



**CARBONEX Sp. z o.o.**

ul. Budowlana 19

41-100 Siemianowice Śląskie

tel/fax +48 32 2030819

[www.carbonex.com.pl](http://www.carbonex.com.pl)

---

DEVICE OF WIRELESS SHAFT COMMUNICATION

**ECHO-P**

TECHNICAL AND OPERATING MANUAL

No. DTR-28P/2014

June 2014

## TABLE OF CONTENTS

1	Use and range of application.
2	Marking.
3	Certificates.
4	Terms of application.
5	Technical data.
6	Description.
7	Installation.
8	Maintenance.
9	Transport and storage.
10	List of spare parts.
11	Guarantee.

## LIST OF DRAWINGS

28P.1	ECHO-P Overall structure variant 1
28P.2	ECHO-P Overall structure variant 2
28P.01	ECHO/AK-P Cage device - outline drawing
28P.01.01	ECHO/AK-P Cage device - block diagram
28P.01.02	ECHO/AK-P Cage device - assembly diagram
28P.01.03	ECHO/AK-P Cage device - box SAKN
28P.01.04	ECHO/AK-P Cage device - internal wiring of box STK/E
28P.02	ECHO/AS-P Headframe device - outline drawing
28P.02.01	ECHO/AS-P Headframe device - block diagram
28P.02.02	ECHO/AS-P Headframe device - assembly diagram
28P.02.03	ECHO/AS-P Headframe device - input/output circuits
28P.02.04	ECHO/AS-P Headframe device - diagram of microphone and feedback microphone
28P.02.05	ECHO/AS-P Headframe device - internal wiring of box SPSS
28P.03	Coupler SK - outline drawing
28P.03.01	Coupler SK - installation drawing variant 1
28P.03.02	Coupler SK - installation drawing variant 2
28P.04	Coupler SS - outline drawing
28P.04.01	Coupler SS - installation drawing variant 1
28P.04.02	Coupler SS - installation drawing variant 2

### **Hazards identification**

The cage unit is powered by 12VDC NiMH battery. It should be taken to consider that in a fully charged battery during setting up might be done by accident shorting pins which may cause battery leakage, overheat and in a consequence may cause injuries (such as burns). The battery should be charged only by the original charger LAE-S3. Used batteries should not be thrown away in the trash. The cage unit sends once per minute to the headframe unit control signal, accompanied by a beep. The PAK cable has incorporated connection between pins 4 and 7 for authorization higher speed. This cable should be installed in safe place for raise and lower with high speed.

Headframe unit is supplied from 230 VAC network and should be connected to a wall outlet with a protective pin (this applies to primary and reserve power supply). The casing of headframe unit is made of sheet steel, so it should be grounded. Opening the housing is allowed only after disconnect from the power. The "⚡" sign on the input/output block means that inside can be dangerous voltage from the shaft system. Headframe unit should be installed in safe place i.e. not in EX zone. Power-up sequence is as follows: first main power and second reserve power. In other case there might be occur an electrical arc on contacts of power supply switch relay

## **1. Use and range of application**

Device of wireless shaft communication ECHO-P version EN1 is designed to communicate between crew in conveyance (cage or skip) and hoist operator in mine shaft. The basic advantages of this system are following:

- two-way semiduplex audio communication,
- sending remote control signals from cage to hoist,
- receiving information signals from hoist to cage.

The cage unit is made as intrinsically safe device group I, category M1.

The device is intended to use in time of shaft inspection, person ride, emergency egress as well as maintenance in shaft.

The principle of working of this device is utilization rope as carrier to move electromagnetic waves. Carrier is created by:

- headrope, tailrope and conveyances (in case of friction hoist),
- guiderope and earth (in case of drum hoist),
- additional rope and earth (in other cases).

Electric continuity of such loop is the main condition of correct work of device.

Electromagnetic wave is generated to the loop and received from it by inductive couplers.

There are fixed two inductive couplers (transmitter and receiver) in headframe in such way, that headrope crosses by their center. Over cage there are fixed another pair of couplers.

Headframe unit sends signal by inductive coupler (transmitter) to rope and cage unit receive signals from rope by other inductive coupler (receiver). Communication from cage unit to headframe unit is performed in the same way by other pair of couplers.

Only one device can work in one loop. The device has four frequency version:

A, B, C, D thanks to which, it is possible to use four devices in one shaft.

## 2. Marking

MARKING	ABBREVIATED MARKING
Device of wireless shaft communication <b>ECHO-P</b> - frequency version: <b>A,B,C,D</b> - software version: <b>EN1</b>	<b>ECHO-P-A,B,C,D-EN1</b>

Example of order: **ECHO-P-A-EN1**.

The device consists of a cage unit, headframe unit and battery charger.

Cage unit consists of:

MARKING	ABBREVIATED MARKING
Cage device <b>ECHO/AK-P</b> frequency version: <b>A,B,C,D</b> - software version: <b>EN1</b>	<b>ECHO/AK-P-A,B,C,D-EN1</b>
Battery <b>BAKS-9</b>	<b>BAKS-9</b>
Box <b>SAKN</b>	<b>SAKN</b>
Coupler <b>SK-32</b> (transmitter, frequency version <b>A</b> )	<b>SK-32</b>
Coupler <b>SK-64</b> (receiver, frequency version <b>A</b> )	<b>SK-64</b>
Coupler <b>SK-48</b> (transmitter, frequency version <b>B</b> )	<b>SK-48</b>
Coupler <b>SK-80</b> (receiver, frequency version <b>B</b> )	<b>SK-80</b>
Coupler <b>SK-80</b> (transmitter, frequency version <b>C</b> )	<b>SK-80</b>
Coupler <b>SK-80</b> (receiver, frequency version <b>C</b> )	<b>SK-80</b>
Coupler <b>SK-80</b> (transmitter, frequency version <b>D</b> )	<b>SK-80</b>
Coupler <b>SK-80</b> (receiver, frequency version <b>D</b> )	<b>SK-80</b>
Box <b>STK/E</b>	<b>STK/E</b>

Headframe unit consists of:

MARKING	ABBREVIATED MARKING
Headframe device <b>ECHO/AS-P</b> frequency version: <b>A,B,C,D</b> - software version: <b>EN1</b>	<b>ECHO/AS-P-A,B,C,D-EN1</b>
Microphone unit <b>MNO</b>	<b>MNO</b>
Loudspeaker <b>G</b>	<b>G</b>
Feedback microphone <b>MK</b>	<b>MK</b>
Coupler <b>SS-32</b> (receiver, frequency version <b>A</b> )	<b>SS-32</b>
Coupler <b>SS-64</b> (transmitter, frequency version <b>A</b> )	<b>SS-64</b>
Coupler <b>SS-48</b> (receiver, frequency version <b>B</b> )	<b>SS-48</b>
Coupler <b>SS-80</b> (transmitter, frequency version <b>B</b> )	<b>SS-80</b>
Coupler <b>SS-80</b> (receiver, frequency version <b>C</b> )	<b>SS-80</b>
Coupler <b>SS-80</b> (transmitter, frequency version <b>C</b> )	<b>SS-80</b>
Coupler <b>SS-80</b> (receiver, frequency version <b>D</b> )	<b>SS-80</b>
Coupler <b>SS-80</b> (transmitter, frequency version <b>D</b> )	<b>SS-80</b>
Box <b>SPSS</b>	<b>SPSS</b>

MARKING	ABBREVIATED MARKING
Battery charger <b>LAE-S3</b>	<b>LAE-S3</b>

Note:

Markings are provided for installation variant no.1. For installation variant no.2 there are changing the couplers SK with SS.

### **3. Certificates**

Device met requirement of electromagnetic compatibility in accordance with the European Union directive no. **89/336/EEC** including the changes **91/263/EEC**, **92/31/EEC** and **93/68/EEC** and standards harmonized with it protocol no. **LKE/043/2004** issued by the Laboratory of Electromagnetic Compatibility, Institute of Telecommunication and Acoustics Wrocław Engineering College. 50-370 Wrocław, ul. Wybrzeże Wyspiańskiego 27. The PCA (Polish Centre for Accreditation) accreditation no **AB 167**.

Cage unit met requirement of the European Union directive no. **94/9/WE (ATEX)** and other standards which are harmonized with them certificate no. **KDB 09ATEX023X** issued by the **Notified Body no. 1453** Central Mining Institute. Experimental Mine „BARBARA” 43-190 Mikołów, ul. Podleska 72. The PCA (Polish Centre for Accreditation) accreditation no. **AC038**.

### **4. Terms of application**

- 4.1. The shaft has to have: tailrope, or there must be two guide ropes, or the conveyance must be suspended on at least two ropes (not for frequency version D).
- 4.2. There should be electrical connection between headrope and tailrope or between two guideropes (not for frequency version D).
- 4.3. Over the conveyance which we want to get communication should be mounted a pair of couplers, and second pair of couplers should be mounted in headframe.
- 4.4. In one shaft there may work only one cage unit in specific frequency version, in the case of using two devices they have to have different frequency version or one of them should be switched off. The same applies to two cage units installed in one conveyance.
- 4.5. Couplers SK (or SS in variant 2) can be connected only to cage unit ECHO/AK-P, connection may be made either directly or through box STK/E.
- 4.6. Battery BAKS-9 can be charged only by battery charger LAE-S3 made by CARBONEX.
- 4.7. Maintenance may be carried out only by authorized personnel.
- 4.8. It is forbidden to make any change in device and use the device in another way as mentioned in this manual.
- 4.9. Headframe unit should be installed in safe place i.e. not in EX zone.

