



User manual

28 MHz < - > 144 MHz Transverter

ZST 200

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1. Preface

Congratulations on your purchase of the new ZST-200 from SSB-Electronic.

This 10m to 2m transverter is a German quality product, developed and assembled in Germany. To preclude mistakes between transceiver and transverter we will refer to this **transverter** as **ZST-200**.

The **ZST-200** distinguishes itself through the following advantages:

- all mode operational (*all modulation and operation modes*)
- operation with transceivers without special transverter ports
- outstanding TX and RX selection
- high IIP and OIP values of the receiver
- 25 W RF Output power
- RF output adjustment via the front panel
- presetting of maximum power output
- split operation in 2m tape
- small dimensions

Attention: Before you start operating the ZST-200, please read this manual carefully. Do not allow children to play with this device. Operation of this device is allowed only by persons with a valid radiocommunication license. Preserve this manual carefully. It contains important operational instructions for the ZST-200.

2. Safety instructions

For correct operation, the **ZST-200** requires a stabilized voltage supply of 13,8V (DC 12-14 V), with a minimum current of 6A. Pay attention to the right polarity! Never connect this device to alternating current (AC) or un-stabilized DC voltage!

Never expose the **ZST-200** to rain, snow or any other liquid. Do not place drinks on it. The heat sink must not be covered, as this would interrupt the circulation of air. The heat sink gets hot during continuous operation (for example FM, WWSJT). This is not a malfunction.

Do not open the **ZST-200**. It does not contain any servicable parts. You would loose your right of warranty.

The ambient temperature should not be below -10°C or more than +50°C.

The operating temperature is 0-40°C. Relative humidity, non condensing 0-80%. If operating with a downstreamed power amplifier you have to use a correctly connected sequencer (for example SSB-Electronic DCW 2004 B item No. 1025, or similar),

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The **ZST-200** has only one TRX connection. Take care, that the transmitting power of the transceiver never exceeds 5W before the execution of the power output preadjustment of the **ZST-200**.

After execution of the power output preadjustment, the transmitting power of the transceiver must not be raised.

PTT control of the transverter intrasystem is done through the *PTT-THROUGH* connector of the **ZST-200**, which is connected to the *PTT-port* of the transceiver via a *cinchcabel*. All automatic sending/receive switchings (*VOX, Semi- BK, full- BK*) in the transceiver must be deactivated.

CAUTION: The direct PTT-controlling of the transceiver must not be used, otherwise the **ZST-200** could be damaged!

In the case of transceivers that can only provide 5W to max. 10W RF 28 MHz. Drive power which is above the ZST-200 input limit, you definitely have to integrate a 3dB/10W attenuator (*for example SSB item No..5098*) in the TRX connection wiring.

CAUTION: In case of operation with a downstreamed power amplifier, adjust the outputpower of the ZST-200 considerably lower than the maximum input power of your power amplifier, otherwise the power amplifier can be damaged too!

Although this device is operated at a low DC voltage, it is possible that considerably higher RF voltages will occur at the antenna outlet as well as at the antenna.

Please keep a safe distance away from the antenna during sending operations and stay outside the direct radiationcone of the antenna. Never touch elements of the antenna during sending operations. burns und electric shocks could be the result!

All components of a sending- and receiving installation have to be grounded. An installation without proper connection to earth potential, especially in the mountains, could accumulate itself with electrostatic charge to a dangerous level. The charging voltages can lead to electric shocks, malfunctions or destruction of your equipment too. Stop operations during a thunderstorm for safety reasons.

Operation of equipment during a thunderstorm can be dangerous. Take adequate shelter during these conditions and never stay near the installation or antenna.

The operator is, under any circumstances, responsible for the proper setup and operation of his sending- and receiving installation!

3. Connection

Please take the principle connection of the following figures. Tips to usable wires and startup are given in the following chapters.

