

Industriefunkuhren



Technical Manual

Line Booster 4820DC-24V
for DCF77 Time Code

ENGLISH

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Symbols and Characters



Operational Reliability

Disregard may cause damages to persons or material.



Functionality

Disregard may impact function of system/device.



Information

Notes and Information.



Safety regulations

The safety regulations and observance of the technical data serve to ensure trouble-free operation of the device and protection of persons and material. It is therefore of utmost importance to observe and compliance with these regulations.

If these are not complied with, then no claims may be made under the terms of the warranty. No liability will be assumed for any ensuing damage.



Safety of the device

This device has been manufactured in accordance with the latest technological standards and approved safety regulations

The device should only be put into operation by trained and qualified staff. Care must be taken that all cable connections are laid and fixed in position correctly. The device should only be operated with the voltage supply indicated on the identification label.

The device should only be operated by qualified staff or employees who have received specific instruction.

If a device must be opened for repair, this should only be carried out by employees with appropriate qualifications or by *hopf* Elektronik GmbH.

Before a device is opened or a fuse is changed all power supplies must be disconnected.

If there are reasons to believe that the operational safety can no longer be guaranteed the device must be taken out of service and labelled accordingly.

The safety may be impaired when the device does not operate properly or if it is obviously damaged.

CE-Conformity



This device fulfils the requirements of the EU directive 89/336/EWG "Electromagnetic compatibility" and 73/23/EWG "Low voltage equipment".

Therefore the device bears the CE identification marking (CE = Communautés Européennes = European communities)

The CE indicates to the controlling bodies that the product complies with the requirements of the EU directive - especially with regard to protection of health and safety for the operator and the user - and may be released for sale within the common markets.

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1 System Description Line Booster 4820DC – 24 Volt

Line Booster 4820DC is a DCF77 pulse (1Hz) to DCF77 Time Code converter designed for rail-mounting.

A DCF77 pulse fed in over optical fiber is converted into a DCF77 Time Code signal for controlling slave clocks with DCF77 Time Code input. The 24V DC power supply for the Line Booster's electronics also serves as the power supply to the slave clock line.

By way of status LEDs on the front panel and status relays, the Line Booster disposes of status information which can be evaluated both visually and electrically.

The function of these LEDs and relays can be checked in operation by means of a button on the front panel, without affecting the functions of the Line Booster.

A high degree of flexibility and high availability are achieved in conjunction with complete freedom from maintenance.

Converters with customer-specific properties can be supplied on request.

The *hopf* Line Booster 4820DC further enhances the innovative product range from *hopf* Elektronik GmbH.

Some basic functions of Line Booster 4820DC:

- Signal conversion of a **DCF77 pulse** to **DCF77 Time Code – 24 volt**
- **Fiber optic signal input** for DCF77 pulse with status LED
- **Fiber optic repeater function** for DCF77 pulse
- **Aluminum rail housing** for 35mm mounting rail in accordance with EN 50 022
- Connection for slave clocks over plug-in screw terminal for **cables up to 2.5mm²**
- **Status LEDs** in the front panel for:
 - **Power**
 - **Time Signal**
 - **Time Signal Error**
 - **Line Error**
- **Status relays** on Sub-D connector for:
 - **Power O.K.**
 - **Time Signal O.K.**
 - **Line O.K.**
- **Function test button** for status LEDs and relays
- **Signal monitoring** for activity on the DCF77 pulse input
- **Line monitoring** of the slave clock line for short circuit and undervoltage
- Self-resetting fuse for **restricting line current** on short circuit on the clock line

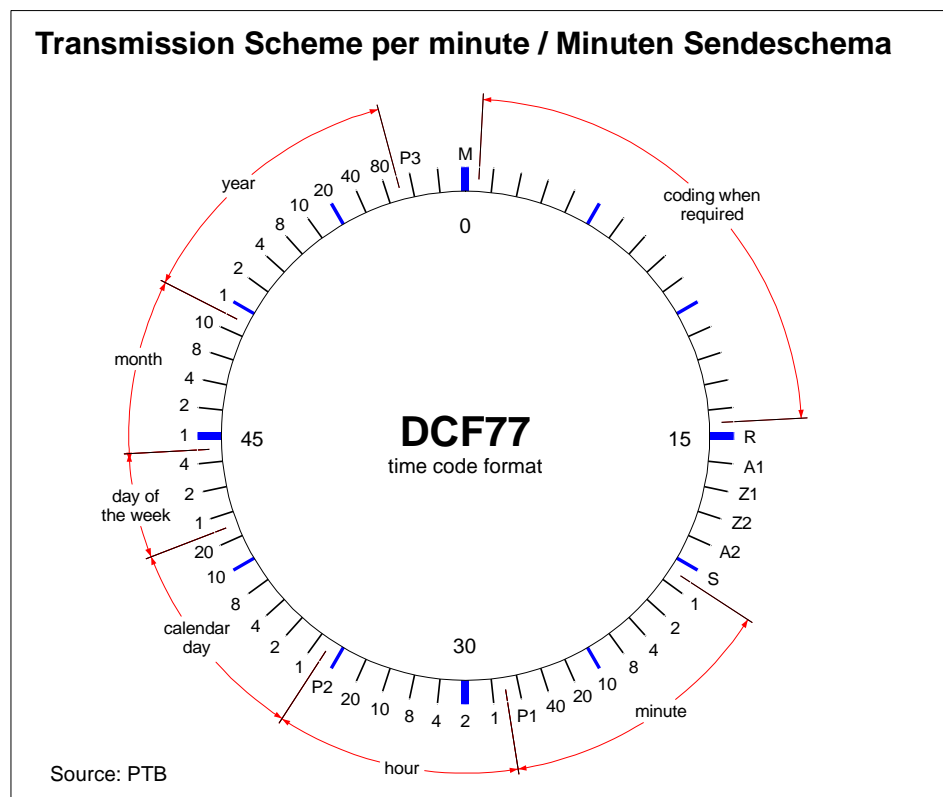
1.1 DCF77 Pulse (1Hz)