## 5. Technical data

### 5.1. Normal working conditions

5.1.1. Cage unit	
5.1.1.1. Temperature range	-20°C to + 40°C
5.1.1.2. Humidity	< 98%
5.1.2. Headframe unit	
5.1.2.1. Temperature range	0°C to + 40°C
5.1.2.2. Humidity	< 80%

### 5.2. General parameters

5.2.1. Type of work	
- audio signal	semiduplex
- remote control signals	duplex
5.2.2. Type of modulation	FM
5.2.3. Frequency performance:	
- A (from cage unit to headframe unit)	32 kHz
- A (from headframe unit to cage unit)	64 kHz
- B (from cage unit to headframe unit)	48 kHz
- B (from headframe unit to cage unit)	80 kHz
- C (from cage unit to headframe unit)	112 kHz
- C (from headframe unit to cage unit)	144 kHz
- D (from cage unit to headframe unit)	128 kHz
- D (from headframe unit to cage unit)	160 kHz
5.2.4. Method of sending signals	serial
5.2.5. Delay of sending signals	< 0,1 s
5.2.6. Range of work	1250 m

### 5.3. Cage unit

5.3.1. Power supply	battery 12 V (10.5÷15 V)
5.3.2. Indication of low battery	<11,5 V
5.3.3. Current consumption	< 400 mA
5.3.4. Output signal	> 7 Vpp
5.3.5. Receiver sensitivity	1 mV
5.3.6. Operating time without battery replacement	10 h
5.3.7. Number and type of input	2 NO contact
5.3.8. Marking	I M1 Ex ia I Ma
5.3.9. Protection degree	IP65
5.3.10. Dimensions	520 x 300 x 145 mm
5.3.11. Weight	15 kg

### 5.4. Headframe unit

5.4.1. Main and reserve power supply	230 VAC
5.4.2. Power consumption	< 50 VA
5.4.3. Output signal	> 7 Vpp
5.4.4. Receiver sensitivity	2 mV
5.4.5. Number and type of outputs	9 relays (DPDT 1A, 250VAC)
5.4.6. Number and type of input	7 NO contact
5.4.7. Dimensions	282 x 350 x 240 mm
5.4.8. Weight	10 kg

**5.5. Coupler SK**

## 5.5.1. Nominal inductance

SK-32	178 $\mu$ H
SK-48	80 $\mu$ H
SK-64	40 $\mu$ H
SK-80	40 $\mu$ H

## 5.5.2. Protection degree

IP54

## 5.5.3. Dimensions

265 x 220 x 90 mm

## 5.5.4. Weight

4,5 kg

**5.6. Coupler SS**

## 5.6.1. Nominal inductance

SS-32	178 $\mu$ H
SS-48	80 $\mu$ H
SS-64	40 $\mu$ H
SS-80	40 $\mu$ H

## 5.6.2. Protection degree

IP54

## 5.6.3. Dimensions

335 x 265 x 40 mm

## 5.6.4. Weight

4,5 kg

## 6. Description

Drawing no. 28P.1 shows overall structure the communication system in arrangement with the headrope and tailrope. Drawing no. 28P.2 explains principle of work the communication system in arrangement with the guiderope. There are installed two inductive couplers in headframe in such way that the rope passes through the center of couplers. One of them is transceiver and the second one is receiver. The second pair of couplers is fitted over conveyance. Transceiver coupler sends current signal, which flows through rope to the receiving coupler. The main condition of proper work of system is existence of a closed loop for current flow (not for frequency version D). This loop is formed by headrope, tailrope and conveyances. Other way of making such loop is by connecting two headropes. In case of existing guiderope loop may be done by making connection between two such ropes or by connecting to ground ends of guiderope. For frequency version D such loop is formed by headrope and the capacitance headrope-shaft. Blok diagram of cage device is shown in drawing no. 28P.01.01. Blok diagram of headframe device is shown in drawing no. 28P.02.01. Transmitters of both devices emit continuously carrier frequencies. There are two carrier frequencies at each system, which depend on version of devices. When the carrier frequency is received the device is switched to ready mode. Circuits of contacts NO or NC which will be connected to the headframe device inputs should be connected between proper input and common terminal.

**6.1. Audio communication** is realized in a semiduplex way. Cage device is continuously in the receive mode when the unit is in ready mode and not transmitting. Voice communication is done after pressing and hold blue button PTT, conveyance has priority. In headframe unit broadcast is done after pressing microphone foot switch.

**6.2. Signal code** is used to transmit the Code of Signals. After pressing yellow button CODE in cage device, output relay P2 is turned on in headframe device if input no. 3 in headframe device will be closed. In cage device we should hear bell if feedback microphone would be fastened near to signal bell as well as we should see green led CCS if input no.2 in headframe device will be connected to output of relay P2.

**6.3. Signal alarm** is send from cage device after pressing red button ALARM. It is possible to hear alarm bell in cage device, for this purpose should be closed input no. 4 in headframe device. This input activates feedback microphone so it should be fastened near to alarm bell.

**6.4. Signal blockade** is done by switching red switch BLOCKADE in cage device into right position. There is red led CB in cage device confirming the activation of the lock. For this purpose input no. 5 in headframe device should be connected to output of relay P4.



**TABLE OF OUTPUTS OF HEADFRAME UNIT**

<b>Relay</b>	<b>Function</b>	<b>Description</b>
<b>P1</b>	Ready RDY	Relay is turned on when cage unit and headframe unit are turned on, both are operational, and there is communication between them.
<b>P2</b>	Code of Signals CS	Relay is turned on when: - will be closed input no. 3 in headframe device and, - yellow button CODE in cage device would be pressed.
<b>P3</b>	Alarm A	In normal operation when headframe unit is in ready mode, relay is turned on. The relay will be turned off when: - red button ALARM in cage device would be pressed, - there will be a loss of communication between units.
<b>P4</b>	Blockade B	In normal operation when headframe unit is in ready mode, relay is turned on. The relay will be turned off when: - red switch BLOCKADE in cage unit would be set into right position, - there will be a loss of communication between units.
<b>P5</b>	Battery control BC	Relay is switched on when the battery is working properly and charged. Relay is switched off when the battery voltage drops below 11,5 V.
<b>P6</b>	Sensor no.1 S1	Relay will be turned on when: - input S1 (pin 1, 2 in socket ZG3) in cage unit would be closed.
<b>P7</b>	Sensor no.2 S2	Relay will be turned on when: - input S2 (pin 6, 7 in socket ZG3) in cage unit would be closed.
<b>P8</b>	Authorization for higher speed AHS	Relay will be turned on when: - input AHS (pin 4, 7 in socket ZG1) in cage unit would be closed.
<b>P9</b>	Impulse control IC	Relay will be turned on for 6 seconds when: - will be closed input no. 3 in headframe device and, - will be closed input no. 6 in headframe device, - will be closed input no. 7 in headframe device two or three times. Relay is released: - after 6 seconds or, - after opening input no. 3 or - after opening input no. 6 or, - after closing input no. 7 one time.

## 6.6. Description of faceplate of cage device

- „POWER”-power switch on/off, when red led next to the switch lights means that the battery voltage is correct, when led flashes means discharging the battery.
- „BLOCKADE”-blockade switch.
- „ALARM”-alarm button.
- „CODE”-the Code of Signals button.
- „PTT”-push to talk button, pressing this button the microphone is activated.
- „FTC”- failure of the transmitting coupler yellow led lights when transmitter coupler is unserviceable not connected or its inductance is too low.
- „FRC”-failure of the receiving coupler yellow led lights when receiver coupler is unserviceable not connected or its inductance is too low.
- „ACS”-authorization for Code of Signals green led indicates activation the Code of Signals button, lights when input no.3 in headframe device is closed.
- „RDY”-ready green led indicates when cage unit is in ready mode.
- „LTS”-lack of a transmitting signal yellow led lights when there is a lack of carrier frequency of the transmitter or its level is too low.
- „LRS”-lack of receiving signal yellow led lights when there is a lack of carrier frequency of the receiver.
- „CCS”-confirmation for Code of Signals green led confirms code, lights when input no.2 in headframe device is closed.
- „CB”-confirmation for blockade red led confirms that blockade is in switch on state, lights when input no.5 in headframe device is closed.
- „S1”-sensor no.1 yellow led indicates when input S1 in cage device is closed.
- „S2”-sensor no.2 yellow led indicates when input S2 in cage device is closed.
- „AHS”-authorization for higher speed green led indicates when input AHS in cage device is closed, in that time relay P8 in headframe device will be turned on.

## 6.7. Description of faceplate of headframe device

### 6.7.1. Power block

There are led indicate the presence of power supply in the power block.

### 6.7.2. The transmitting block TB

„FTC” failure of the transmitting coupler yellow led not lights when transmitter coupler is unserviceable not connected or its inductance is too low. „LTS” lack of a transmitting signal yellow led lights when there is proper level of carrier frequency of the transmitter, 10 bar led indicator indicates the level of transmitting wave.

### 6.7.3. The control block CB

RDY	Ready
CS	Code of Signals
A	Alarm
B	Blockade
BC	Battery control
S1	Sensor no.1
S2	Sensor no.2
AHS	Authorization for higher speed

#### 6.7.4. The receiving block RB

„FRC” failure of the receiving coupler yellow led not lights when receiver coupler is unserviceable not connected or its inductance is too low. „LRS” lack of a receiving signal yellow led lights when there is proper level of carrier frequency of the receiver, 10 bar led indicator indicates the level of receiving wave. Knob is used to adjust volume level.

#### 6.7.5. The impulse control block ICB

IC	Impulse control
----	-----------------

#### 6.7.6. The galvanic separation block GSB1

RCS	Remote control of sections
CCS	Confirmation for Code of Signals
ACS	Authorization for Code of Signals
CA	Confirmation for alarm
CB	Confirmation for blockade
MR	Machine in rest
ICI	Impulse control input

#### 6.7.7. The switching section block SSB

“SC1” section of couplers 1, led will light up in yellow when knob is set on SC1 position inputs of section 1: SN1 and SO1 will be activated. “SC2” section of couplers 2, led will light up in yellow when knob is set on SC2 position inputs of section 2: SN2 and SO2 will be activated. When knob is set on 0 position section might be switched by switch which is located out of headframe device. For this purpose that switch should be connected to input no. 1. Open contact at input no. 1 activated section 1 what is indicated by led SC1. Closed contact at input no. 1 activated section 2 what is indicated by led SC2 and RCS in GSB1 block.

