the clock after mains power failures. The failure time is unlimited.
- Swapping receivers on the same SR250 is only possible with DCF and HBG.

## Time backup

If fitted only useful in combination with a receiver. At the moment of a power failure the internal time of the SR250 is written to a memory chip and is holded for an unlimited time. If power has been restored the SR250 reads the time from this chip and makes calculations for a time correction.

## Altering optional settings

Switch unit SW1 has four subminiature DIP switches S1-S4, each of which can be set to 'on' or 'off' using the point of a ballpoint pen or a small screwdriver. These allow you to select the following settings (the unit must be resetted after alteration to S1). S4 is not connected.

### Minute pulse (60 per hour)

S1: off

S2: off

S3: off—single pulse, 0.6 second long, interval during corrections time slave dial 0,2 second.

S3: on—single pulse, 2 seconds long, interval during corrections time slave dial 1 second.

### Half-minute pulse (120 per hour)

S1: off

S2: on

S3: off—single pulse 0.6 second long, interval during corrections time slave dial 0,2 second.

S3: on—single pulse 2 seconds long, interval during corrections time slave dial 1 second.

### Seconds pulse (60 per minute)

S1: on single pulse, 0.6 second long

S2: no function

S3: no function

## Jumper JP2

Slided over one pin: the SR250, generating its timings internally. No radio receiver must be connected.

Slided over two pins: the SR250 generates its timings internally but must be connected to a radio receiver. Otherwise the SR250 does not start.

## Adjusting the unit's master oscillator

This applies only to units without a radio receiver.

By means of the variable capacitor C3, the crystal oscillator can be adjusted to advance (speed up) or retard (slow down) the SR250. This action requires some care. When C3 is fully open (a whole circle is visible) the SR250 runs at its fastest speed. Reducing the visible amount of the circle will slow down the SR250. Bear in mind that the ambient temperature also has an influence on the speed of the internal clock of the SR250. The best option is to set the SR250 slightly fast, allowing you to make backwards corrections with the push button SW2 (see below).

## Operation of push button SW2

*The functions of SW2 vary according to whether a radio receiver option is fitted or not.*

- **On units without a radio receiver**

### To set the slave to the correct time

When the power supply is first connected to the SR250, the LED lights. Wait until the LED goes out, at which time adjustment must start *within 5 seconds*, otherwise this option will be blocked.

Pushing button SW2 once will cause the time to run fast (LED on); it will stop if SW2 is pushed a second time. This sequence can be repeated. After the push button has been pressed to stop the correction, the fast mode will be blocked again after 5 seconds (LED on). Push SW2 once more and the slave dial (slave clock) will start to run (LED off).

*If you have chosen to connect a bell to the ringer output, set the slave at 09.00.*

### Time correction

After setting the slave to the correct time (as indicated above) and with the slave is running it is possible, with a short push on SW2, to adjust the slave downwards—minutes by 1 minute maximum, half minutes by 30 seconds maximum and seconds by 1 second. By setting the SR250 to run slightly fast it is possible, by means of this option, to adjust the slave periodically to the exact correct time. When, for instance, the minute pulse is used, and the slave is 2 seconds fast, simply push SW2 two seconds after the minute pulse and the slave is on time again.

### Reset

If you have exceeded the 5 seconds time allowed for reaction and you still need to set the slave clock, simply push SW2 for approx. 5 seconds *until the LED lights*. Wait till the led goes out. The slave can now be set again.

- **On units with a radio receiver fitted**

### To set a minute or half minute slave (this action is necessary when a radio receiver is fitted)

DCF: to 08.50 in the CET (Central European Time) zone and to 07.50 in Britain or Ireland

HBG: to 08.50 in the CET zone

MSF: to 08.50 in Britain or Ireland and to 09.50 in the CET zone

WWVB: to 08.50 added or subtracted with a correction of one or more hours depending the time zone

### Second slaves:

DCF: to 08.59.50 in the CET (Central European Time) zone and to 7.59.50 in Britain or Ireland

HBG: to 08.59.50 in the CET zone

MSF: to 8.59.50 in Britain or Ireland and to 9.59.50 in the CET zone.

WWVB: to 8.59.50 added or subtracted with a correction of one or more hours

When the power supply is first connected to the SR250, the LED will light. Wait until the LED starts flashing, at which time adjustment must start *within 5 seconds*, otherwise this option will be blocked. Pushing button SW2 once will cause the movement to run fast (LED on); it will stop if SW2 is pushed a second time. This sequence can be repeated. After the push button has been pressed to stop the correction, the fast mode will be blocked again after 5 seconds (LED on). STOP the movement as soon as it is on 09.00 (MSF). The SR250 now starts automatically. Using this manner of setting, a correct polarity connection between the SR250 and a dual-polarity slave is not needed.

### Reset

If you have exceeded the 5 seconds time allowed for reaction and you still need to set the slave clock, switch off and on the SR250 and when the leds starts flashing, the slave can be set again.

## Time correction

- **No receiver, no time-backup**

No automatic correction is possible. After mains failure the slave must be set to the right time and restarted. A push button could be connected between terminals 1 and 4 of the connector J1. At a push on this button and using the minute and half minute pulses, it is possible to advance the slave one hour. Using the seconds pulse, the slave will wait an hour. This makes corrections for the changeover from summer to winter time (and vice versa) simple.

- **No receiver but with time-backup**

Configuration is not significant.

- **With receiver installed, no time-backup**

Correction between summer and winter time is made automatically in spring and autumn, employing the minute or half-minute pulses by running fast and with the use of the seconds pulse by stopping the slave until the correct time. After a mains failure the slave has to be set to the start time manually.