The DCF77 pulse is a digital signal which is subject to the same coding procedure as is used on the DCF77 signal radiated by the transmitter. The difference in this case is that it is not an amplitude-modulated carrier signal that is used for transmission but rather the 100 and 200 msec long reductions represented by logic signal levels (pulse width-modulated coding of the reductions in the amplitude-modulated signal).

This means, for example:

- No reduction in amplitude (DCF77) = Logic HIGH (DCF77 pulse)
- Reduction in amplitude (DCF77) = Logic LOW (DCF77 pulse)

The information contained in the DCF77 signal is transmitted by way of a digital signal. In this digital form, the signal can also be transmitted over fiber optic cable, for example.



1.2 DCF77 Time Code

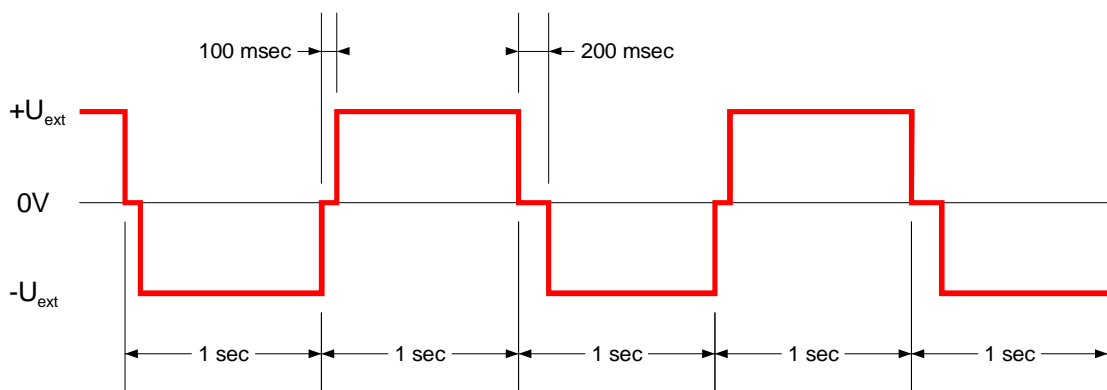
There are different control procedures for slave clocks. Manual setting of slave clocks is not necessary when controlling by DCF77 Time Code, as the complete time and date information is transmitted to the slave clock. In this case the user needs only to connect the slave clock to the line and after evaluating the time telegram the clock automatically sets itself to the correct time.

In the case of analogue clocks, the clockwork is also supplied with the required operating voltage over the line.

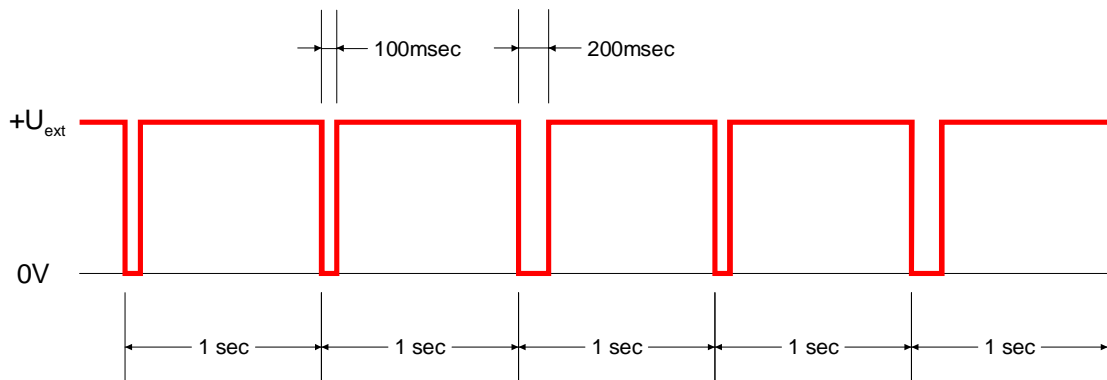


Line Booster 4820DC transmits a simplified DCF77 Time Code.

Signal form of the standard DCF77 Time Code



Signal form of the simplified DCF77 Time Code of Line Booster 4820



Simplified DCF77 Time Code

Contrary to standard DCF77 Time Code, pulse output takes place **with no** polarity change.