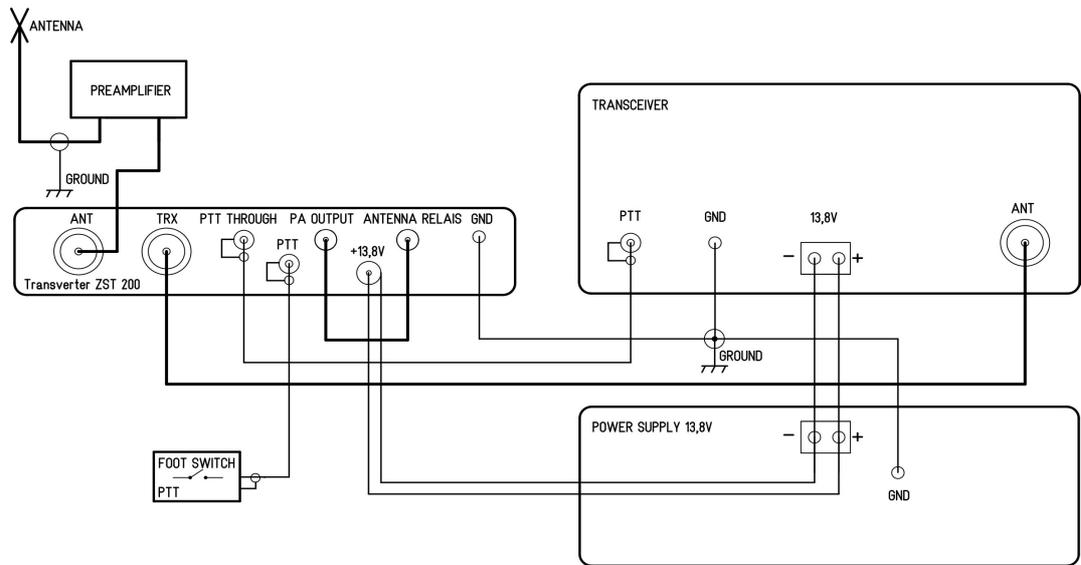


Figure 1: Connection of the ZST -200

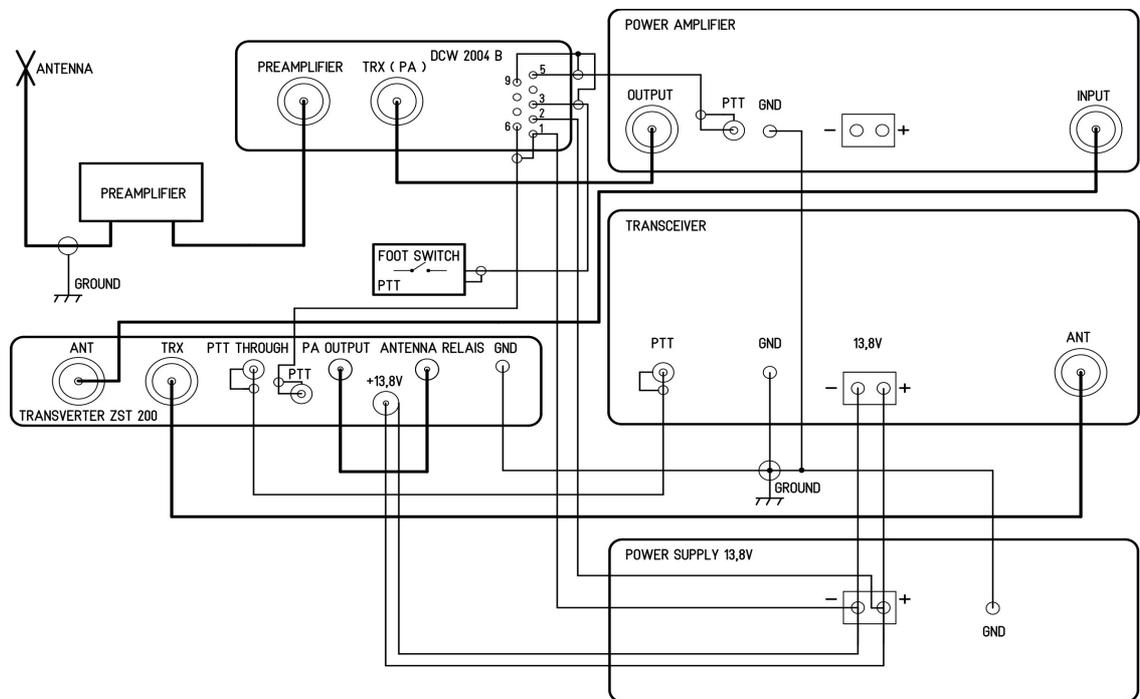


Figure 2: Connection of the ZST-200 in a installation with a power amplifier

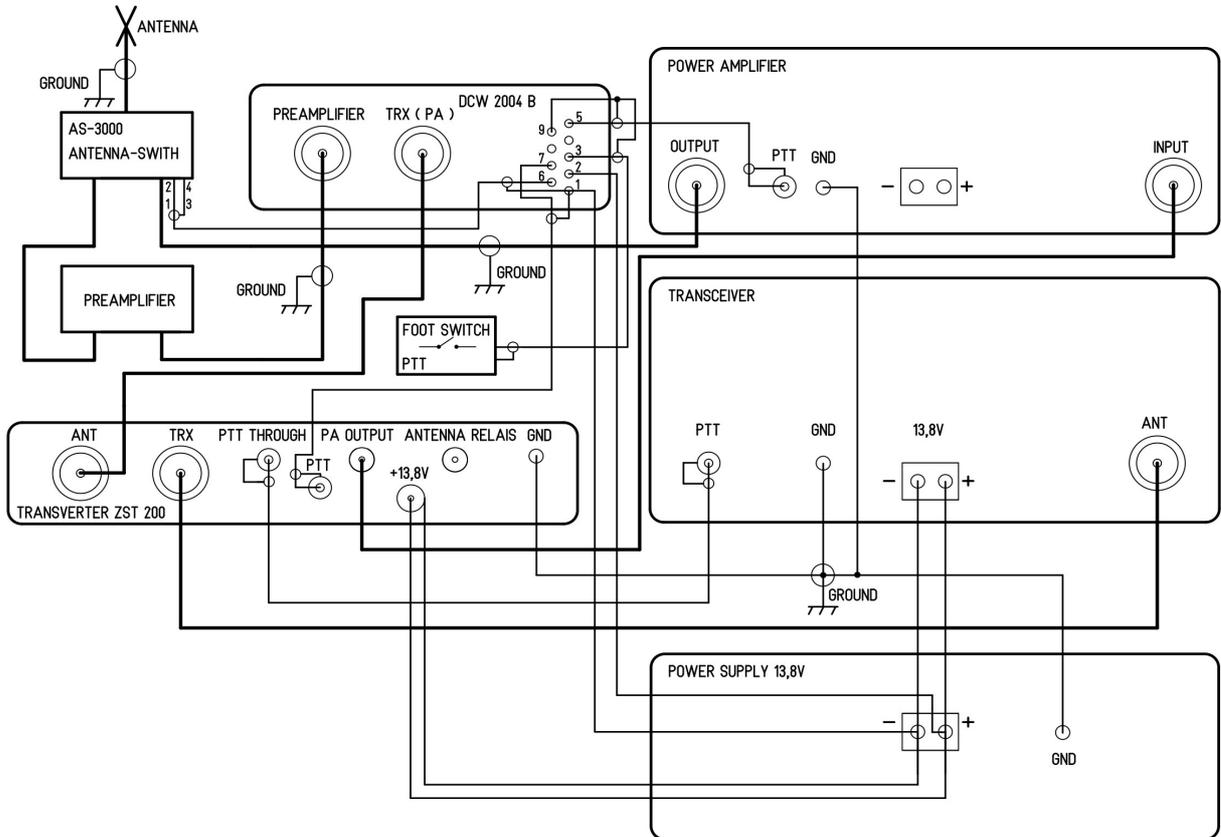


Figure 3: Connection of the ZST-200 in an installation running in split operation with a power amplifier without coaxial relays.

4. Connection with ZS-1 transceiver

Use the principle connection of the ZST-200 with the ZS-1 transceiver as shown in figures 4, 5 and 6. Before you start operation of the system, the TX On delay time has to be adjusted to minus 100 ms and the Enable button has to be activated. The Sequencer used in the system must have the complete sequence time below 100 ms. The sequencer of the ZS-1 has to be adjusted to 1W, maximum 2W. Now the pre-adjustment of the outputpower of the ZST-200 has to be done.

The adjustment of the frequency accuracy is realised as shown in the startup.