## 7. Installation

### 7.1. Unpacking

During unpacking, check the completeness of the set according to the proof of delivery. Check if the power switch on cage device was in off position during transport and storage. The switch in on position could cause discharging of battery.

### 7.2. Cage device

Cage device is shown in drawing no.28P.01. Housing is divided into two parts. At the bottom there are placed electronics board, buttons and switches, at the top socket battery BAKS. The walls of the housing are made of stainless steel sheet. In the bottom side of the housing there are sockets for connecting: sensors and couplers. In the right side there is socket to charge battery BAKS without removing it out of housing. Access to battery and electronics board is possible after unscrewing proper cover. Device is designed for mounting on the wall of conveyance using 4 screws M8. If device is exposed to heavy rain or water in shaft it is recommended to mount it in additional box SAKN which is shown in drawing no.28P.01.03.

### 7.3. Coupler SK

Coupler SK is shown in drawing no.28P.03. Coupler consists of two parts, to allow his assembly around rope. There is a ferromagnetic core with coil inside housing of device. Core and coil are encapsulated by chemical compound. There are two variant of installation of coupler. There are shown in drawings no.28P.03.01 and 28P.03.02.

### 7.4. Box STK/E

Box STK/E is shown in drawing no.28P.01.04. It is designed to connect cables: PAK, PAKS and PAKD with couplers.

#### **Note:**

**The PAK cable has incorporated connection between pins 4 and 7 for authorization higher speed. This cable should be installed in safe place for raise and lower with high speed.**

### 7.5. Headframe device

Headframe device is shown in drawing no.28P.02. Housing consists of three parts: power supply unit from the left side, main unit in the center and input/output circuits unit at the right side. Center unit consist of mainboard and subrack for 7 eurocards. Headframe device is designed for mounting in the winding engine room using 4 screws M8. Method of connecting headframe device is shown in drawing no.28P.02.02.

### 7.7. Coupler SS

Coupler SS is shown in drawing no.28P.04. Coupler consists of two parts, to allow his assembly around rope. There is a ferromagnetic core with coil inside housing of device. Core and coil are encapsulated by chemical compound. There are two variant of installation of coupler. There are shown in drawings no.28.04.01 and 28.04.02. The couplers SK and SS differ only way of fixing.

## 8. Maintenance

Before using any cage device it is recommended to charge the battery, using a charger LAE-S3 CARBONEX company production. To do this, connect the plug of charger into the battery socket in cage device or remove the battery from the cage device housing and put it on the charger basket and then turn on the power of charger. Charging may take place only in room without any danger vapours. Battery, on which there are traces of leakage should be withdrawn by person of service and returned to the manufacturer. The battery may not have dents. In the headframe device power-up sequence is as follows: first main power and second reserve power. In other case there might be occur an electrical arc on contacts of power supply switch relay. Cage device should not be at the same time, use the audio and control. After pressing simultaneously two control buttons only one of them will be send. The foot switch should be pushed only in time of audio transmission. Measurements of the installation should be performed at least once a year.

**Inductance of coupler SK** should be measured in disconnected plug of cage unit. During the measurements the headframe unit must be turned off.

Type	Value (Required)	Version	Pin
SK-32	178 $\mu$ H (150-240) $\mu$ H	A	3-6
SK-64	40 $\mu$ H (30-60) $\mu$ H	A	2-5
SK-48	80 $\mu$ H (65-120) $\mu$ H	B	3-6
SK-80	40 $\mu$ H (30-60) $\mu$ H	B,C,D	2-5, 3-6

**Insulation resistance of coupler SK** should be measured in disconnected plug of cage unit. Measurement voltage 500 V. Measurement performed in safe zone between conveyance and pin in accordance with the table.

Type	Value	Version	Pin
SK-32	> 100 k $\Omega$	A	3
SK-64	> 100 k $\Omega$	A	2
SK-48	> 100 k $\Omega$	B	3
SK-80	> 100 k $\Omega$	B,C,D	2, 3

**Inductance of coupler type SS** should be measured in disconnected plug of cage unit. During the measurements the cage unit must be turned off.

Type	Value (Required)	Version	Pin
SS-32	178 $\mu$ H (150-240) $\mu$ H	A	3-6
SS-64	40 $\mu$ H (30-60) $\mu$ H	A	2-5
SS-48	80 $\mu$ H (65-120) $\mu$ H	B	3-6
SS-80	40 $\mu$ H (30-60) $\mu$ H	B,C,D	2-5, 3-6

**Insulation resistance of coupler type SS** should be measured in disconnected plug of headframe unit. Measurement voltage 60 V. Measurement performed between ground and pin in accordance with the table.

Type	Value	Version	Pin
SS-32	> 100 k $\Omega$	A	4
SS-64	> 100 k $\Omega$	A	4
SS-48	> 100 k $\Omega$	B	4
SS-80	> 100 k $\Omega$	B,C,D	4

## **9. Transport and storage**

The device can be transported by any means of transport. During transport, equipment shall be protected against rain and strong mechanical shock. The temperature during transport should be in the range of -25°C to +60°C. The device will be ready for use after keeping it in the room temperature for 6 hours. The device shall be stored in a closed room where the humidity should not exceed the permissible limit of 75% and the temperature ranging from 0°C to 60°C. The room should be free of active vapors or chemical compounds. In case of storage longer than 14 days before installing cage device should be connected to the battery charger.

## **10. List of spare parts**

### **10.1. Cage unit**

- 10.1.1. Cage device ECHO/AK-P-(A or B or C or D)-EN1
- 10.1.2. Battery BAKS-9
- 10.1.3. Box SAKN
- 10.1.4. Coupler SK-32, 64, 48, 80
- 10.1.5. Plug ZGT28KP7a
- 10.1.6. Socket ZGT28B7S
- 10.1.7. Box STK/E
- 10.1.8. Cable PAK, PAKD, PAKS

### **10.2. Headframe unit**

- 10.2.1. Headframe device ECHO/AS-P-(A or B or C or D)-EN1
  - power supply block
  - transmitting block TB
  - control block CB
  - receiving block RB
  - impulse control block ICB
  - galvanic separation block GSB1
  - switching section block SSB
  - Relay type Finder 48.52 (12VDC)
- 10.2.2. Microphone unit MNO-6
- 10.2.3. Loudspeaker G
- 10.2.4. Feedback microphone MK
- 10.2.5. Coupler SS-32, 64, 48, 80
- 10.2.6. Plug MIC-324
- 10.2.7. Plug MIC-323
- 10.2.8. Plug MIC-322
- 10.2.9. Plug XLR

It is allowed to replace these items. Any repair of components may only be performed by authorized employees of the CARBONEX company.

## **11. Guarantee**

The manufacturer,

**CARBONEX Sp. z o.o.**

ul. Budowlana 19

41- 100 Siemianowice Śląskie, Poland

guarantees:

- 11.1. The highest quality and proper functioning of the device in accordance with the terms and conditions given in this manual.
- 11.2. Guarantee period: 12 months from the date of purchase.
- 11.3. During guarantee period, all the repairs are carried out free of cost, provided that the customer shall be responsible for any transportation cost.
- 11.4. Guarantee terms and conditions do not apply if the mechanical damages are caused by improper use and operation of the device.
- 11.5. Sales and after sales service. After sales service and supply of spare parts on payment. Any repair/damage shall be reported through phone/fax no. +48 32 2030819 or to service department of:

