High Performance Paging Transmitters

LBB 5888 VHF 0.5 – 5 W
LBB 5868 UHF 0.5 – 5 W
LBB 6019 UHF 50 mW

Installation Instructions 85

Philips
Communication,
Security & Imaging

PHILIPS

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1 INTRODUCTION

1.1 Purpose of this manual

This manual supplies an engineer with the information required to install and replace the UHF/VHF transmitters. The complete technical specifications can be found in the Data Sheets. Refer to the Service Manual for maintenance, troubleshooting and repair.

1.2 Intended audience of this manual

This manual has been written with the service engineer in mind. However, this does not mean that there are no other legitimate users of this manual. To be able to make the right judgements in error situations, such a person must have had an education on engineering level and must have had training on general DP6000 paging system tasks.
Great care has been taken to ensure that the information in this manual is complete and correct. However, maintenance and repair of sophisticated electronic equipment is a task for trained engineers, well aware of the dangers and risks involved.

1.3 Available documentation

The following documentation is available for the UHF/VHF transmitters:

12 NC	Name
9922 141 50021	Datasheet LBB 5888 and LBB 5868
9922 141 50031	Datasheet LBB 6019
9922 141 50041	Installation Instructions (this manual)
3922 880 00811	Service Manual

1.4 CE marking

This product has the CE marking CE **0344** ⓘ. The number added to the CE mark is the identification number of the consulted Notified Body.

ⓘ *This transmitter is using frequencies which are not harmonised in the European Community.*

1.5 Declaration of Conformity

en Philips Communication Security & Imaging declares that the transmitters LBB 5888 (VHF 0.5-5W), LBB 5868 (UHF 0.5-5W) and LBB 6019 (UHF 50 mW) are in conformance with the essential requirements of the R&TTE Directive 1999/5/EC. The official Declaration of Conformity can be found on the Philips CSI Extranet. All Philips National Sales Organisations and authorised dealers have access to the Philips CSI Extranet. Please contact one of those if necessary.

fr Philips Communication Security & Imaging déclare que les émetteurs LBB 5888 (VHF 0.5-5W), LBB 5868 (UHF 0.5-5W) et LBB 6019 (UHF 50 mW) satisfont aux exigences essentielles de la directive R&TTE 1999/5/CE. La Déclaration de conformité officielle (Declaration of Conformity) se trouve sur l'extranet de Philips CSI. Tous les services commerciaux nationaux Philips ainsi que tous les revendeurs agréés ont accès à l'extranet de Philips CSI. Le cas échéant, contactez un de ceux-ci.

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es Philips Comunicaciones y Seguridad declara que los transmisores LBB 5888 (VHF 0.5-5W), LBB 5868 (UHF 0.5-5W), LBB 6019 (UHF 50 mW) cumplen los requisitos esenciales de la directiva R&TTE 1999/5/EC. La declaración oficial de conformidad (Declaration of Conformity) se puede consultar en la Extranet de Philips CSI. Todas las organizaciones nacionales de venta de Philips y distribuidores autorizados tienen acceso a la Extranet de Philips CSI. Por favor póngase en contacto con alguna de ellas si lo considera necesario.

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1.6 Transmission licence

This transmitter is designed for the use as a part of a Philips DP6000 on-site paging system. For this service, the transmitter is using frequencies which are not harmonised in the European Community. National Authorities have prescribed requirements for putting this kind of equipment in service. Therefore the transmitter may only be put in service with a license obtained from the National Authority responsible in the relevant Member State. Together with the license, the National Authority shall assign the transmission frequency that may be used. The Spectrum Authorities for all EU Member States can be found on the following internet site: **http://www.europa.eu.int/comm/enterprise/rtte/spectr.htm**. When this transmitter is used outside the member states of the EU, the local regulations must be taken into account.

1.7 Modifications

Modifications or additions to the transmitter are not allowed without the written consent of Philips CSI.

***Warning**: Any unauthorised modification or use of the transmitter will invalidate the Declaration of Conformity.*

1.8 ESD protection

All ICs and many other electrical components are susceptible to Electro Static Discharge. ESD could cause instantaneous failures but could also drastically limit the life span of the affected part. This can cause unexplainable behaviour of the equipment.

When handling printed circuit boards always take preventive measures like:
- Keep printed circuit boards as long as possible in their protective bags.
- Use an anti-ESD bracelet.
- Use an ESD-protected workspace.

1.9 Contact addresses

Transmitters:
For information and inquiries, see the Philips CSI internet site: **http://www.philipscsi.com**.

Power supply:
For dealer addresses to order a UK-specific mains input plug, see the Friwo internet site: **http://www.friwo.de**.

1.10 Contents of the packing

- Installation Instructions
- Transmitter
- Mains power adapter
- DP6000 connection cable
- 400 mA fuse

1.11 Abbreviations

AGC	Automatic Gain Control
FM	Frequency Modulation
LF	Low Frequency
PCB	Printed Circuit Board
RF	Radio Frequency
TSU	Transmitter Surveillance Unit
Tx	Transmitter
UHF	Ultra High Frequency
VHF	Very High Frequency
VSWR	Voltage Standing Wave Ratio

2 PRODUCT OVERVIEW

The paging transmitters LBB 5888, LBB 5868 and LBB 6019 are intended for use in a Philips DP6000 Digital Paging System, operating in the VHF or UHF band. The transmitters provide an adjustable output power into a 50 Ohm load. The modulation type is FM.
Table 1 gives an overview of the main characteristics of each transmitter type. Figure 1 gives a block diagram of the transmitters.