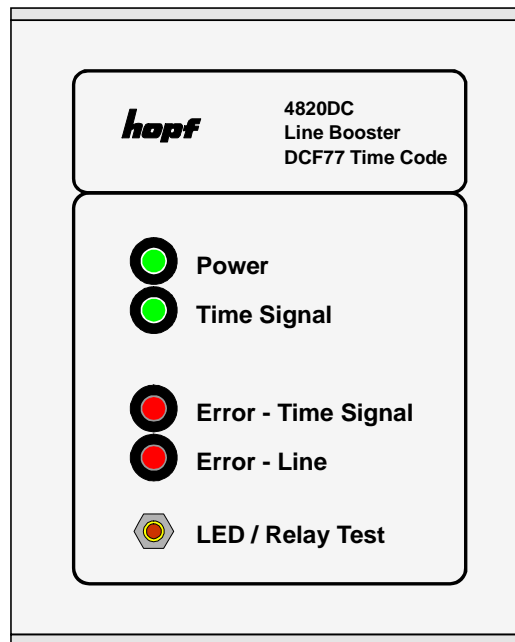
However, this has no effect on the function of the connected DCF77 Time Code clocks. Due to their internal construction, these basically function with both variants of the DCF77 Time Code.

2 Construction of the Line Booster

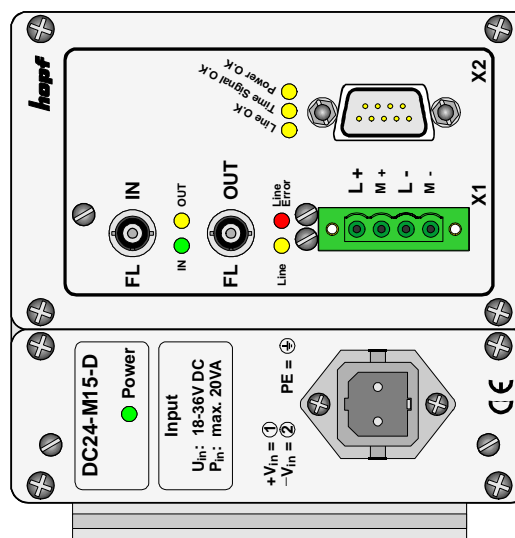
This section provides an overview of the individual elements of the Line Booster.

2.1 Overview

Front view: Line Booster 4820DC



Underside view: Line Booster 4820DC



2.2 Casing

The aluminium casing of Line Booster 4820DC is designed for rail-mounting. Line Booster 4820DC can be mounted on all rails in accordance with EN 50 022 and is suitable for horizontal mounting. For exact construction details and dimensions please see **Chapter 8 System Drawing**.

2.3 Front elements

This section provides an overview of the front panel elements.

2.3.1 Status LEDs

The front panel of the Line Booster contains status LEDs by means of which the device's current operating status can be read.

Status LEDs in the front panel for:

- **Power**
- **Time Signal**
- **Error - Time Signal**
- **Error – Line**

Power LED:	
ON	The Line Booster is operating
OFF	<ul style="list-style-type: none"> • The Line Booster is not receiving the required operating voltage • The Line Booster is faulty

Time Signal:	
ON	A signal is detected on the fiber optic cable input
OFF	No signal is detected on the fiber optic cable input

Error - Time Signal:	
ON	No edge change was detected on the fiber optic signal input for more than 3 seconds
OFF	An edge change was detected on the fiber optic signal input during the last 3 seconds

Error - Line:	
ON	Insufficient line voltage is measured on monitoring input terminal M+ during pulse transmission
OFF	Adequate line voltage is measured on monitoring input terminal M+ during pulse transmission

2.3.2 Buttons for LED and Relay Test

By way of the button on the front panel, the function of the four status LEDs on the front panel and the three status relays can be checked without affecting the ongoing operation of the Line Booster.

The test begins after activating the button. While the button is activated, the four status LEDs on the front panel flash at a pulse of 1Hz and the status relays run through a repetitive sequence of four seconds:

Sec n+1	"Power O.K." relay active "Line O.K." and "Time Signal O.K." relays in idle condition
Sec n+2	"Time Signal O.K." relay active "Line O.K." and "Power O.K." relays in idle condition
Sec n+3	"Line O.K." relay active "Time Signal O.K." and "Power O.K." relays in idle condition
Sec n+4	All relays in idle condition (de-energized)

2.4 Connection element

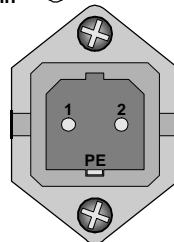
All connection elements are on the underside of the casing.

2.4.1 Power supply

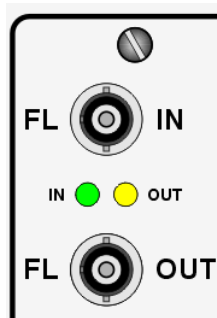
The power supply to the Line Booster is provided by a 3-pole, lockable plug-in connector.