**CARBONEX Sp. z o.o.**

ul. Budowlana 19

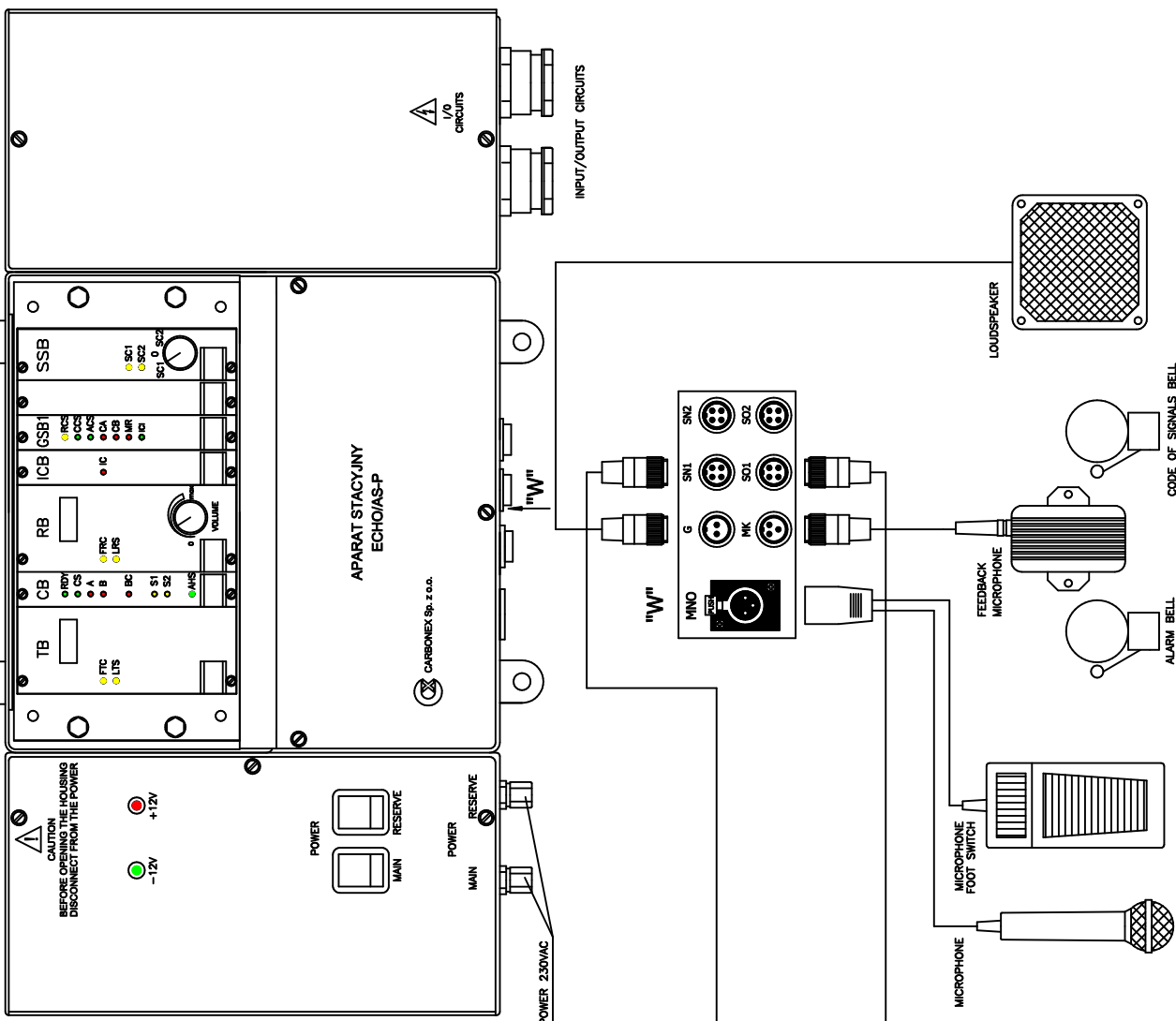
41- 100 Siemianowice Śląskie, Poland


e-mail: [biuro@carbonex.com.pl](mailto:biuro@carbonex.com.pl)

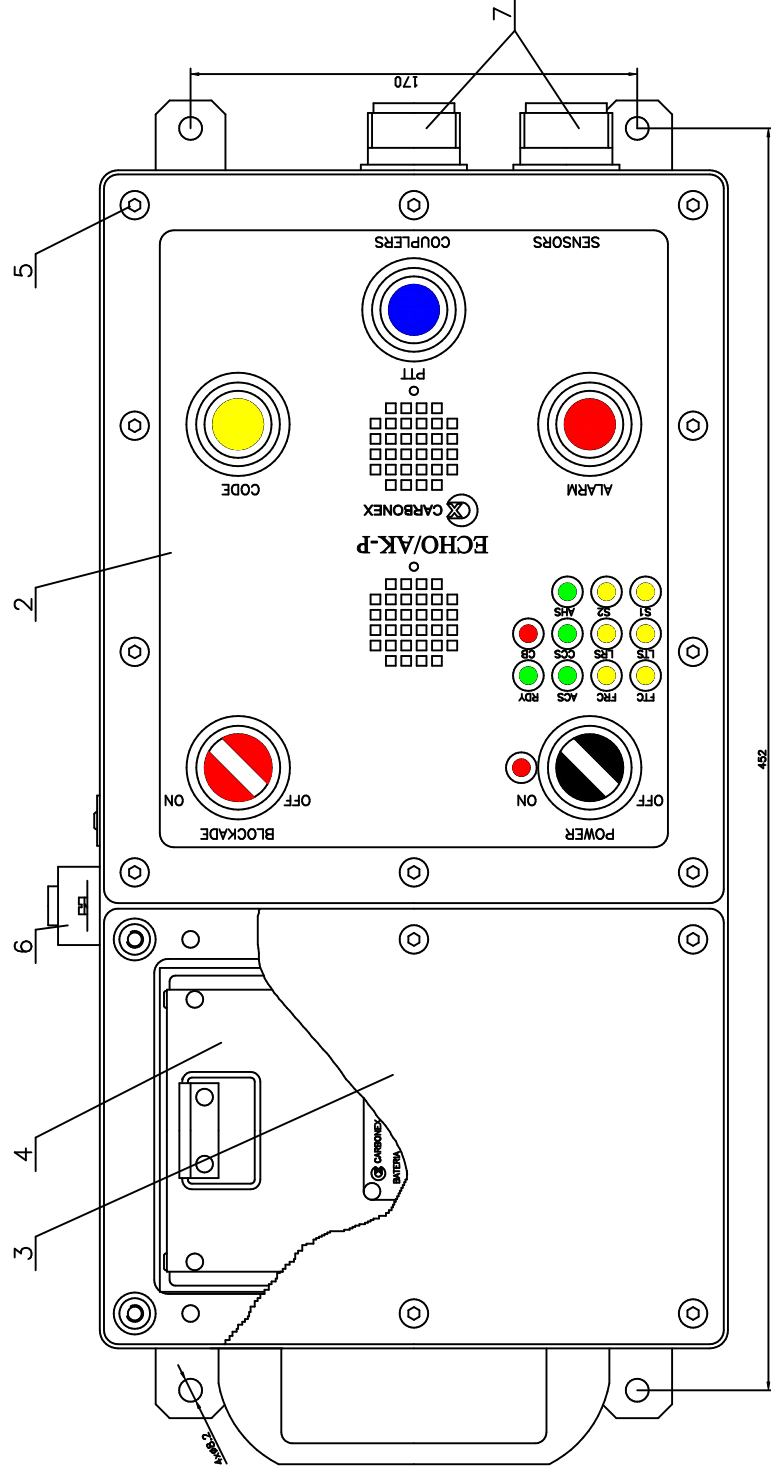
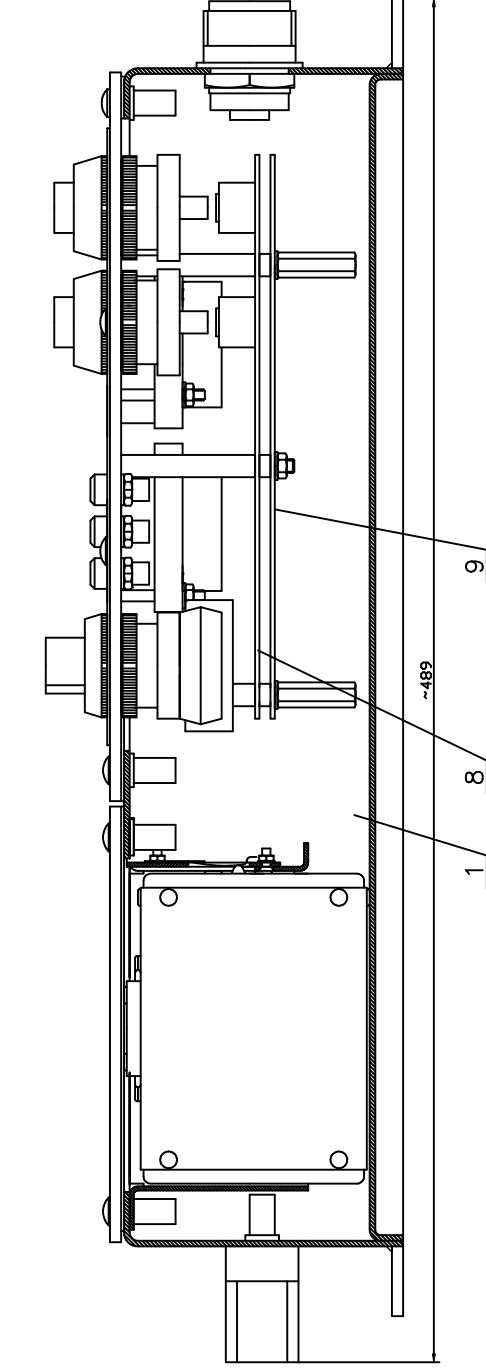
web: carbonex.com.pl