Table 1: Transmitter's main characteristics

Product type	Band	Frequency range*	Deviation	Output power	Synchronisation
LBB 5888	VHF	25 - 50 MHz	2 kHz	0.5 - 5 W adjustable	LF or RF
LBB 5868	UHF	409 - 470 MHz	4 kHz	0.5 - 5 W adjustable	LF
LBB 6019	UHF	409 - 470 MHz	4 kHz	50 mW	LF

* The actual frequency of a transmitter depends on the crystal unit that is used in the transmitter's RF-section.

The transmitters are housed in a metal cabinet with a plastic cover. The housing is intended for wall mounting and is applicable for indoor use only. Do not use the transmitters in an environment where explosion protection is required.

The housing contains a basic PCB with the LF circuitry and a VHF or UHF transmitter module with the RF circuitry.

The transmitters are supplied from the mains via an external switched-mode mains power adapter.
The transmitters also provide a 12 Vdc, 400 mA power supply outlet for a central receiver, a master synchronisation unit or a modem, connected to the same DP6000 bus.

If one transmitter cannot cover the required transmission area, subsequent transmitters can be installed in the same system. All transmitters installed in the system can then be synchronised from a master synchronisation unit, via a low frequency (LF) signal on the DP6000 bus.
Alternatively, the VHF transmitters (LBB 5888) can also be 'synchronised' by connecting the antenna output of a master transmitter to the RF sync. inputs of the slave transmitters.

The transmitters are prepared for use with a CSI-certified (third party) Transmitter Surveillance Unit (TSU).

***Warning**: When using a TSU, the transmitter/TSU combination must comply with the R&TTE directive 1999/5/EC.*

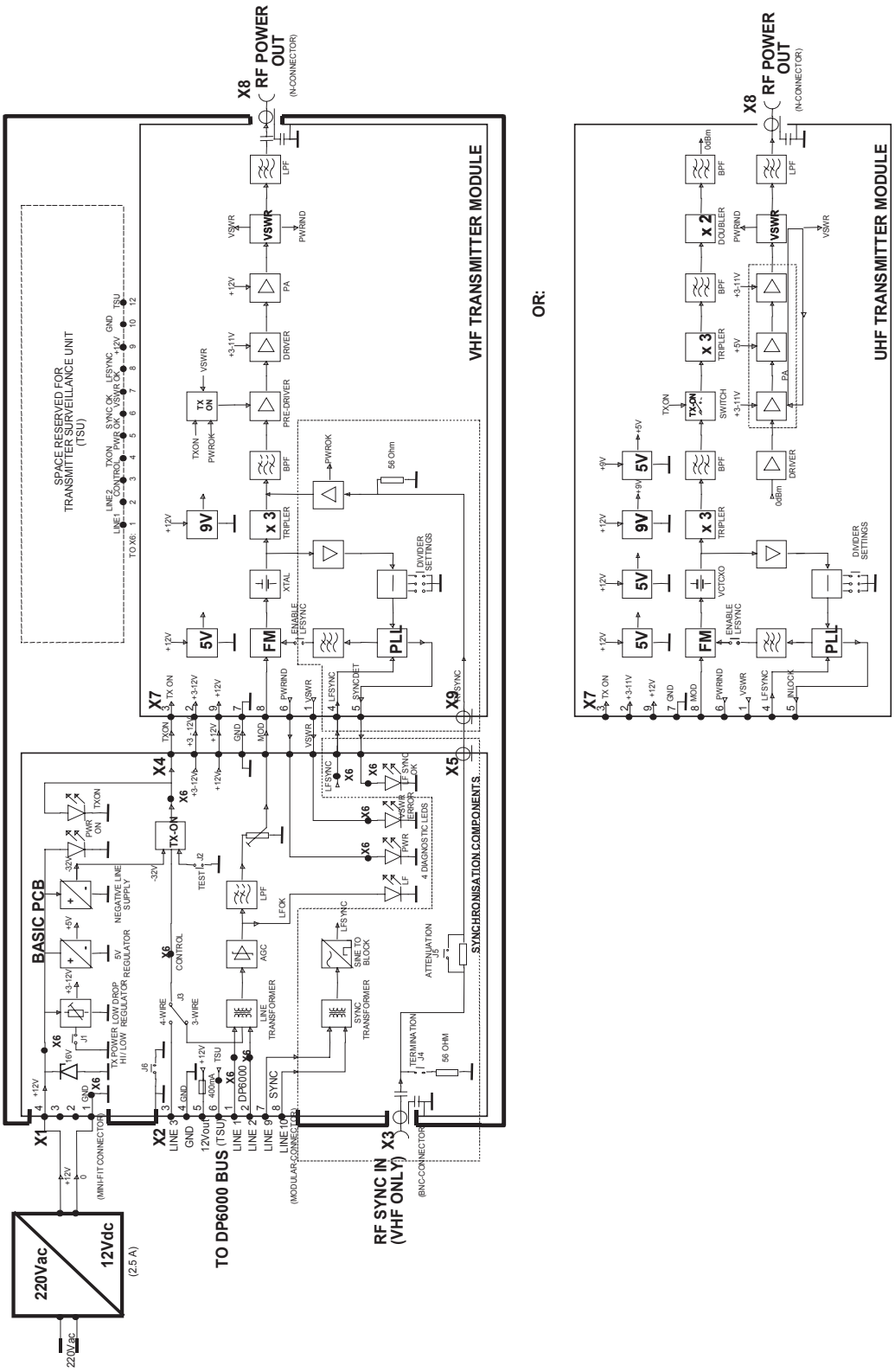


Figure 1: Transmitter block diagram

3 WALL MOUNTING

The transmitter is intended for wall mounting. A free space of at least 15 mm between the top of the transmitter cabinet and the ceiling is required to open the cabinet. The distance to the nearest mains outlet should be less than 1.5 m. For electrical insulation, the mounting holes in the metal back plate have plastic insulators.