DC power supply connection:

$+V_{in} = \textcircled{1}$
 $-V_{in} = \textcircled{2}$ PE = \oplus

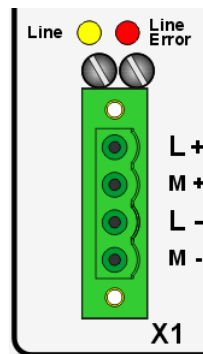


2.4.2 Fiber Optic Line (FL) Signal Input and Output (Time Signal)



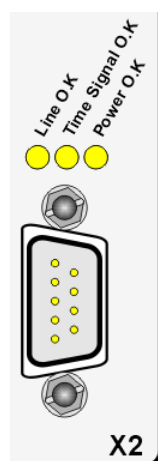
The DCF77 pulse signal required for operation is fed in over a fiber optic line (FL) infeed on the F-ST model. In order to supply additional devices with the DCF77 pulse, on the F-ST model the Line Booster has an FL output switched as a repeater.

2.4.3 Line Output (X1)



The DCF77 Time Code clocks are connected over a pluggable 4-pole screw terminal with molding.

2.4.4 Status Output (X2)



The status relays are connected over a 9-pole SUB-D connector

3 Installation

The installation of the Line Booster is described below.

3.1 Installation of casing

The rail-mounting module can be mounted on all rails in accordance with EN 50 022 and is designed for horizontal mounting.

Dimensions

The dimensions of the casing can be found in **Chapter 8 System Drawing**.

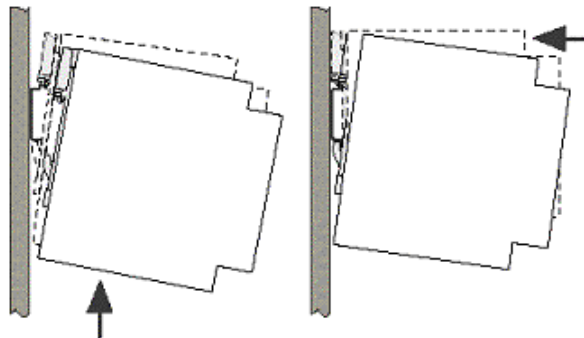


In order to guarantee adequate convection, we recommend the following minimum distance between modules:

- 1.0 cm in a horizontal direction

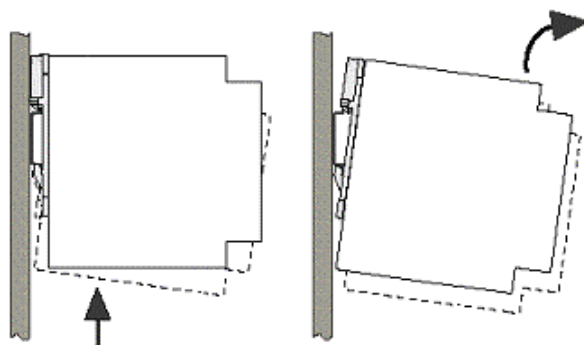
3.1.1 Mounting

Place the module's rail guide bar against the lower edge of the rail, push the module upwards and clip into place at the top.



3.1.2 Demounting

Push the module upwards and then tip forward to remove from the rail.

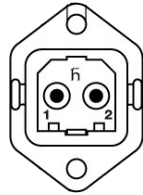


3.2 DC Power Supply

The Line Booster's DC power supply unit is described here; however the connection data on the nameplate of the respective device always applies.



Make sure that the external voltage source is switched off. When connecting the power supply, ensure that the polarity and ground connection are correct.



The power supply cable is connected to Line Booster 4820DC by means of a 2-pole connector with additional ground connection and interlock:

+V_{in}: Positive pole (contact 1)
 -V_{in}: Negative pole (contact 2)
 PE: Ground



Grounding:

The negative pole (-V_{in}) and the ground (PE) are connected together as standard on the system side.

3.2.1.1 Power Supply Unit Specifications

All specifications regarding DC power supply can be found in **Chapter 7 Technical Data**.

3.2.1.2 Fuse Protection

When connecting Line Booster 4820DC, make sure that there is adequate fuse protection on the power supply.

Consult the technical data on the device nameplate for details.



If the internal fuse (device protection) trips it is highly likely that the device is faulty. In this case the equipment should be checked at the factory.

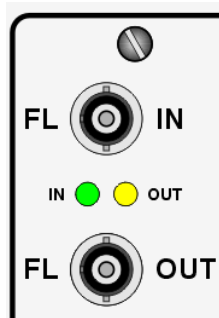
3.2.1.3 Polarity Reversal Protection

Line Booster 4820 with DC power supply has polarity reversal protection. This protection prevents the device from damage if the DC power supply is connected with reverse polarity.

Protection is realized by means of a "self-resetting" fuse. In the event of polarity reversal, after this fuse trips it is necessary to disconnect the device from the power supply for approx. 20 seconds. The power supply can then be connected with the correct polarity.

3.3 DCF77 Pulse Connection (Time Signal)

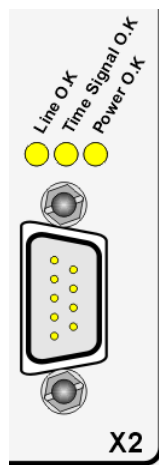
Line Booster 4820DC has a fiber optic line signal input for the DCF77 pulse.
The DCF77 pulse is re-transmitted as a fiber optic line signal to connect additional line boosters (repeater function).