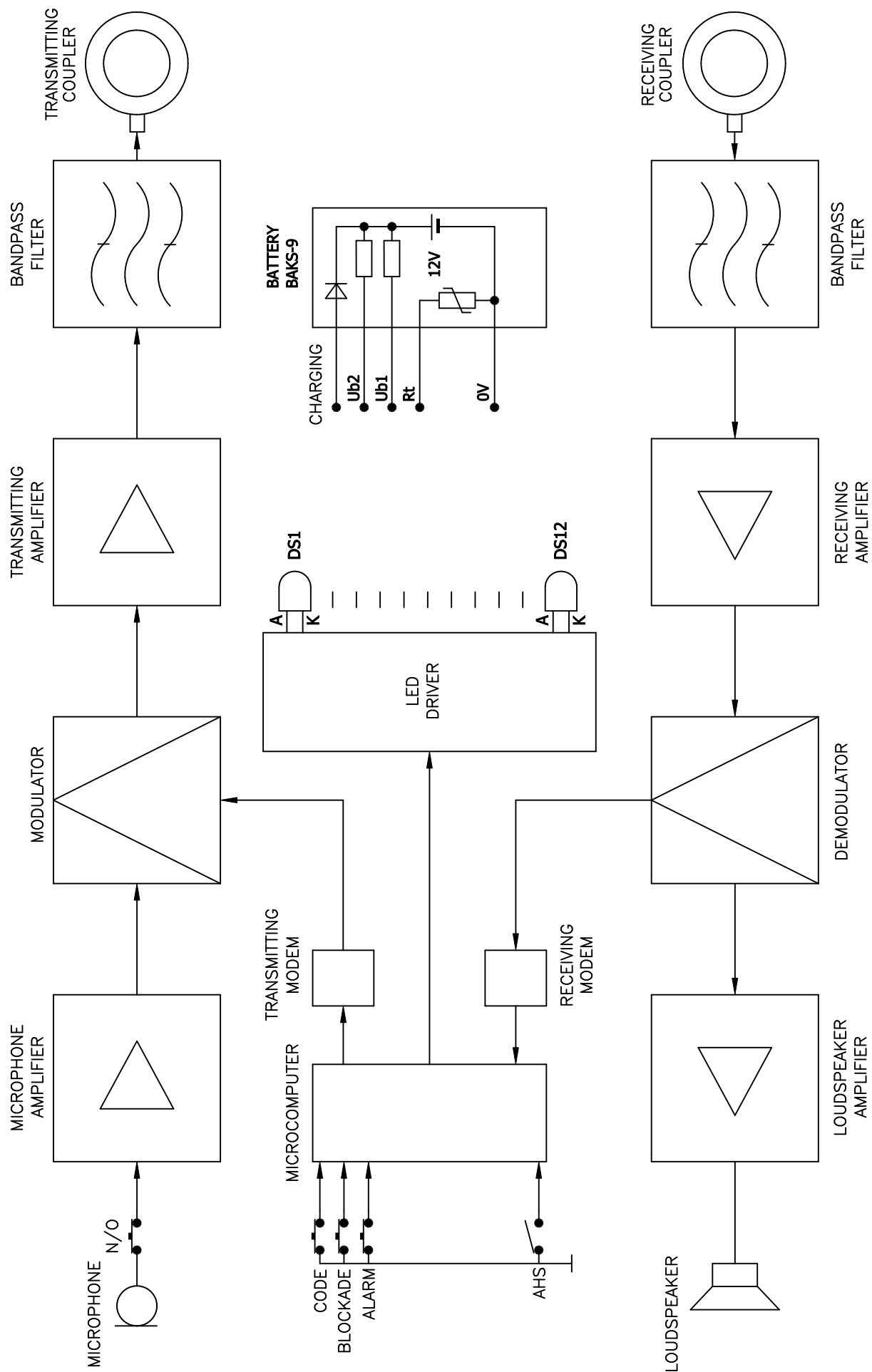





Item	Part ( unit) name			Quantity	Drg.or Standard No.	Material	Remarks
Designed by	T. Jackiewicz				Material	Name ECHO-P Overall structure variant 2	Weight
Drawn by	R. Rosik						
Checked by	R. Nowak						
Scale	 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date 07.2014	Drawing number 28P.2	Sheet	

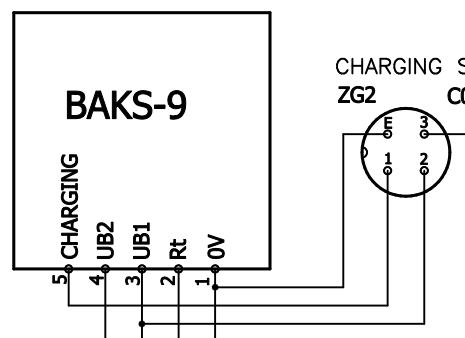
[illegible]

**NOTE:**  
ALL DIMENSIONS IN MILLIMETERS

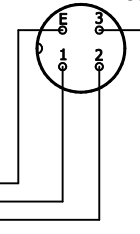


Designed by	T. Jackiewicz			Material	Name ECHO/AK-P Cage device – block diagram	Weight
Drawn by	R. Rosik					
Checked by	R. Nowak					
Scale	 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date 07.2014	Drawing number 28P.01.01	Sheet

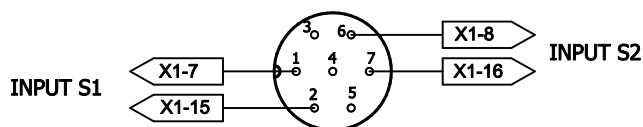
BATTERY SOCKET



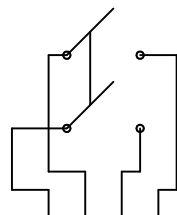
CHARGING SOCKET  
ZG2 C016 20C003 100 12



SENSOR SOCKET  
ZG3 ZGT28B7Sa



POWER SWITCH



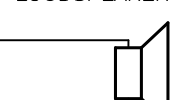
BOARD PF



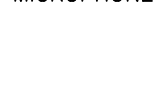
BOARD PS



LOUDSPEAKER



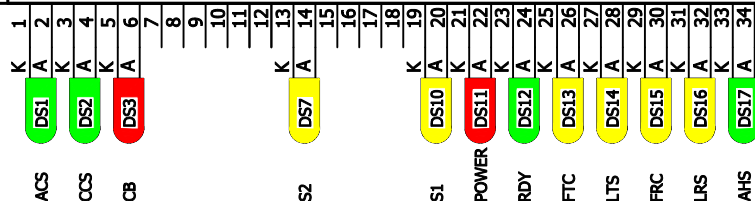
MICROPHONE




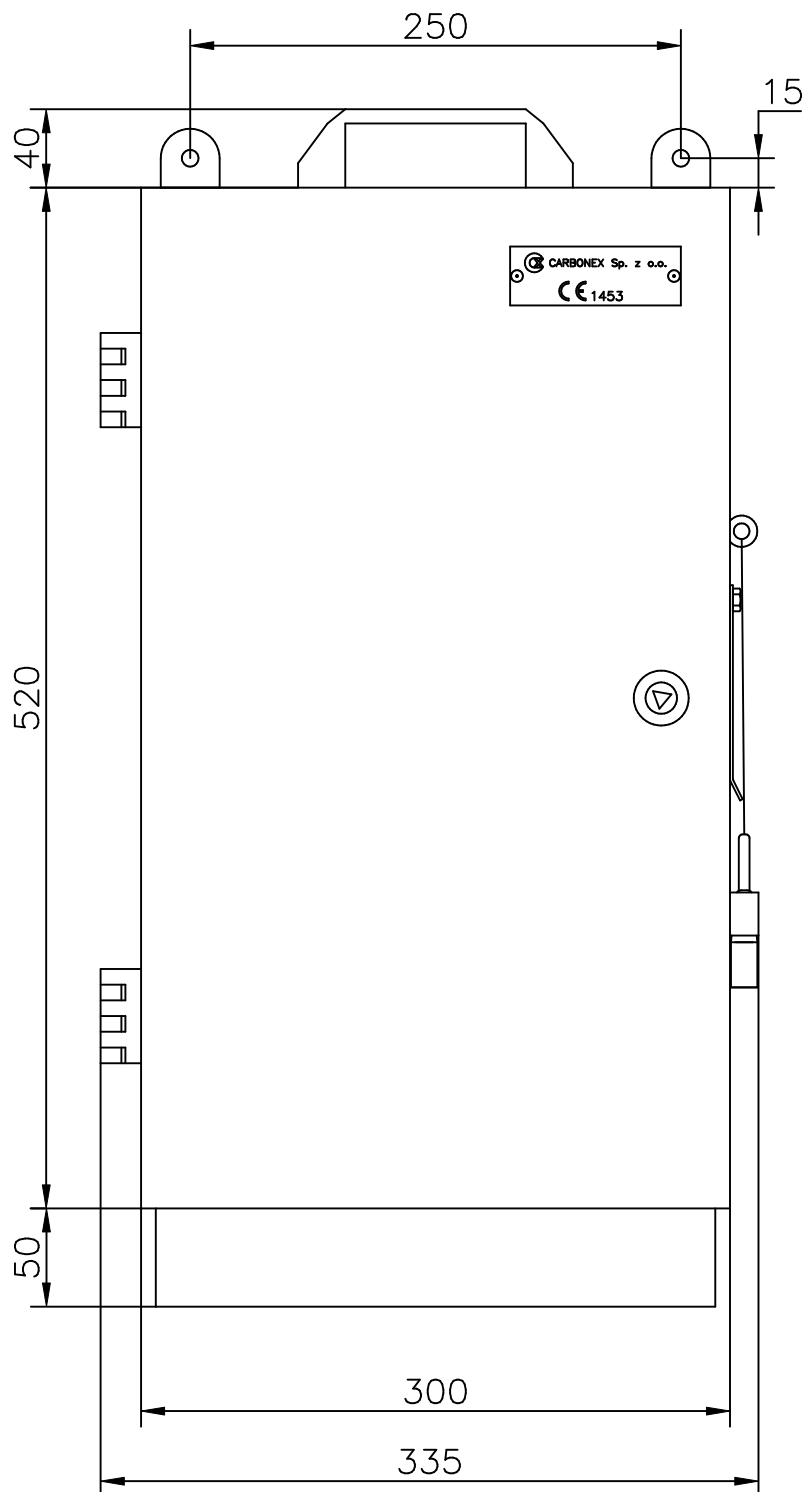
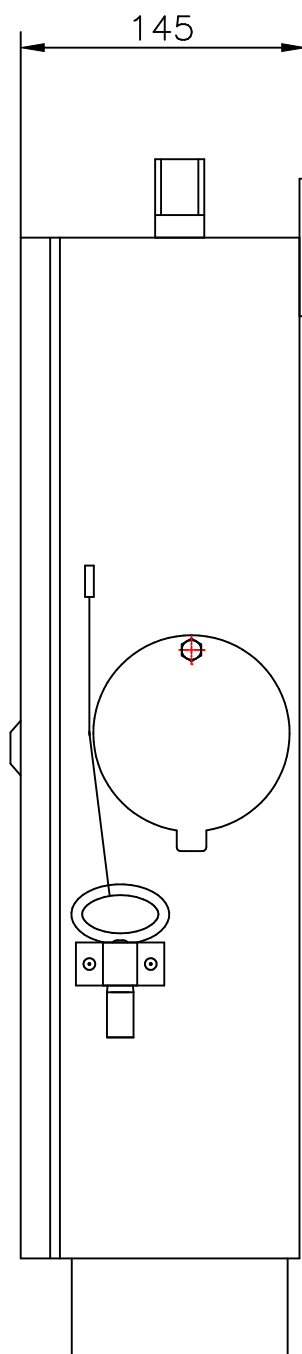
COUPLER SOCKET  
ZG1