To open the housing, unscrew the two screws (torx no. 8) at the connector panel of the housing and rotate the plastic cover upwards.

Mounting instructions:

- Drill four holes in the wall using the dimensions as given in Figure 2.
- Screw four 4 mm screws with a head diameter ≤ 8 mm into the wall, use plugs when necessary.
- Leave a space of 2 mm between the wall and the screw's heads.
- The transmitter can now be hooked onto the four screws.

***Note**: Do not tighten the screws. To comply with safety regulations, the transmitter must be easily removable without tools in case of emergency.*

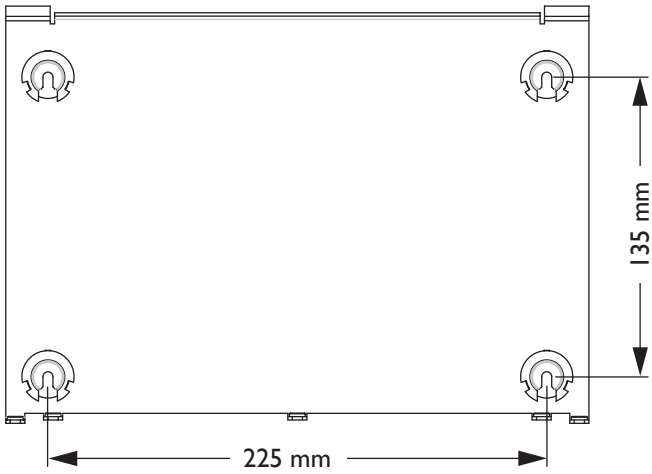


Figure 2: Wall mounting dimensions

4 POWER SUPPLY

4.1 Power supply from the mains

The transmitter connects to the mains supply via the supplied external switched-mode mains power adapter. The adapter can deliver a regulated voltage of 12 Vdc, 2.5 A max. The adapter can be used for a mains voltage of 100 - 240 Vac, 47 - 63 Hz. The length of the output lead is 2 m. See Figure 4 for connection details.

The supplied mains power adapter has a 2-pin Euro mains input plug. For use in the United Kingdom, a UK specific mains input plug (part number 1717618) can be ordered directly from the nearest Friwo-dealer. See paragraph 1.8 for contact addresses.

The transmitter has no back-up battery. When required, an Uninterruptable Power Supply (UPS) can be used.

***Warning**: Only the original mains power adapter supplied by Philips CSI should be used.*

4.2 12 Vdc power supply output

The transmitter can provide a 12 Vdc power supply on lines 4 (GND) and 5 (+12 Vdc) of the DP6000 bus. This output is normally disabled. It can be enabled by inserting the supplied 400 mA fuse on the basic PCB (see Figure 6).

***Warning**: When using the +12 Vdc output, make sure that no other 12 V supply (other transmitters or a central power supply) is connected in parallel to the same DP6000 bus. When necessary disable the 12 Vdc output from the transmitter(s) by removing the 400 mA fuse.*

5 EXTERNAL CONNECTIONS

The transmitter's external connections and two indicator LED's are positioned on the connector panel of the transmitter cabinet, see Figure 3.

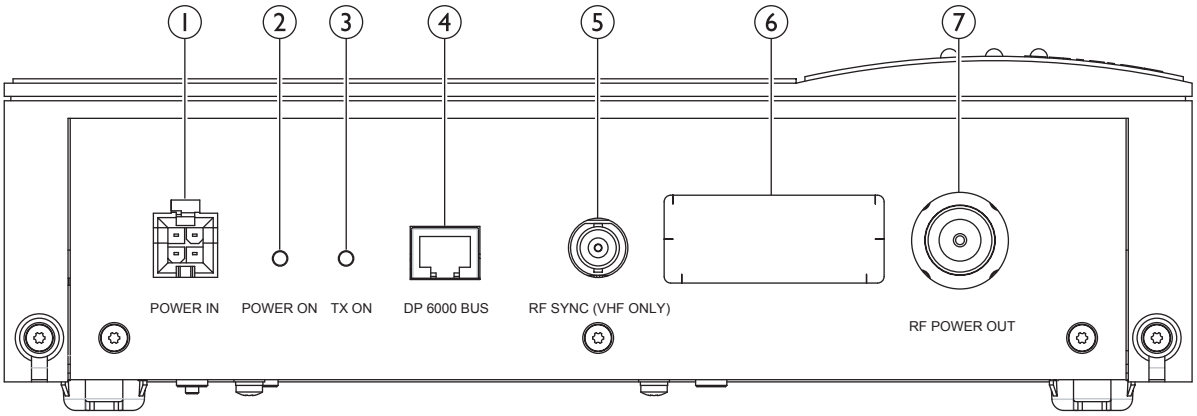
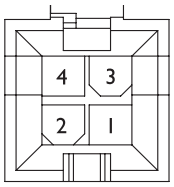


Figure 3: Connector panel view with external connections

1	Power input	3	Transmitter On LED	5	RF sync. input	7	RF antenna output
2	Power On LED	4	DP6000 bus input	6	Type identification label		

5.1 Power input

The input for the mains power adapter is a Molex 4-pin 'mini-fit' female header, see Figure 4.