Time Signal		
Fiber Optic Line Connection		
FL1	FL IN	DCF77 pulse input
FL2	FL OUT	DCF77 pulse output fed in over FL IN
Meaning of LEDs		
FL1	IN - LED green	Signal reception
FL2	OUT - LED yellow	Signal transmission

3.4 Status Relays (X2) Connection

Line Booster 4820DC has three relays for transmitting the operating status.

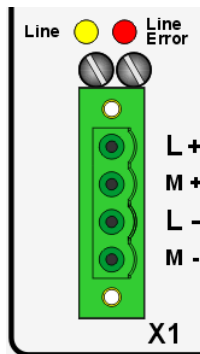


Status Relays (X2)	
LED	Labeling
1	Line O.K.
2	Time Signal O.K.
3	Power O.K.
9-pole SUB-D Connector	
Pin	Signal
1	Power O.K. - Normally closed contact (nc)
2	Power O.K. - Normally open contact (no)
3	Time Signal O.K. - Common contact (com)
4	Line O.K. - Normally closed contact (nc)
5	Line O.K. - Normally open contact (no)
6	Power O.K. - Common contact (com)
7	Time Signal O.K. - Normally closed contact (nc)
8	Time Signal O.K. - Normally open contact (no)
9	Line O.K. - Common contact (com)



Status O.K. = Relay energized/active (LED on)
Error = Relay de-energized/idle (LED off)

3.5 Slave Clocks Connection (X1)



Line	
LED	Meaning
Yellow	Voltage switched on line
Red	Line fault
Connector	
Pin	Signal
L+	Line +
M+	Monitoring +
L-	Line -
M-	n.c.

n.c. = not connected

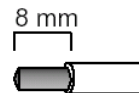
3.5.1 Slave Clock Line Connection

The line connection is made over a pluggable 4-pole screw connection. You can connect the following cable cross-sections to the slave clock line connector:

	Fixed [mm ²]	Flexible [mm ²]	AWG	Fastening Torque [Nm]
L+, L-, M+, M-	0.2-2.5	0.2-2.5	24-12	0.5 – 0.6

For a reliable and secure contact:

Strip the insulation by 8 mm



3.5.2 Connecting Slave Clocks to the Line Booster



Only slave clocks with DCF77 Time Code input are suitable for connection to Line Booster 4820.



To prevent damage to the slave clocks, take care to ensure that the line and DCF77 Time Code input voltages are consistent.

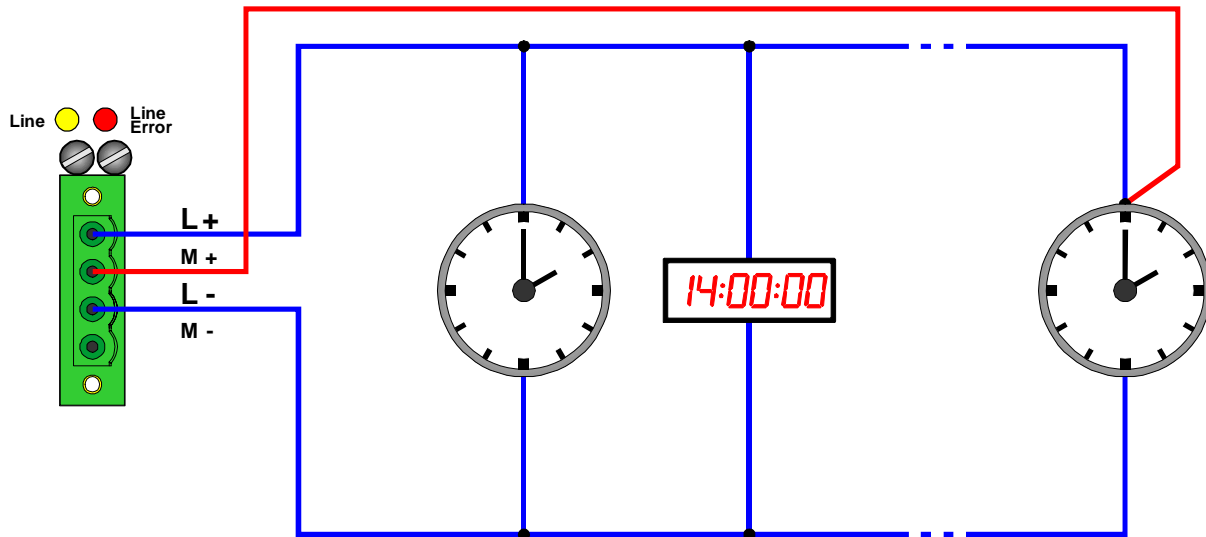


Pay attention to the maximum line current of the Line Booster when selecting the number of slave clocks to be connected.

3.5.2.1 Example of Connection with Line Monitoring:

In this operating mode, the voltage on the last slave clock in the line is measured over a feedback line. In this way the Line Booster can detect whether there is adequate line voltage on the last slave clock.