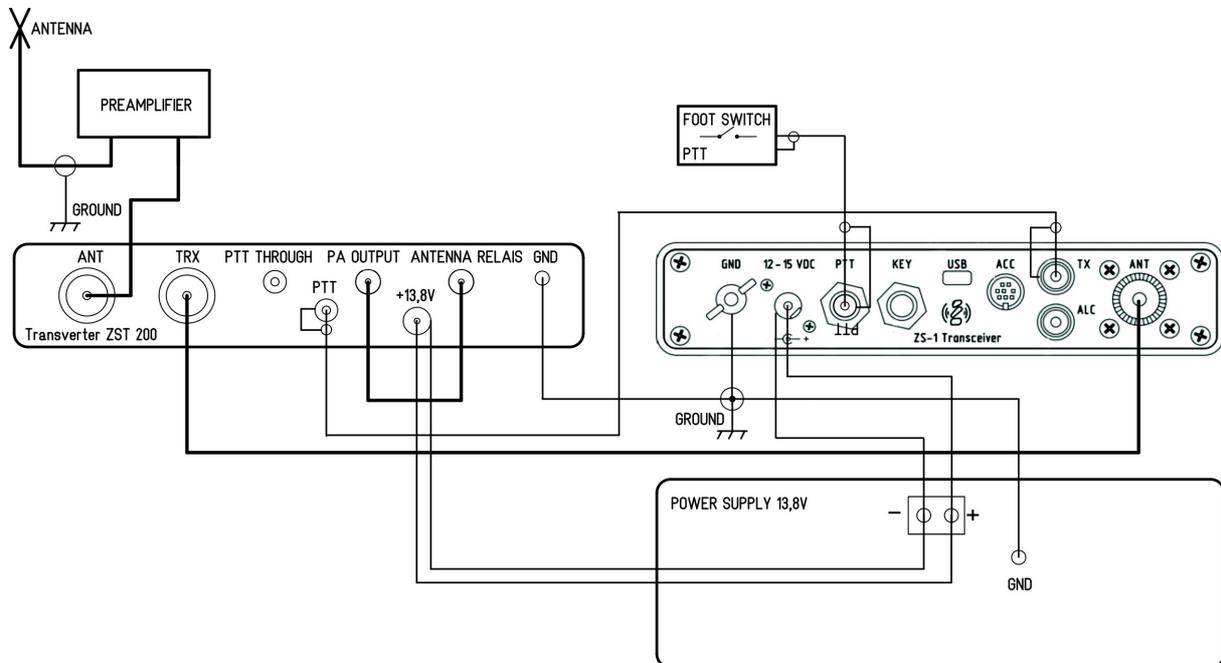


Figure 4: Connection of the ZST -200 with the ZS-1 transceiver

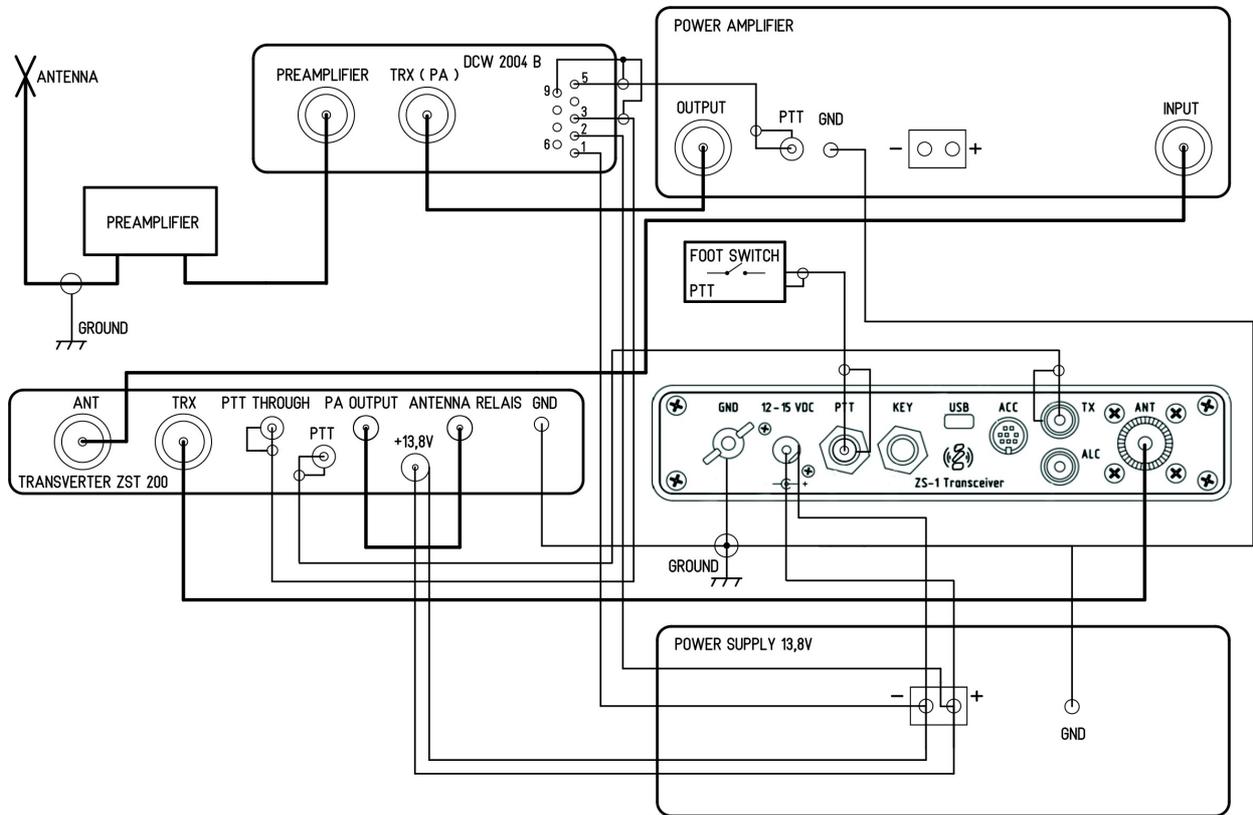


Figure 5: Connection of the ZST -200 with the ZS-1 transceiver and with a power amplifier.