1 GND
2 not used
3 not used
4 +12 Vdc

Figure 4: Power supply input (front view)

5.2 DP6000 bus

The input for the DP6000 bus is an 8-pin RJ45 modular jack, see Figure 5. A DP6000 connection cable is supplied with each transmitter. The pin configuration of the DP6000 bus connector is as shown in Table 2.
To connect the transmitter to a DP6000 bus using the 'old' 16-pin Hirschmann connector, a transition cable can be used.

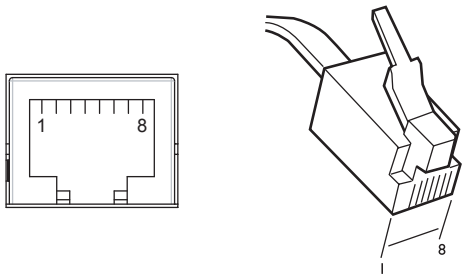


Figure 5: DP6000 input (front view) and plug

Table 2: DP6000 bus pinning

Pin	Description	'old' DP6000-bus equivalent
1 + 2	LF input signal (DP6000 code + speech) Switching input for line level (3 wire operation)	line 1 + 2
3	Switching input for line level (4 wire operation)	line 3
4	System earth	line 4
5	+12 Vdc output (400 mA max.)	line 8
6	Reserved for Transmitter Surveillance Unit	-
7 + 8	LF synchronisation signal input	Line 9 + 10

5.3 RF synchronisation input

The RF synchronisation signal is connected to a 50 Ohm female BNC connector, see Figure 3. Although this connector is present on all transmitter types, RF synchronisation can only be used with the LBB 5888 VHF transmitter.

5.4 RF antenna output

The RF antenna output is provided through a 50 Ohm female N type connector, see Figure 3.

***Warning**: It is advised to use an earthed lightning protector between the RF output and the antenna. In some countries this is a legal requirement.*