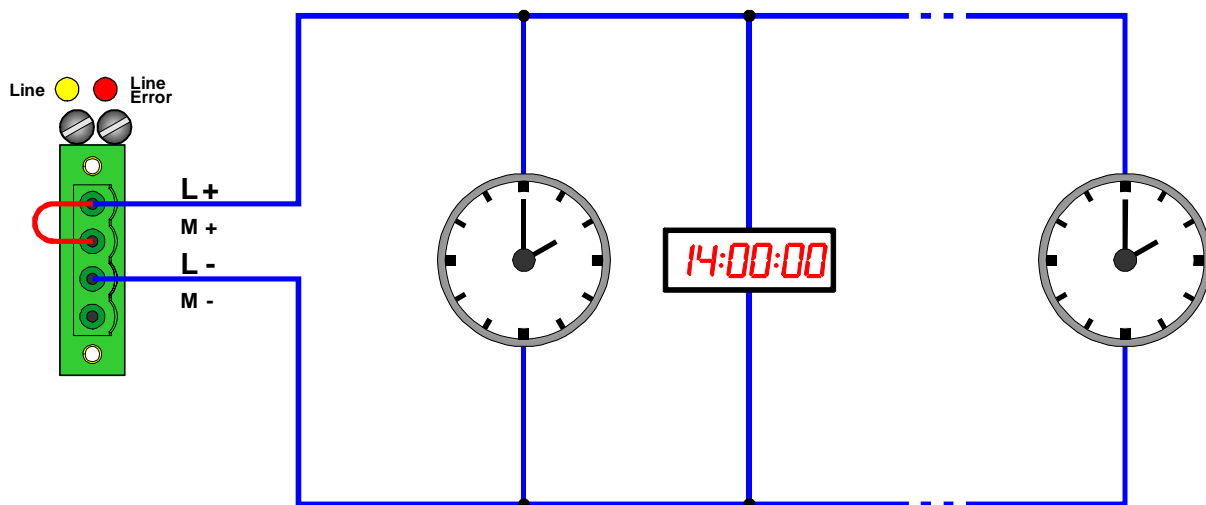
Allocation:



3.5.2.2 Example of Connection without Line Monitoring:

In this operating mode, feedback is bridged directly in the Line Booster output. In this case the Line Booster can detect only whether there is adequate line voltage on the output but not whether this is sufficient for, or even reaches, the slave clocks.

Allocation:



4 Commissioning

This section describes the commissioning of Line Booster 4820DC.

4.1 General Procedure

Commissioning is structured as follows:

- Check the cabling:
 - Grounding
 - Power supply
 - Signal feed
 - Status relay
 - Slave clock line
- Switch on the external power supply
- Use the function test button to check the status LEDs and relays
- Put the slave clock line into operation and check its function



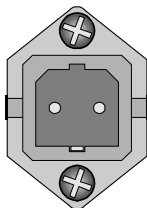
The status LEDs and relays in fault-free operation are as follows:

LED Power	ON
LED Time Signal	Flashes on DCF77 pulse (1Hz)
LED Error - Time Signal	OFF
LED Error – Line	OFF
Relay Line O.K.	Active/energized
Relay Time Signal O.K.	Active/energized
Relay Power O.K.	Active/energized

4.2 Switch on the Operating Power Supply

The Line Booster has no own power supply switch. The Line Booster is activated by the external power supply source.

DC power supply:



Switch on the external power supply.

4.3 Function Test of Status LEDs and Relays

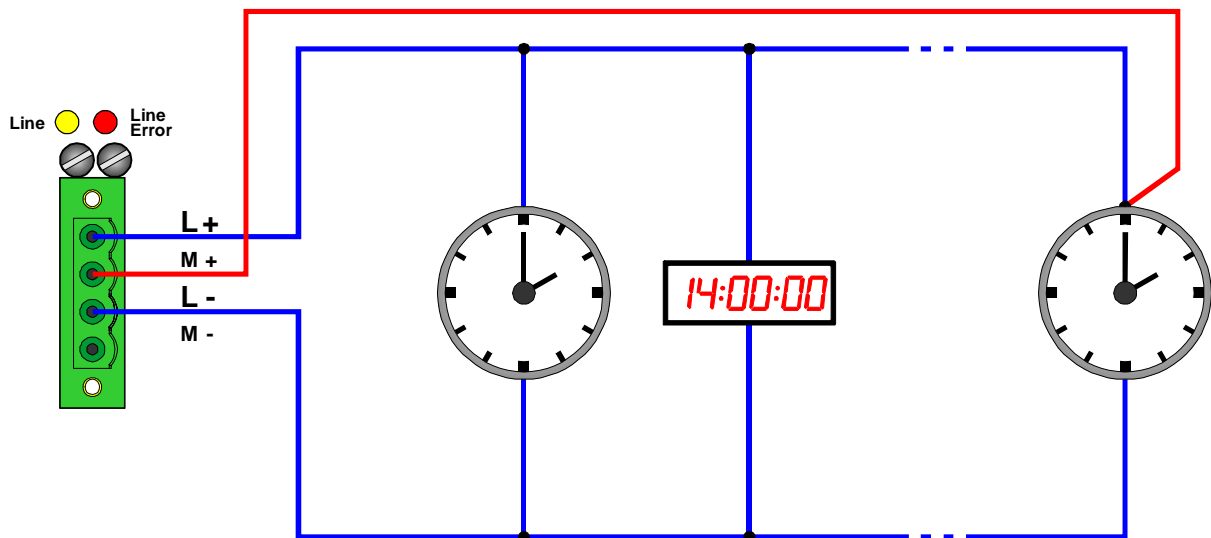
The keyboard arrangement and key assignment are described below.