- **With receiver installed, time-backup fitted**

Correction between summer and winter time is made automatically in spring and autumn. Correction as above. After a mains failure the maximum time-backup holding is unlimited. After this period and a minimum of five minutes, correction is made by running fast.

When using the seconds pulse the time-backup holding is unlimited. If mains power is restored after 15 minutes, the SR250 waits until the correct time and then restarts the slave automatically.

When using the seconds pulse and a mains power is restored within 15 minutes the SR250 will running fast the second hand until the correct time.

## Radio receiver

The SR250 checks its internal clock timing with the received time once every minute. If an identical difference is detected four times in succession, the SR250 will initiate a correction. So, at initial installation and when setting for the change between winter and summer time, you should allow the SR250 ample time to acquire the correct time.

Connector J4, if supplied, is for connecting all the EM2S receivers. Connect J4-1 to LP1, J4-2 to LP2, J4-3 to LP3 and J4-4 to LP4. The top view of the receiver print is directed to the middle of the SR250 print.

Connector J1, if supplied, is for connecting a DCF receiver with screwconnector. J1-1 (-), J1-2 (+) and J1-4 (DCF). The receiver can be placed on the pins of connector J1. The top view of the receiver print is directed to the middle of the SR250 print. Pins J1: J1-1 (-), J1-2 (+6V) and J1-4 (DCF).

Be sure to fix the SR250 master clock in a position where the radio signal is received well. The higher above ground the better. Keep the unit well clear of metal objects, transformers and telephone or power wiring.

Point the antenna perpendicular at the direction of the transmitter. DCF-Frankfurt (D), HBG-Prangins (CH), MSF-Rugby near Coventry (GB), WWVB-Fort Collins, Colorado (US).

With DCF/HBG the red LED on the main unit lights briefly once every second (HBG second one twice) except the 59th, which is the moment of synchronisation. With MSF/WWVB the LED lights every second. With MSF some seconds twice and second one the LED lights half a second. If the received signal is weak interference may disrupt the receiver. The LED will blink irregularly under these conditions and a better location for the unit should be found.

## Power supply

With the standard mains power supply provided with the SR250 the *white* wire must be connected to terminal 9 (+) and the *pink* one to terminal 10 (-) otherwise the fuse on the SR250 will blow.

There are two other options:

- the printed circuit board is supplied without rectifier G1, in which case a stabilised power supply with an output of max. 24V DC/500mA should be connected to terminals 9 (+) and 10 (-).
- the printed circuit board is supplied with rectifier G1, in which case a transformer with an output of 18 to 22V AC/1A should be connected to terminals 9 (~) and 10 (~).

### *Important note if you are supplying another transformer*

After rectification the voltage must be no more than 34V maximum (higher voltages will damage the SR250) and no less than 22.5V under load. A small transformer rated, for example, at 24V/100mA gives a significantly higher voltage than indicated when not fully loaded. The rectified voltage can easily exceed 34V!

## **Slave clock dials**

Single and dual polarity slave dials are connected to terminals 3 and 4 of connector J2.

The first pulse from the SR250 produces a positive voltage on terminal 3 and a negative voltage on terminal 4.

### *Note*

- If a dual polarity slave runs one minute (or second) slow, connect the wires reversed (not needed if the slave is set on time with SW2).
- When 24V slave dials are used, the jumper JP1 must be slid over both pins. With 12V slaves the jumper should be slid over just one pin.
- Ensure you never exceed a maximum current of 450mA!

For slaves with a coil voltage below 12V a series resistor is necessary.

Example: Brillié: coil 10 ohms / 1.5 V makes:  $1.5V$  divided by 10 ohms = 150mA. Slide the jumper over both JP1 pins. The formula:  $24V$  (SR250)  $-/ -$  1,5V (Brillié) =  $22.5 : 0.150$  (Brillié mA) makes 150 ohms /5Watt. The surplus in ohms is to limit the current and to avoid blowing the fuse on the SR250 by drawing too much current. Always place a wire resistor **in** the slave. Never close to the SR250!

## **Auxiliary output (open collector type)**

The collector is connected to terminal 6 of connector J2.

For safety and to guarantee optimal operation of the radio receiver, connect between terminal 6 and 7(+) a 12/24V relay.

The maximum current is 250mA. Never make a direct connection between the SR250 and the mains!

With the jumper JP1 over one pin (open) the maximum voltage is 13V. With the jumper JP1 covering both pins (made) the maximum voltage is higher, dependant on the power-supply or transformer used.

Standard (D/H/M8bu) the extra output has been programmed to drive a relay that in turn rings a bell. On the hour this closes the relay for 0.6 seconds to indicate the appropriate number of hours with an interval of 2 seconds between each closure. A single relay closure is made on the half-hour. For WVVB, after programming the correct time zone by us.

Option (D/M12bu): To replicate the Greenwich Time Signal, as it was until some 10 years ago. This produces 6 pips during the last 6 seconds of each hour starting at the 55th second in the form of square pulses 0.10 second long. This facility is for master clocks that were originally synchronised by radio or telegraph signals. Not available for WVVB.

Use terminals 6 and 7 for this connection. When the SR250 starts, corrections are made as if the slave dial was set at 09.00. When no other function of the SR250 is required, set S1 and S2 of the DIP switch block SW2 at 'off'.

## **Opening the case, if applied to**

The case is opened by gently squeezing in the 4 slots (and lifting the cover at the same place) in sequence clockwise.