AHS INPUT




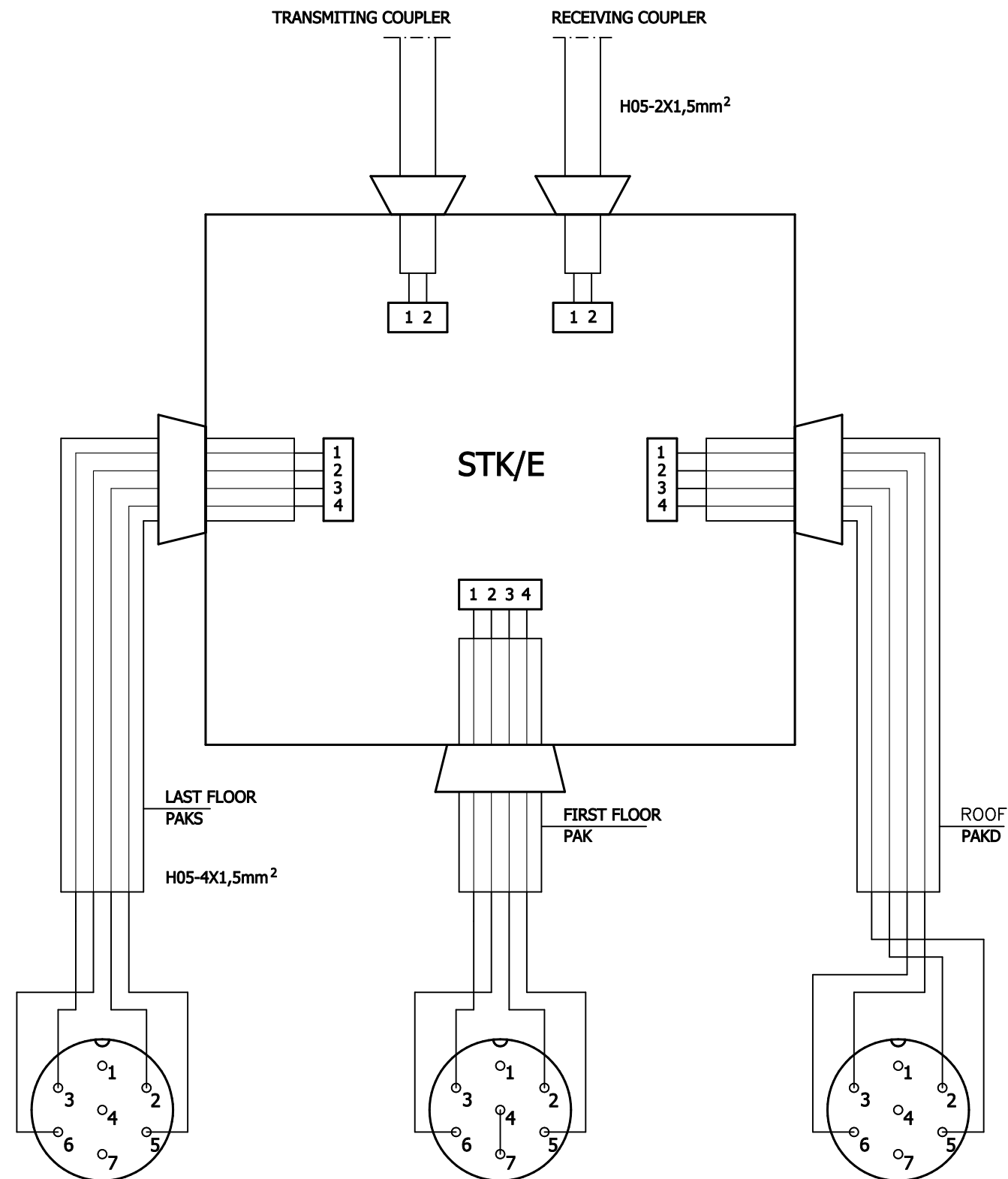
Item	Part (unit) name		Quantity	Drg.or Standard No.		Material	Remarks
Designed by	T. Jackiewicz			Material	Name ECHO/AK-P Cage device - assembly diagram		Weight
Drawn by	R. Rosik						
Checked by	R. Nowak						
Scale	 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570						
				Date 07.2014	Drawing number 28P.01.02		Sheet



NOTE:

ALL DIMENSIONS IN MILIMETERS

Designed by	T. Jackiewicz			Material	Name	Weight
Drawn by	R. Rosik				ECHO/AK-P	
Checked by	R. Nowak				Cage device – box SAKN	
Scale	 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date	Drawing number	Sheet
				07.2014	28P.01.03	




PLUG ZGT28KP7a

Pin	Inductance	Ver.
3-6	178uH	A tr.
2-5	40uH	A re.
3-6	80uH	B tr.
2-5	40uH	B re.
3-6	40uH	C tr.
2-5	40uH	C re.
3-6	40uH	D tr.
2-5	40uH	D re.