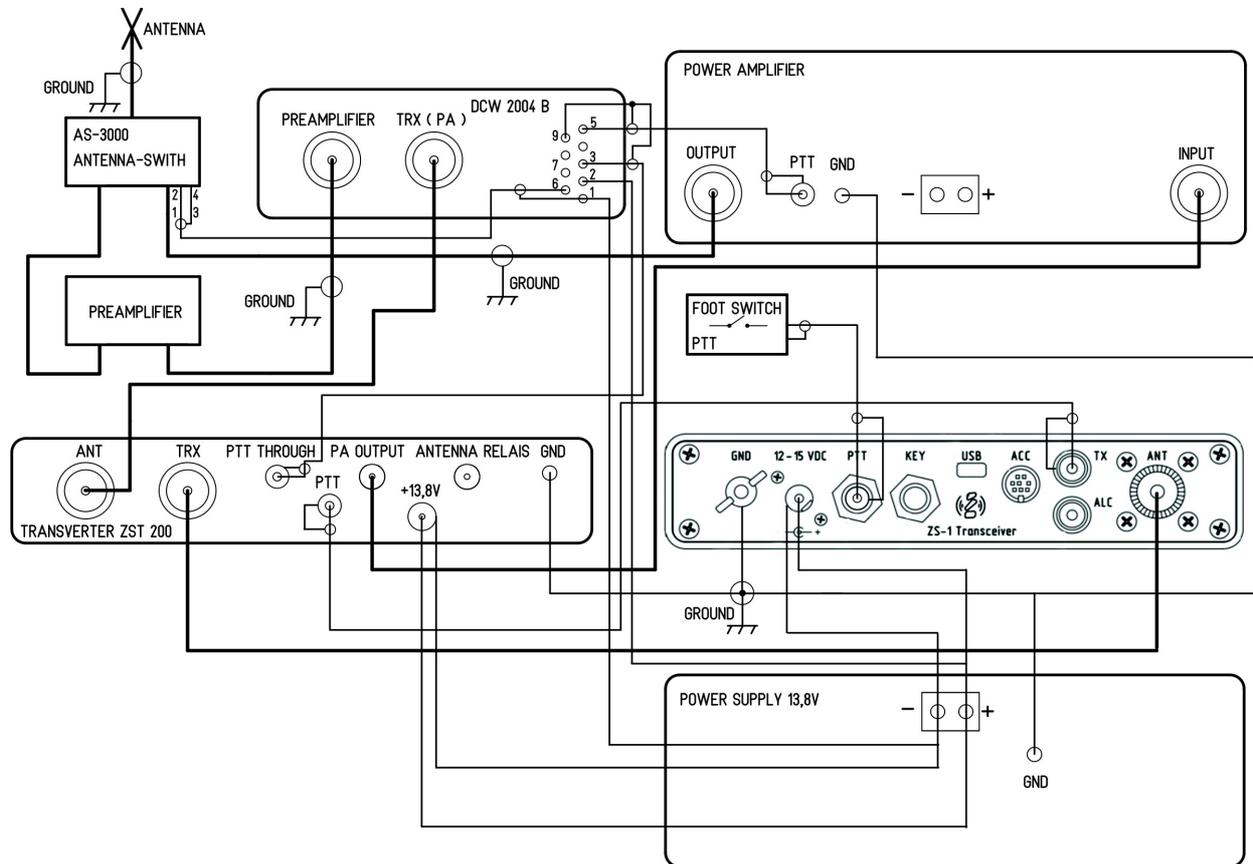


Figure 6: Connection of the ZST -200 with the ZS-1 transceiver and a poweramplifier without relaiswitching.

5. Functional characteristics

The reason for the development of the **ZST-200** was the numerous requests for a low noise, high dynamic range, frequency stable transverter with nominal 25 W power output with a low intermodulation characteristics. Components of the latest generation are used, making a compact design and an outstanding price-performance ratio possible.

The **ZST-200** is made for interconnection with transceivers, without special transverter connections. The low phase-noise and highly frequency-stable overtone oscillator is build in on a 60°C temperature stabilized module. After reaching the operating temperature the heater of the oscillator is supplied with short power impulses and the temperature is stabilized precisely. The frequency accuracy of the local oscillator is adjusted with a 10-gear potentiometer on the left side of the **ZST-200**. With this, the frequency-match can be adjusted precisely and independently from any inaccuracy of the frequency display of the transceiver.