4.4 Commissioning the Slave Clocks

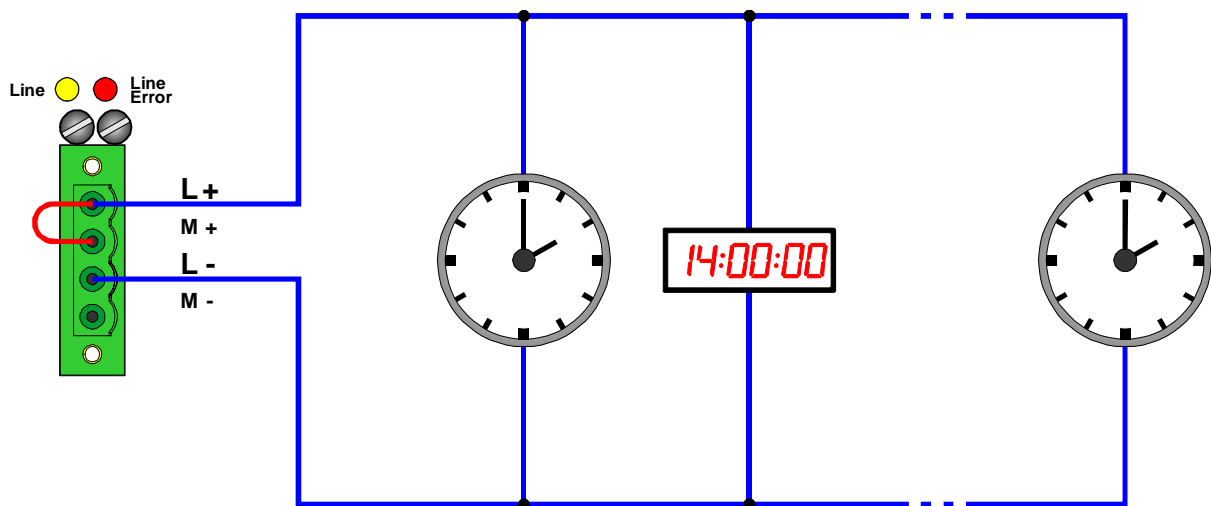
This section describes the commissioning of the slave clocks.

4.4.1 Checking the Connections

Connection with monitoring:



Connection without monitoring:



4.4.2 Short Circuit Protection on the Slave Clock Line

Protection is realized by means of a "self-resetting" fuse. In the event of a short circuit on the slave clock line, after this fuse trips it is necessary to disconnect the device from the power supply for approx. 20 seconds. After eliminating the cause of the short circuit the power supply can then be re-connected.

4.4.3 Function Test of Slave Clocks

The connected Time Code clocks should have been set in accordance with the supplied DCF77 pulse at the latest 10-15 minutes after switch-on and feeding of a DCF77 pulse (1Hz) to Line Booster 4820.

Exception:

The "Error - Time Signal" and/or "Error - Line" LEDs are active.

4.4.3.1 Line Error Active

The Line Error is always active when no or inadequate line voltage is measured over the monitoring input.



The transmitted line voltage corresponds to the respective external infeed voltage to the Line Booster.



Monitoring input M+ **must** always be allocated.

Operating Mode with Line Monitoring

In this operating mode, the voltage on the last slave clock in the line is measured over a feedback line. In this way the Line Booster can detect whether there is adequate line voltage on the last slave clock.

Possible causes of inadequate voltage on the last clock are:

- Voltage drop over slave clock line cables too high
Cause: Line cross-section too small and /or line too long
- Too many slave clocks connected to the slave clock line
Effect: Maximum line current exceeded
- Broken cable
Effect: Line voltage no longer reaches the slave clocks

Operating Mode without Line Monitoring

In this operating mode, feedback is bridged directly in the Line Booster output. In this case the Line Booster can detect only whether there is adequate line voltage on the output but not whether this is sufficient for, or even reaches, the slave clocks.

Possible causes of error messages in this operating mode:

- Input M+ is not connected to output L+.
- The operating voltage of the Line Booster is too low
Effect: The Line Booster power supply is also being used as the line voltage
- Too many slave clocks connected to the slave clock line
Effect: Maximum line current exceeded

4.4.3.2 Time Signal Error Active

The Line Booster requires an externally supplied DCF77 pulse (1Hz) in order to successfully set DCF77 Time Code clocks.

The time signal error is active if no edge change was detected on the fiber optic line signal input "FL IN" in the last 3 seconds.

5 Support from the *hopf* Company

Should the System demonstrate error descriptions other than those listed in this description, please contact Support at *hopf* Elektronik GmbH with an exact description of the fault and the following information:

- Exact error description
- Device Type
- Serial number
- Occurrence of the error during commissioning or operation

Please write to the following E-mail address with the above information:

support@hopf.com



Providing a detailed description of the error and the information listed above avoids the need for additional clarification and leads to faster processing by our Support team.