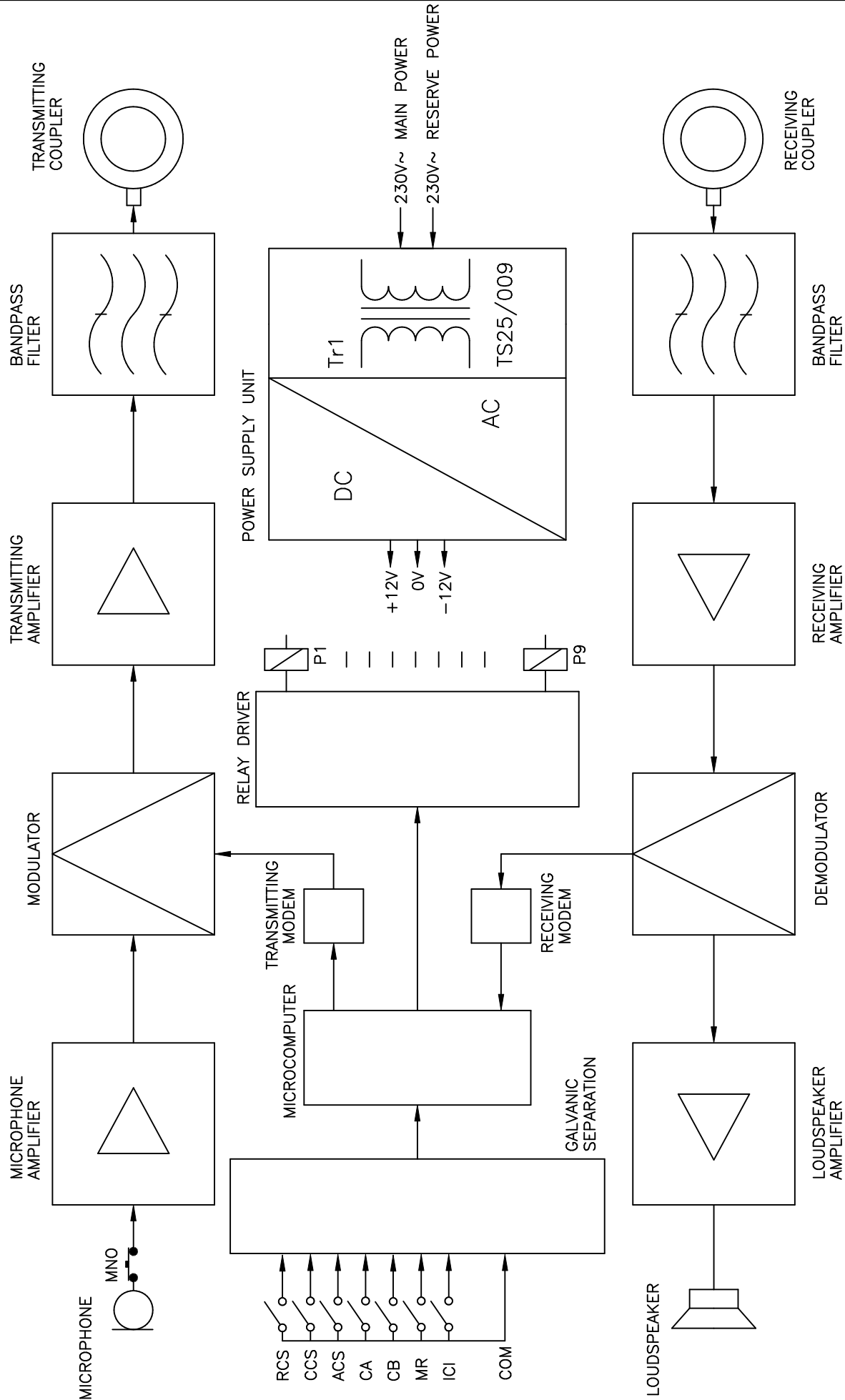
PLUG ZGT28KP7a


PIN 4-7  
CONNECTED FOR AHS

PLUG ZGT28KP7a

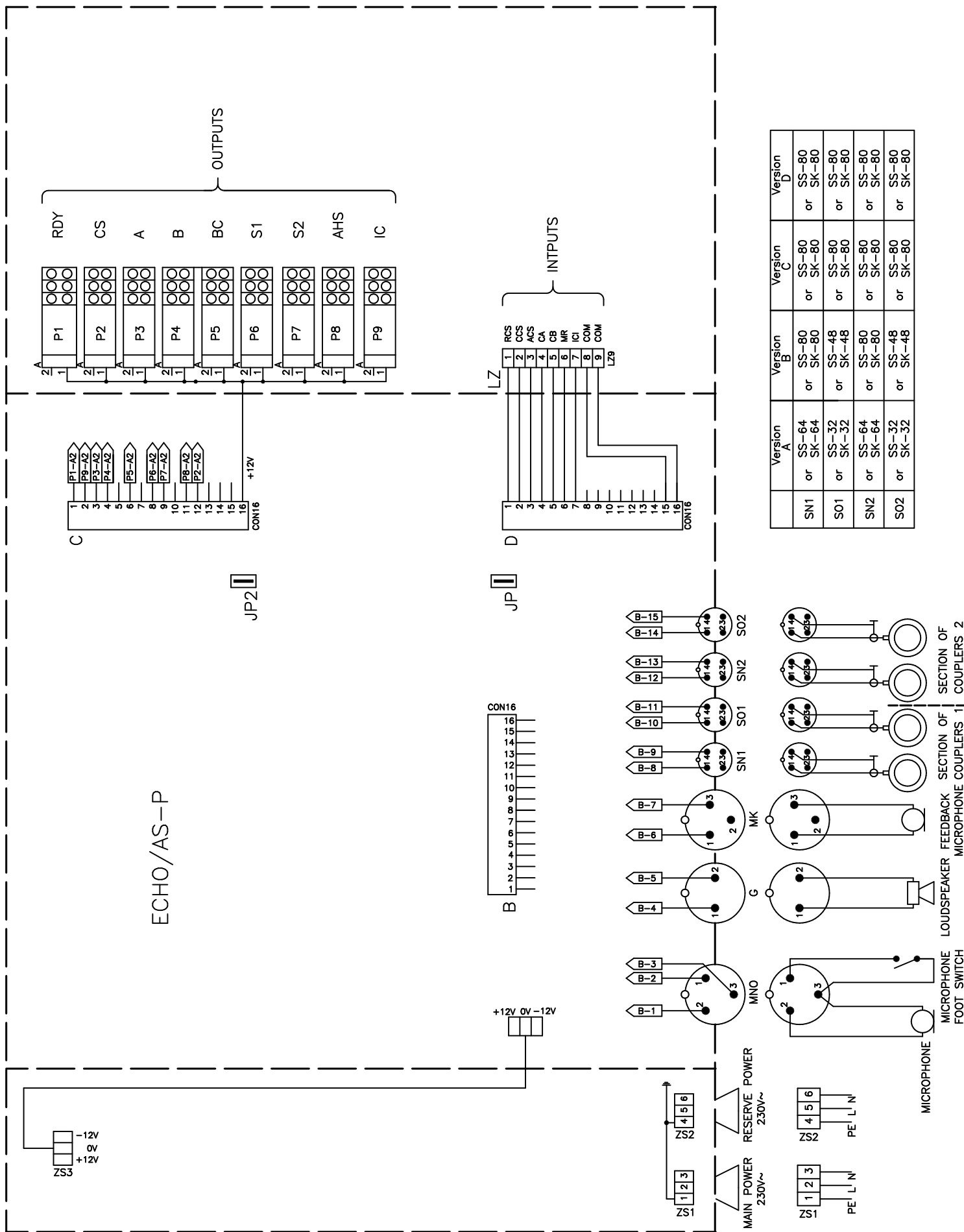
Item	Part ( unit) name			Quantity	Drg.or Standard No.		Material	Remarks	
Designed by	T. Jackiewicz			Material	Name ECHO/AK–P Cage device – internal wiring of box STK/E			Weight	
Drawn by	R. Rosik								
Checked by	R. Nowak								
Scale		 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date 07.2014		Drawing number 28P.01.04		Sheet





Designed by	T. Jackiewicz			Material	Name ECHO/AS-P Headframe device – block diagram	Weight
Drawn by	R. Rosik					
Checked by	R. Nowak					
Scale						
	 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date	Drawing number	Sheet
				07.2014	28P.02.01	





Item	Part ( unit) name	Quantity	Drg.or Standard No.	Material	Remarks
Designed by	T. Jackiewicz		Material	Name ECHO/AS-P Headframe device - assembly diagram	Weight
Drawn by	R. Rosik				
Checked by	R. Nowak				
Scale	CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570		Date 07.2014	Drawing number 28P.02.02	Sheet

# ECHO/AS-P

## INPUTS

**MAIN POWER**

**RESERVE POWER**

**RCS**

**CCS**

**ACS**

**CA**

**CB**

**MR**

**ICI**

**COM**

**COM**

**LZ9**

ZS1-1

ZS1-2

ZS1-3

ZS2-4

ZS2-5

ZS2-6

1

2

3

4

5

6

7

8

9

P1

P2

P3

P4

P5

P6

P7

P8

P9

**RDY**

**CS**

**A**

**B**

**BC**


**S1**

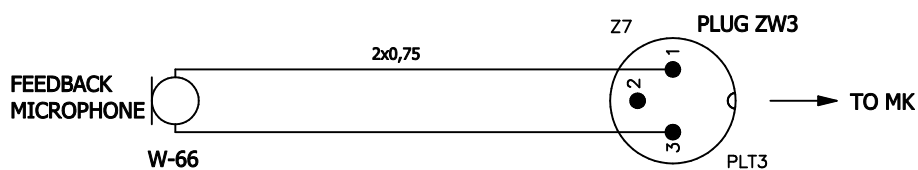
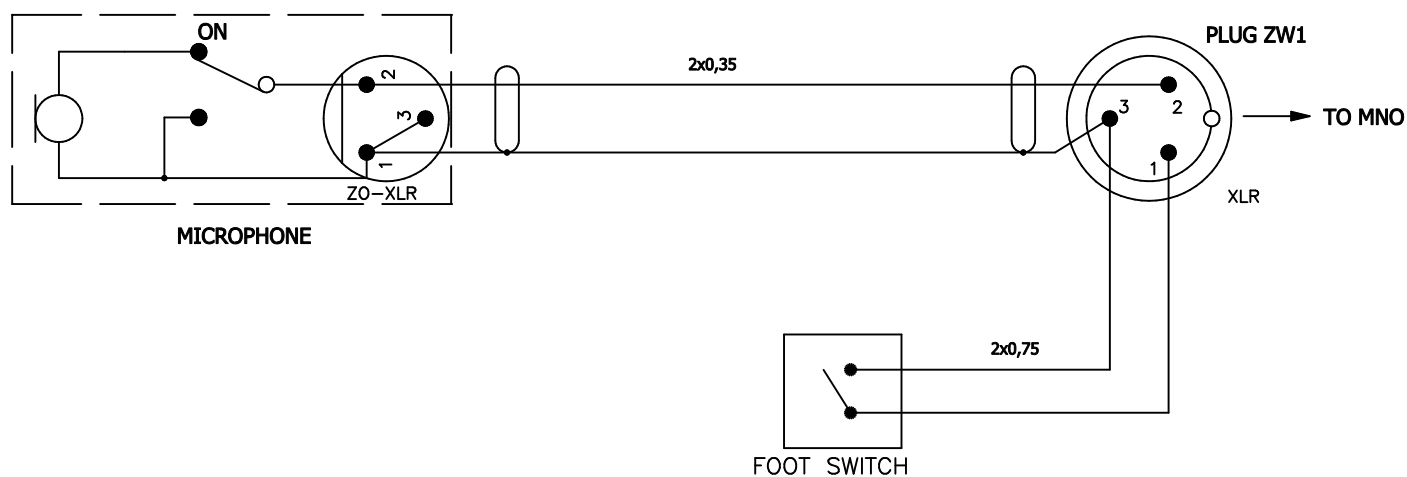
**S2**


**AHS**

**IC**

## OUTPUTS

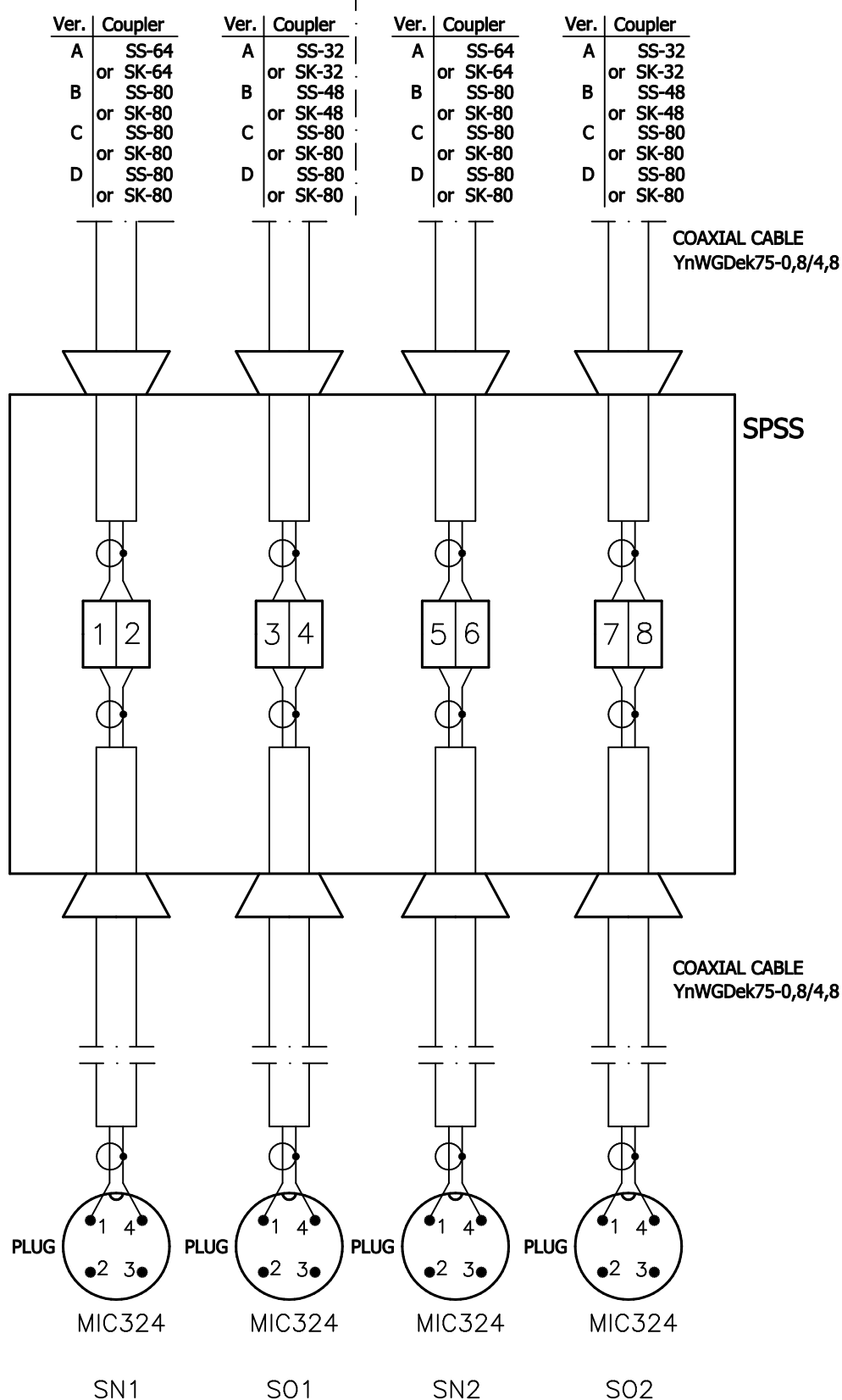
Designed by	T. Jackiewicz			Material	Name ECHO/AS-P Headframe device - input/output circuits	Weight
Drawn by	R. Rosik					
Checked by	R. Nowak					
Scale	 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date 07.2014	Drawing number 28P.02.03	Sheet