6 PCB LAYOUTS

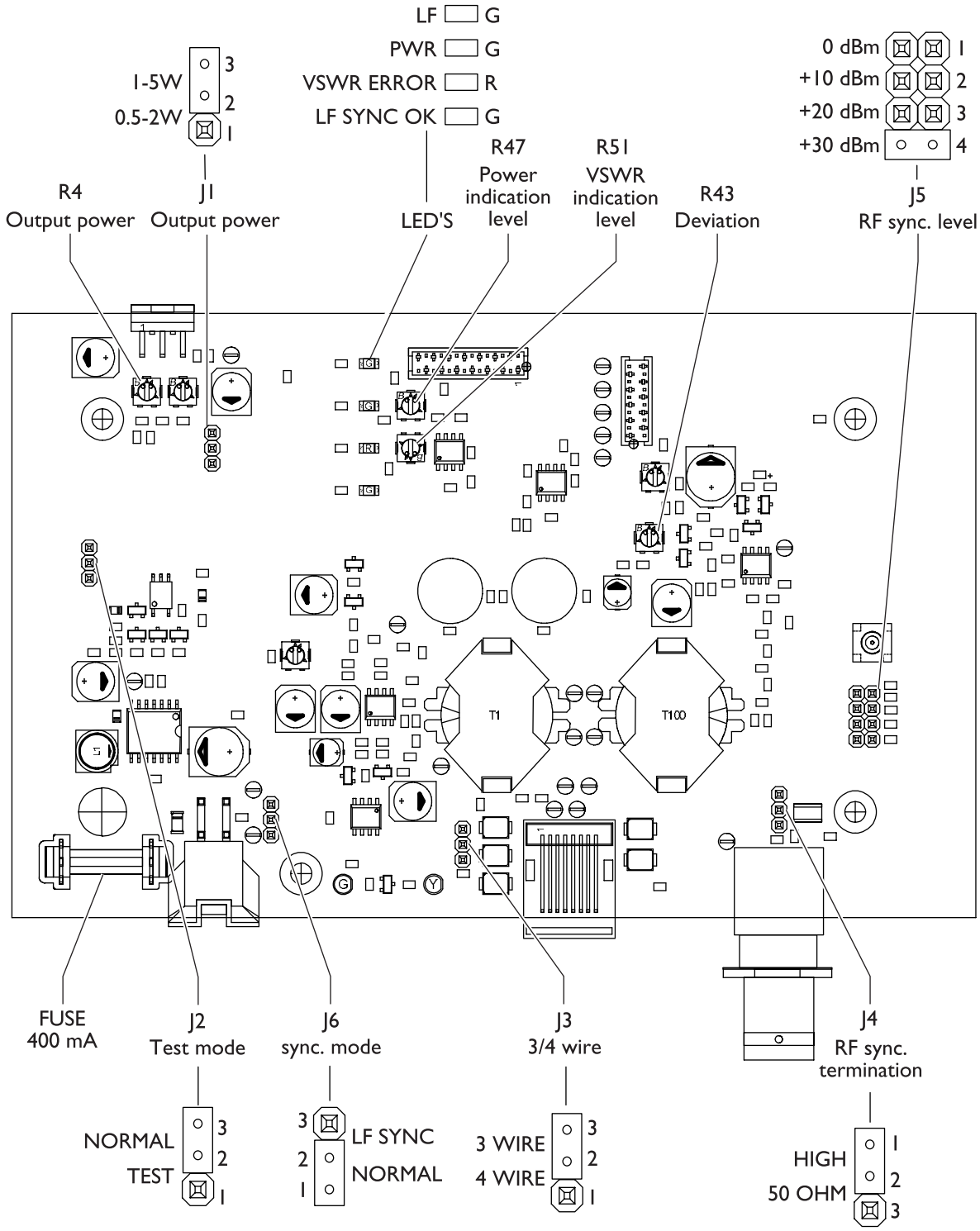


Figure 6: Basic PCB layout

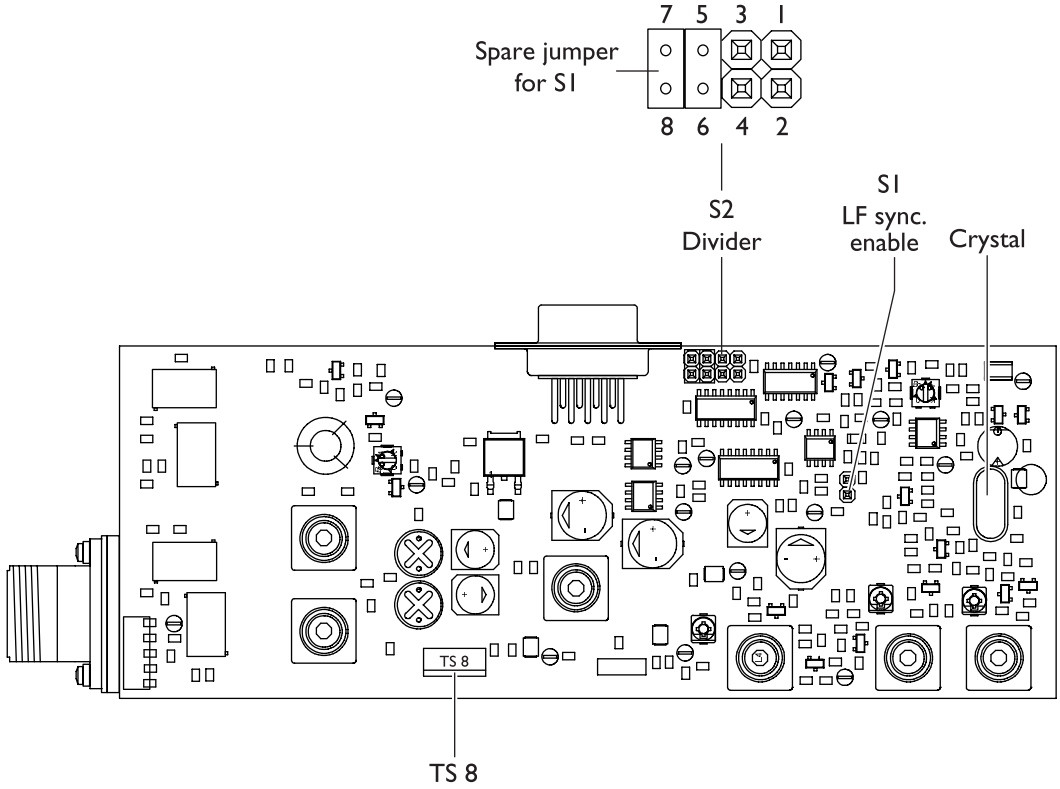


Figure 7: VHF module PCB layout

***Warning**: Transistor TS8 (2SC1971) in the VHF transmitter LBB 5888 (see Figure 7), contains beryllium oxide. This product is entirely safe provided that the BeO disk inside the housing is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.*