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The pre-stage of the receiving converter uses a power- LDMOS transistor with a high OIP3 value and a low noise-factor.

An RF amplifier stage after the active mixer, which would only raise the OIP3 value was not included because only the input IP3 value is vital for the large signal handling.

On the transmit side, the input signal is decreased with an adjustable attenuator before the mixer. Access to the attenuator is built-in to the groundcover. With it you can adjust the RF output power of the **ZST-200** to the match the driving power of the transceiver.

The potentiometer for adjustment of the output power is placed on the frontplate. The adjustment range is 20 dB which, for example, makes a stageless reduction of the outputpower to 100 mW at a preadjusted maximum output power of 10W possible.

The scaling of the power adjustment is realised in 3 dB stages. After the mixer follows a four pole bandpass filter and several barriers for the oscillator- and image frequency. The downstream MMIC sends the transmission signal to the driver, which drives the RF power amplifier. LDMOS transistors are featured in the driver and the RF final amplifier stage.

The power amplifier is equipped with a protective circuit, which shuts down with a VSWR of 1:3.. When this safety circuit has been tripped, it is shown to the operator by a red light on the device front panel.

The transmission converter of the **ZST-200** creates a signal of highest quality possible with very low distortion and very good harmonic and auxillary wave suppression.

The connection of the transceiver to the **ZST-200** takes place over the **TRX N-connector**. 28 MHz. RF Drive should be applied here. During receive the 28 Mhz. IF Receive signal (Down converted 144 MHz. Rx) appears at this connector. *Your* 2m antenna or Linear power amplifier should be connected to the **ANT N-connector** on the back of the device.

The SMA- connector labeled **PA OUTPUT** enables you to split the 144 Rx and TX path to send the transverters Tx RF output separately via this connector. Remove the SMA Jumper if you wish to SPLIT the 144 MHz. Rx / Tx inputs. 28 MHz. Rx still appears at the TRX connection while 144 MHz. Tx will appear at the PA Output SMA-connector.

When the SMA jumper is connected between the **ANTENNA RELAIS SMA and PA Output normal Non-split operation is present.**

In the normal non split type of installation, a preamplifier with internal relays should be used. We recommend the SP-200 (*SSB-item.No. 1032*) or MHP-200 (*SSB-item.No. 1062*) depending on the transmitting power of the installation. The preamplifier can also be deactivated via the **PREAMP** switch on the **ZST-200** for installations without poweramplifier – or with the **PREAMP** switch of the DCW-2004B sequencer for installations with a power amplifier.

Split operation:

After removal of the coaxial connection between the SMA connectors **PA OUTPUT** and **ANTENNA RELAIS**, the **ZST-200** is ready for split operation, (see *figure 3*).

In split operation, any power amplifier without input/output coaxial relays as well as a preamplifier with or without coaxial coaxial relays for switching can be used. Near the antenna a high power coaxial relays (*for example. AS-3000 SSB-item.No. 5059*) must be used.

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From the mast mounted antenna switch, two separate coaxial cables lead into the station. The coaxial cable carrying the RF power should absolutely be the lowest loss possible. We recommend the use of *Ecoflex 10 / Ecoflex 10 Plus*, or *Ecoflex 15 / Ecoflex 15 Plus*.

In cases where split operation has been implemented and a Mast-mounted preamplifier is being used, a thinner coax cable such as *Aircell 5* or *Aircell 7* may be used.

In split operation, the signals on the receiving leg can be distributed to several receiving devices.

If an receiver preamplifier is used (*for example SP-200 SSB-item.No.1032 or MHP-200 SSB-item.No.1062*), It can be directly controlled and supplied by the **ZST-200** (*figure 1*). The pre-amplifier can be activated and deactivated with the **PREAMP** switch.

For transmission installation setups like those shown in *figure 2* and *figure 3*, the pre-amplifier is remote-fed by the sequencer. In split operation (*figure 3*) a pre-amplifier without coaxial relay- switching (*for example LNA-200 SSB-item.No.1011-NF*) can also be used. In this case operation without the pre-amplifier is not possible and the LNA- supply at the sequencer has to stay activated.

6. Startup

Place the **ZST-200** in an area with good air circulation, close to the transceiver. Wire your system, depending on the used components, like illustrated by *figures 1 - 3*.

Before you make the connection between your transceiver antenna connector / transverter connector to the TRX connector of the **ZST-200**, deactivate the following transceiver functions: VOX, Semi BK and full BK!

CAUTION: The PTT control from the transceiver must not be used to PTT the transverter. The transverters PTT should be controlled by a footswitch or via your computer interface and PTT control should be cycled back to your transceiver via the PTT THROUGH connection to your transceivers ACC connector.