6 Maintenance / Care

The Line Booster 4820DC is generally maintenance-free. The following points should be noted if it is necessary to clean the Line Booster 4820DC.

6.1 General Guidelines for Cleaning

The following **must not** be used to clean the Line Booster 4820DC:

- Fluids
- Cleaning agents containing solvents
- Cleaning agents containing acids
- Abrasive media

The use of such cleaning agents or media could damage the Line Booster 4820DC.



Do not use a wet cloth to clean the Line Booster 4820DC.
There is the danger of an electric shock.

To clean the Line Booster 4820DC use a cloth that is:

- Antistatic
- Soft
- Non-fabric
- Damp

6.2 Cleaning the Housing



Make sure that connections or cables are not loosened whilst cleaning the housing of an active system. There is a risk that the system could become damaged and lose functionality.

7 Technical Data

General Data	
Installation location:	On horizontal 35mm rail in accordance with EN 50 022
Operating:	Via push-button in the front
Protection type of the housing:	IP40
Protection class:	I, with PE connection
Housing design:	aluminium, closed
Housing dimensions:	s. System drawing
Display:	<ul style="list-style-type: none"> • 4 Status LEDs in the front • 8 Status LEDs at the bottom
MTBF:	> 400.000 hours
Weight:	approx. 0.9kg

Power Consumption Line Booster (Power Supply + Slave Clock Line):	
Power rating internal DC power supply:	Typical 5W / max. 15W
Power rating slave clock line:	max. Input voltage * 1,35A

DC Power Supply – Typ: DC24-M15-D	
Nominal input voltage:	24V DC
Input voltage range:	18-36V DC
Power consumption (at nominal values):	0.69A
Turn-on time after power supply feed:	< 200msec.
Input fuse, internal (device protection):	2A, fast-acting
Insulation voltage Input / output:	1.500V DC 1 minute, 500V DC 50M Ω mind. (20°C \pm 15°C)
Output Data (internal only)	
Internal nominal output voltage	5V DC
Nominal output current I _N 0°C ... +55°C	3A (U _{OUT} = 5V DC)
Efficiency	> 85%

Slave Clock Line (X1)	
Output Signal:	24V Time Code (The output line voltage is equivalent to the current external input voltage of the Line Booster)
Line Current:	max. 1.35A (The line entry takes place by the external power supply of the Line Booster)
Output voltage range:	18-36V DC (The output line voltage is equivalent to the current external input voltage of the Line Booster)

Optical Fiber General (FL IN / FL OUT)	
Supported multi-mode optical fiber cable types:	50/125µm, 62,5/125µm, 100/140µm or 200µm HCS ® Fiber
Optical fiber outputs: λ = 820nm, connector type: ST (bayonet) – for T=+25°C	
Optical output power P _{OUT} [dBm] to multi-mode optical fiber cable (Length = 1m, 50/125µm):	P _{OUT} [dBm] = -15dBm (± 0.2dBm) ⇔ P _{OUT} [µW] = 32µW (± 1.5µW)
Optical output power P _{OUT} [dBm] to multi-mode optical fiber cable (Length = 2.5m, 62.5/125µm):	P _{OUT} [dBm] = -11dBm (± 0.2dBm) ⇔ P _{OUT} [µW] = 80µW (± 3.6µW)
Optical output power P _{OUT} [dBm] to multi-mode optical fiber cable (Length = 2000m, 62.5/125µm):	P _{OUT} [dBm] = -18dBm (± 0.2dBm) ⇔ P _{OUT} [µW] = 16µW (± 0.8µW)
Switch-on/off delay:	< 10nsec.
Optical fiber inputs: λ = 820nm, connector type: ST (bayonet) – for T=+25°C	
Min. optical received power:	P _{IN} [dBm] = -25dBm (± 0.2dBm) ⇔ P _{IN} [µW] = 3,2µW (± 0.15µW)
Max. optical received power (overload):	P _{IN} [dBm] = -9dBm (± 0.2dBm) ⇔ P _{IN} [µW] = 126µW (± 6.0µW)
Signal delay:	< 75nsec. (at -21dBm)

Status Relay (X2)	
max. Switching Capacity, ohm load:	Switching Current: 1.0A at 30V DC 0.3A at 60V DC 0.5A at 125V AC Switching Voltage: 60V DC / 125V AC
Switching Cycle mechanical / at load:	10 Million / 10.000

Environment Conditions		
Temperature range:	Operation:	0°C bis +55°C
	Storage:	-20°C bis +75°C
Humidity:		max. 95%, no condensation

CE compliant to EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC	
Safety / Low Voltage Directive:	DIN EN 60950-1:2001 + A11 + Corrigendum
EN 61000-6-4:	
EMC (Electromagnetic Compatibility) Stability:	EN 610000-4-2 /-3/-4/-5/-6/-11
EN 61000-6-2:	EN 61000-3-2 /-3
Interference voltage: EN 55022	EN 55022 Klasse B
Interference radiation: EN 55022	EN 55022 Klasse B

Custom-made production:

Modifications can be made to hardware and software in accordance with customer specifications.



hopf reserves the right to modify hardware and software at any time.

8 System Drawing