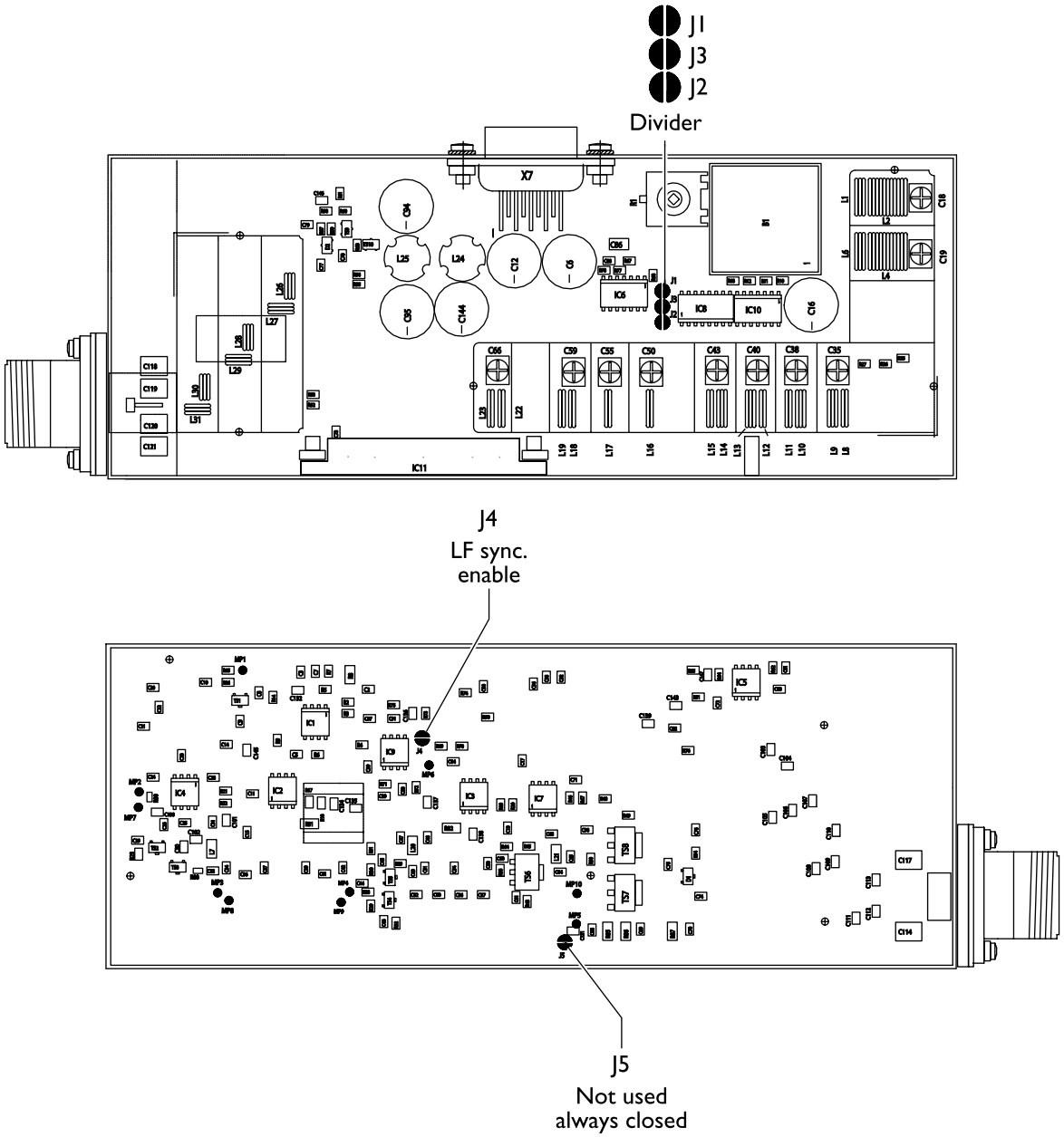


Figure 8: UHF module PCB layout

7 LED INDICATORS

Two LED's located at the connector panel of the transmitter housing (see Figure 3) indicate the general status of the transmitter. Four additional diagnostics LED's are located on the basic PCB (see Figure 6).

Table 3: LED indicators

Name	Colour	Description
On housing:		
PWR ON	green	On when the 12 Vdc power supply is present
TX ON	yellow	On during transmission
On basic PCB:		
LF	green	On when an LF signal is present on the DP6000 input
PWR	green	On when the RF output power is ≥ 60% of the pre-set value
VSWR ERROR	red	On when a bad VSWR is present on the RF output
LF SYNC OK	green	On when an LF signal is detected on the LF sync input

8 JUMPERS

Several options can be chosen by setting jumpers on the main PCB and the VHF/UHF transmitter modules. The jumpers on the basic PCB and the VHF module can be set by placing a pin header at the appropriate position. On the UHF unit the jumpers are set by connecting two contacts on the PCB with a drop of solder.

***Note**: Always disconnect the power supply before changing the jumper settings.*

Table 4: Jumpers on basic PCB (Figure 6)

No.	Function	Position	Value
J1	Output power range	1-2 2-3 *	0.5 - 2 W 1 - 5 W
J2	Test mode (Tx on)	1-2 2-3 *	Test Normal
J3	3 / 4 wire mode	1-2 2-3 *	4 wire 3 wire
J4	RF sync. termination	1-2 2-3 *	50 Ohm High
J5	RF sync. level	1-1 2-2 3-3 4-4 *	0 dBm +10 dBm +20 dBm +30 dBm
J6	Sync. mode	1-2 * 2-3	Normal LF sync.

Table 5: Jumpers on VHF module (Figure 7)

No.	Function	Position	Value
S1	LF sync. enable	open * 1-2	disabled enabled
S2	LF sync. divider	1-2 3-4 5-6 * 7-8	8192 4096 2048 not used

Table 6: Jumpers on UHF module (Figure 8)

No.	Function	Value (when closed)
J4	LF sync. enable	enabled
J1 J2 J3	LF sync. divider	1024 4096 16384

* = Factory settings (UHF module: all open)

To access the jumpers on the VHF module, only the top cover of the module has to be removed. The jumpers are located at the component side of the PCB. See Figure 7.
On the UHF module the jumpers are located on both sides of the PCB. The UHF module can be removed from the transmitter housing by removing the three screws (torx 8) that connect the module's cooling plate to the back plate of the housing.

***Note**: Make sure that after setting the jumpers on the VHF or UHF module, the metal covers are replaced correctly, to assure good shielding of RF frequencies.*

9 ADJUSTMENTS

9.1 Factory settings

When the transmitter is delivered from the factory, the frequency has been set to customer specification. The frequency deviation and the output power are set according to Table 7.

Table 7: Transmitter factory settings

Type	Deviation	Power
LBB 5888 (VHF)	2 kHz	5 W
LBB 5868 (UHF)	4 kHz	5 W
LBB 6019 (UHF)	4 kHz	50 mW

***Note**: The default frequency deviation settings are based on a channel spacing of 10 kHz for the VHF band or 20 kHz for the UHF band. The frequency deviation is set to 20% of the channel spacing. For countries where less channel spacing is used, the frequency deviation must be adjusted to an appropriate lower level before operating the transmitter. See paragraph 9.3 for the adjustment procedure.*

9.2 Output power adjustment

The output power level can be set to a lower level when required. Follow the procedure as described below.
The mentioned jumpers, LED's and potmeters are all located on the basic PCB (see Figure 6).