To prevent transformation of the impedance in the installation, avoid lambda ¼ cabellenghts (or impair multiples) and calculate the lenght of the wires according the the following formula:

$$\text{Lambda} : 2 \times \text{reduction factor} \times n \text{ (number } n = 1. 2. 3. 4 \text{ etc.)}$$

For the internal coaxial- connecton between the components of the installation we recomend the use of coaxialwires of the type *Aircell 5* or *Aircell 7*.

Prevent bypasses during assembly. Proceed with caution!

Note: You can order Ready-for-use coaxial wires in tested HF-quality, under www.kabel-express.com or www.ssb-electronic.de proper for your installation. We guarantee delivery as quickly as possible in perfect HF- quality!

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Check the wiring of the installation.

Now Connect the **ZST-200** to the power supply of the transceiver, or an external supply. Check that the right polarity has been observed! (wrong polarity will destroy the microfuse!).

The **ZST-200** is delivered with minimum adjusted poweroutput.
Check the PTT-functions first without output power.

Prior to doing the above PTT-test, switch the transceiver to CW operation. Do not key the CW Key.
Test the PTT button switch or foot switch. The indicator light „TX“ of the **ZST-200**, the „TX“ of the transceiver and the „TX“ of the power amplifier (if a power amplifier is used) should light.

Adjusting the output power:

First the output power of the *transceiver* has to be adjusted to the Minimum (< 5W !). If necessary interconnect a absorbtion unit between the *transceiver* and the **ZST-200** (see chapter 2 safety instructions)

Connect a power indicator to the antenna port of the installation.

The **RF POWER** adjustment on the frontplate of the **ZST-200** gets adjusted to maximum(right stopper 0dB), afterwards the PTT button at FM / PTT then the morsebutton at CW gets pushed and the powerpreadjustment (*poti underside*) carefully turned to the right (clockwise) to get the maximum wished outputpower of the installation.

CAUTION: When using a downsteamed poweramplifier it must not be actuated with too high power.

Adjustment of the frequence accuracy:

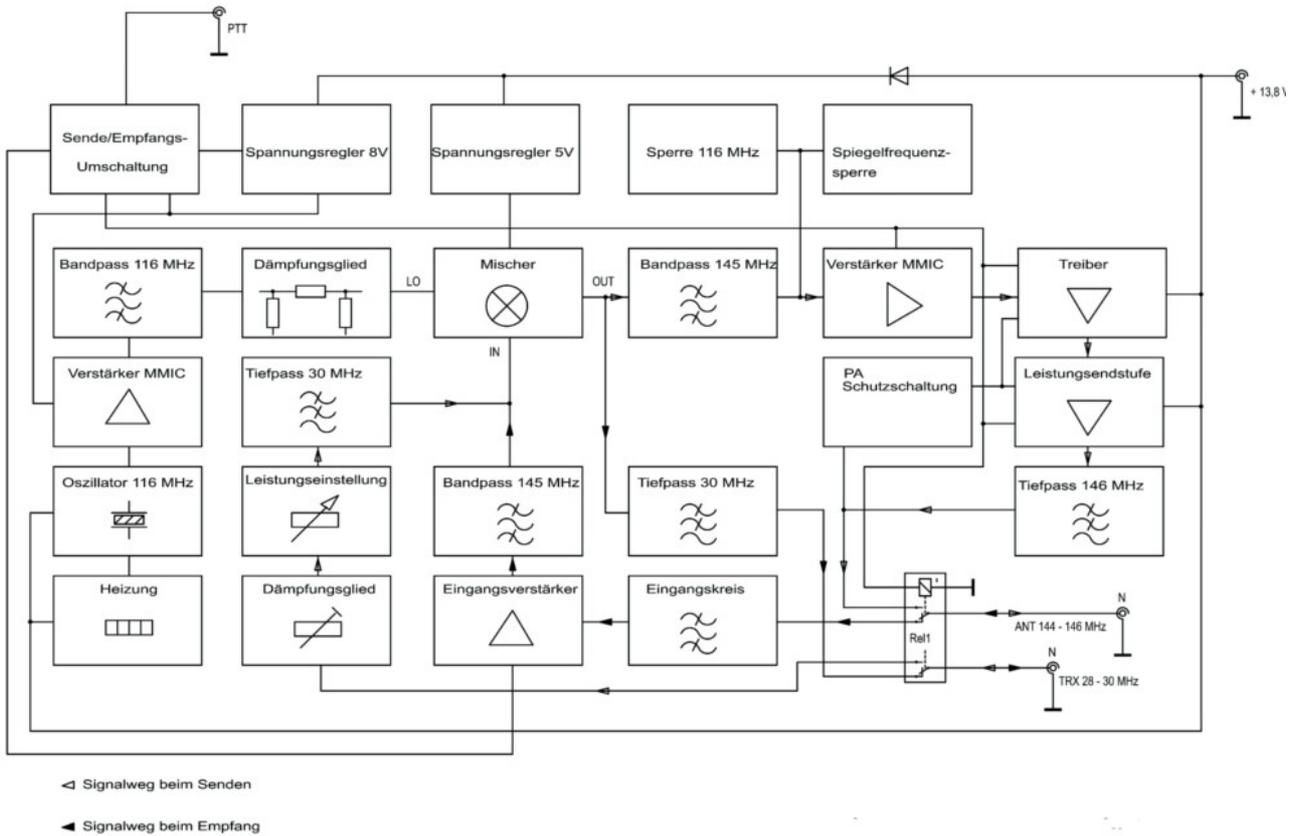
Turn on the **ZST-200** and the *transceiver* and allow them to warm up for about 20 minutes. This allows the oscillators to reach their operating temperatures.