***Note**: Adjusting the output power is only applicable for the 5W transmitters LBB 5888 and LBB 5868. Do not change the output power for the 50 mW transmitter LBB 6019.*

1. Connect a Watt-meter (range 250 mW - 7 W) to the RF antenna output.
2. Set jumper J1 to the appropriate power range (0.5 - 2 W or 1 - 5 W).
3. Set jumper J2 to the 'TEST' position to switch the transmitter on. The yellow 'TX ON' LED should go on.
4. Adjust potmeter R4 to 60% of the required output power value.
5. Adjust potmeter R47 such that the green 'PWR' LED is just going on.
6. Adjust potmeter R4 to 100% of the required output power value. The green 'PWR' LED should now be on continuously.
7. Connect a 50 Ohm dummy load to the RF antenna output.
8. Adjust potmeter R51 such that the red 'VSWR ERROR' LED is just going off.
9. Remove the dummy load. The red 'VSWR ERROR' LED should now go on.
10. Set jumper J2 back to the 'NORMAL' position to switch the transmitter off.

9.3 Frequency deviation adjustment

The frequency deviation can be set to a lower level when required. The maximum frequency deviation should be set to 20% of the channel spacing. Follow the procedure as described below. The mentioned jumpers, LED's and potmeters are all located on the basic PCB (see Figure 6).

1. Connect a dummy load/attenuator (50 Ohm, 20 dB, 7W) to the RF antenna output.
2. Connect a frequency deviation meter (range 1 – 5 kHz) to the output of the dummy load/attenuator.
3. Connect an LF generator (600 Ohm, symmetrical) to pins 1 and 2 of the DP6000 bus connector.
4. Adjust the LF generator to 120 Hz, 0 dBm (0.775 V_{eff} or 2.2 V_{tt}).
5. Set jumper J2 to the 'TEST' position to switch the transmitter on. The green 'LF' LED should go on.
6. Adjust potmeter R43 to the required frequency deviation level.
7. Set jumper J2 back to the 'NORMAL' position to switch the transmitter off.

10 SYNCHRONISATION

When a paging system uses more than one transmitter, the RF frequencies of the transmitters must be synchronised. All transmitter types can be synchronised by a LF signal on the DP6000 bus. The VHF transmitter LBB 5888 can also be RF synchronised (see 10.3).

For optimal performance, the overlap between the transmitter's coverage areas should be kept as small as possible.

10.1 LF synchronisation

In a LF-synchronised system one Master Synchronisation Unit is needed (LBB 5352 (UHF), LBB 5328 (VHF)or LBB 5353 (VHF)). This unit generates a stable LF sine wave and is connected to the DP6000 bus (see Table 2). Each 'slave' transmitter has a PLL-circuit, which locks the RF transmitting frequency to the LF synchronisation frequency. See Figure 9.

The recommended frequency for the LF synchronisation signal is 5.6 kHz - 8.1 kHz. For systems where the synchronisation signal is distributed through public telephone cables (having a frequency band of 300 Hz - 3 kHz), the recommended frequency is 1 kHz - 2 kHz.

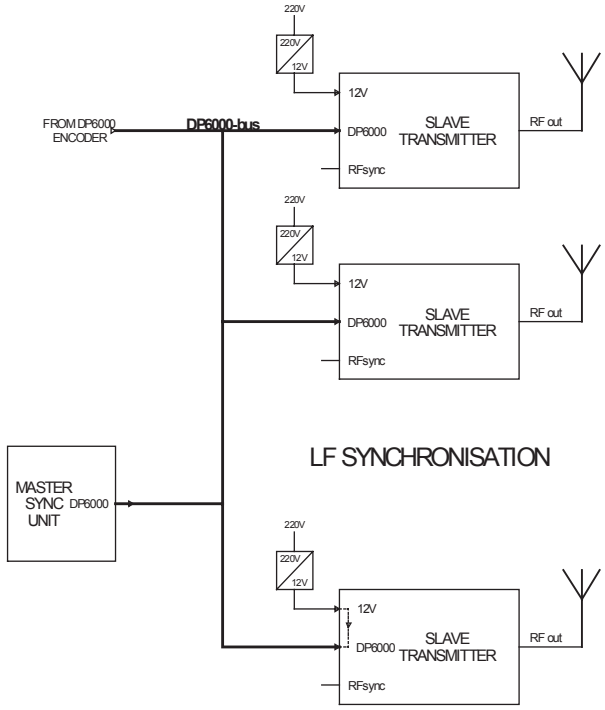


Figure 9: LF synchronisation

Each transmitter has its own power supply. The power for the Master Synchronisation Unit can be supplied from the +12Vdc output line of one of the transmitter's DP6000 bus (see Table 2).

***Note**: Make sure that only one transmitter supplies 12 Vdc to the DP6000 bus. Remove the 400 mA fuse (see Figure 6) from the other transmitters. Remove the fuse from all transmitters when a separate power supply is connected to the same DP6000 bus.*

10.2 Settings for LF synchronisation

To match the RF transmission frequency and the LF synchronisation frequency, a divider value must be set. See Table 8 (VHF transmitter) or Table 9 (UHF transmitters).

Table 8: LF synchronisation settings for VHF transmitter

Transmission frequency	Divider value	Jumper settings	LF sync. frequency
25 - 50 MHz	3 x 8192	S2 1-2	1.0 - 2.0 kHz
25 - 50 MHz	3 x 4096	S2 3-4	2.0 - 4.1 kHz
25 - 50 MHz	3 x 2048	S2 5-6	4.1 - 8.1 kHz

Table 9: LF synchronisation settings for UHF transmitter

Transmission frequency	Divider value	Jumper settings	LF sync. frequency
409 - 470 MHz	18 x 16384	J3 closed	1.4 -1.6 kHz
409 - 470 MHz	18 x 4096	J2 closed	5.6 - 6.4 kHz
409 - 470 MHz	18 x 1024	J1 closed	22 -25 kHz *

* In practice this value can not be used because of the low pass filter on the basic PCB.

Follow the procedure as described below to prepare the transmitters for LF-synchronisation. See Figure 6, Figure 7 and Figure 8 for the location of the jumpers.

VHF transmitter:
1. Set jumper J6 on the basic PCB in the 'LF SYNC' position.
2. Close jumper S1 on the VHF module.
3. Set jumper S2 on the VHF module in the position for the required divider value (see Table 8).

UHF transmitters:
1. Set jumper J6 on the basic PCB in the 'LF SYNC' position.
2. Close jumper J4 on the UHF module.
3. Close one of the jumpers J1, J2 or J3 on the UHF module to set the required divider value (see Table 9).

***Note**: When LF synchronisation is used, it is important that the frequency deviations of all transmitters are adjusted to equal values as good as possible. See paragraph 9.3 for the adjustment procedure.*

10.3 RF synchronisation

RF synchronisation can only be used with the VHF transmitter LBB 5888.
In an RF synchronised system one transmitter functions as a 'master' transmitter. It's RF output is connected to the RF inputs of the other 'slave' transmitters via a 50 Ohm coax line with RF-splitters and/or T-connectors. See Figure 10.

Only the master transmitter is connected to the DP6000 bus. The slave transmitters receive the modulated RF output signal from the master, which they amplify to the desired output power. In the slave transmitters the channel crystal must be removed.

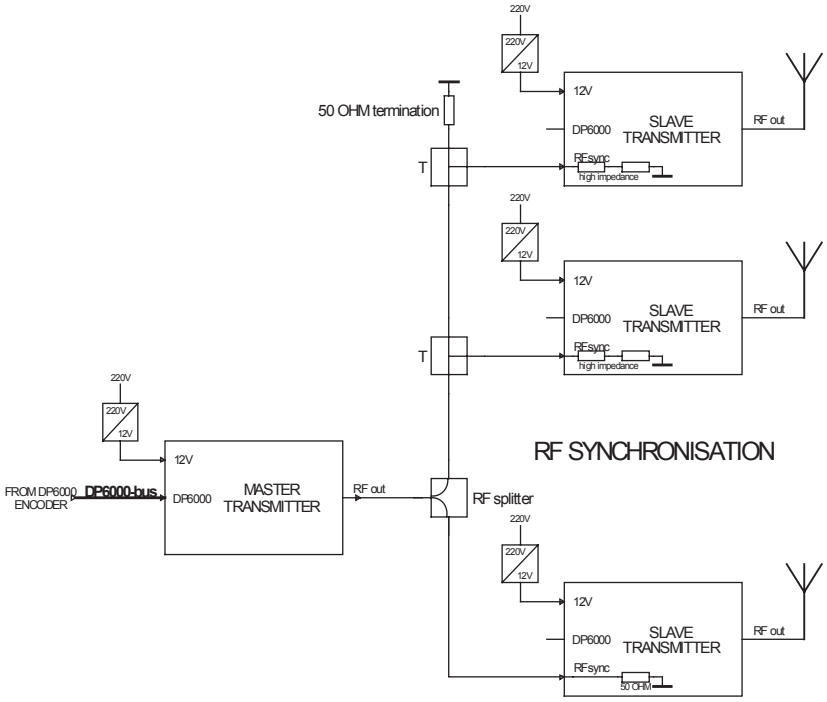


Figure 10: RF synchronisation

10.4 Settings for RF synchronisation

Follow the procedure as described below to prepare the VHF transmitters for RF-synchronisation. See Figure 6 for the location of the jumpers.

Master transmitter:

1. The RF sync. input level for each slave transmitter must be at least 0 dBm. Depending on the losses in the connections to the slave transmitters, the RF output level of the master transmitter must be set to low or high power (jumper J1 on the basic PCB).

***Warning**: The power level at the RF sync. input of any slave transmitter must be limited to 30 dBm (1W) maximum, to prevent overheating of internal resistors.*

Slave transmitters:

2. Remove the channel crystal from the VHF module (see Figure 7).
3. Choose the attenuation level for the RF input signal by setting J5 on the basic PCB in the correct position as indicated in Table 10. The RF input level depends on the master transmitter's output level and the cable losses between master and slave transmitter.
4. Choose the internal termination by setting J4 on the basic PCB in the correct position, see Table 10.

Table 10: RF synchronisation settings for a slave VHF transmitter

RF sync input level	Position J4 (termination)	Position J5 (attenuation)	RF sync input impedance
0 - 5 dBm	High	0 dBm	50 Ohm
5 - 15 dBm	50 Ohm *	+10 dBm	high
15 - 25 dBm	50 Ohm *	+20 dBm	high
25 - 30 dBm	High	+30 dBm	high

* Use the internal termination only when a slave transmitter is at the end of the transmission line and the input level is below 20 dBm. Use an appropriate external 50 Ohm termination for higher input levels. For all other transmitters J4 must be set to 'High'.

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