Switch the transceiver to CW operation. Adjust the frequency of the *transceivers* to, for example to exactly 28.2 MHz. The *output power* of the **ZST-200**, with the power adjustment on the frontplate, has to be adjusted to minimum(left stopper, -20dB).

Integrate a absorber unit (for example *UNAT 20 N*, *SSB-item.No. 5083*) between the frequence counter and antenna output of the **ZST-200**. Push the PTT-button afterwards, then the morsebutton and adjust, with the potentiometer on the left side of the **ZST-200**, a frequence of exactly 144.2MHz, at the frequencecounter.

The startup is now finished.

7. Connection scheme



8. Technical data

General

Operational voltage:	13,8 V DC (12 to 14 V)
Power quartzoscillator (Imp. < 0,5 Sek):	1,4 A
Powerconsumption receiving:	0,6 A
Powerconsumption sending without modulation:	1,2 A
Powerconsumption sending at 20 W PEP:	3,0 A
Sending at 20 W CW, FM, WSJT:	4,2 A
Sending at 25 W CW, FM, WSJT:	5 A
Dimensions. (Case without Connectors and switches):	234 x 170 x 60 (LBH) mm
Weight:	2,2 kg
Case:	aluminiumcase
Frequencestability:	+/-0,5 ppm
Adjustable Frequencestability:	+/- 500 Hz Offset
ZF Connector 10m:	N-Buchse 50 Ohm (TRX)
Antennaconnector 2m:	N-Buchse 50 Ohm (ANT)
Sendingconverter output:	SMA- connector 50 (PA OUTPUT)
Antenna-relais TX input:	SMA- connector 50 (ANTENNA RELAIS)
PTT input:	Cinch- connector, contact on mass
PTT THROUGH output:	Cinch- connector, contact on mass

Receivingconverter

HF-range:	144 - 146 MHz
ZF-range:	28 - 30 MHz
Noise factor:	3,2 dB
Transitampflifying:	16 dB
RX-output-IP3:	30 dBm
RX- input-IP3:	14 dBm
Image frequency suppression:	90 dB
RX Input VSWR :	1:1,4

Sendingconverter

ZF-range 28 - 30 MHz

HF-range 144 - 146 MHz

Adjusting range inputpower: 1 - 5 W

Adjusting range outputpower: 20 dB

max. outputpower: 25 W PEP (SSB); 25 W (FM, WSJT, CW)

IM3 des outputsignal: 40dB (bei 20W PEP)

Harmonic waves suppression: 60 dB

Imagefrequency suppression: 100 dB

9. Notes to ecology

Electric devices must not be disposed with household garbage. These must be disposed in seberately arranged waste collection places, or at the sales point. Materials of packaging must be seperated and disposed through the household garbage.



10. Service & care

Do not open the device. The device does not contain any servicable parts. If there are questions regarding technical support, or service, please contact us: technik@ssb-electronic.de

11. Safety & Warranty

This product is not intended for children. The packaging material and the device could contain small components, wich could be swallowed. Repais must only be executed by specialised personnel. In case of opening of the device, or improper use, any right of warranty extinguishes. A warranty is not given.the warranty of law of the federal republic of germany applies. This device meets the low voltage guideline 2006/95/EG, also 2004/108/EG, 2002/96/EG, 1999/44/ E

12. Declaration of comformity

With this we state that the above-named product meets all relevant specifications in the field of application of guidlines 73/23/EWG, 89/336/ EWG and 99/5/EG of the council.

Manufacturer: SSB-Electronic GmbH, Am Pulverhäuschen 4, 59557 Lippstadt

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13. Contact

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