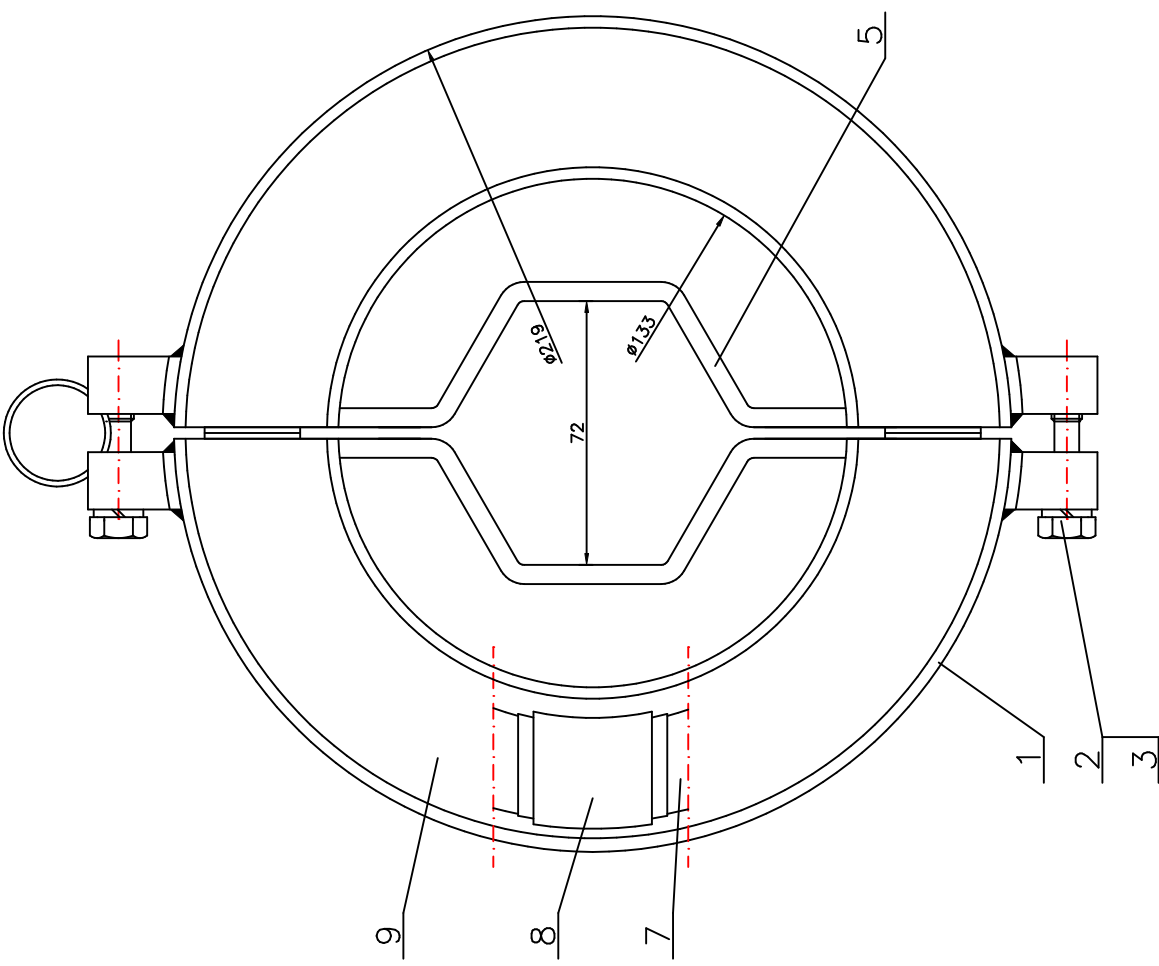
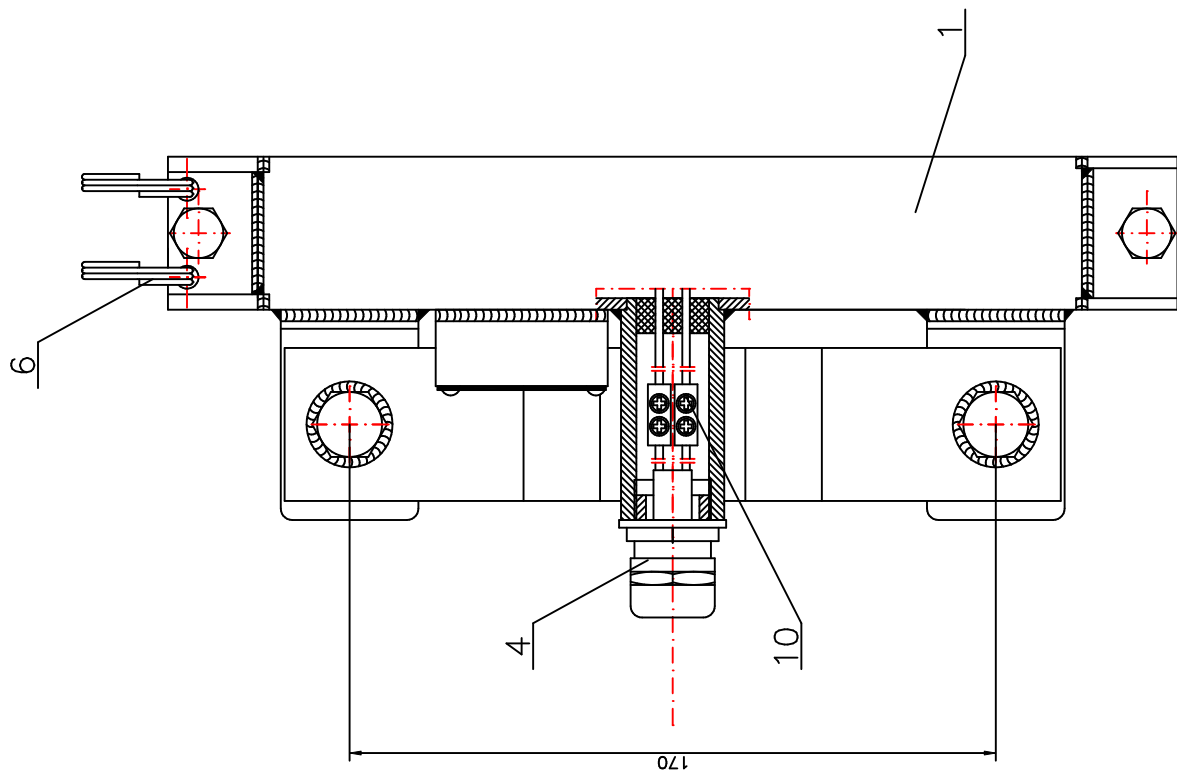
Item	Part ( unit) name			Quantity	Drg.or Standard No.		Material	Remarks
Designed by	T. Jackiewicz				Material	Name ECHO/AS-P Headframe device – diagram of microphone and feedback microphone	Weight	
Drawn by	R. Rosik							
Checked by	R. Nowak							
Scale	 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date 07.2014	Drawing number 28P.02.04		Sheet	

## SECTION 1

## SECTION 2



Item	Part ( unit) name		Quantity	Drg.or Standard No.		Material	Remarks
Designed by	T. Jackiewicz			Material	Name ECHO/AS-P Headframe device -internal wiring of box SPSS		Weight
Drawn by	R. Rosik						
Checked by	R. Nowak						
Scale	 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date 07.2014	Drawing number 28P.02.05		Sheet

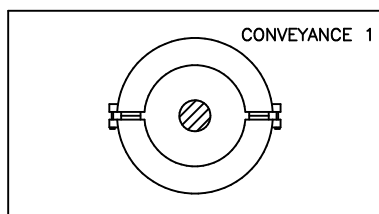


NOTE:  
ALL DIMENSIONS IN MILLIMETERS

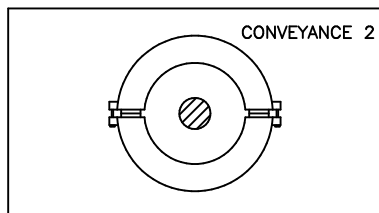
10	TERMINAL BLOCK	1	Sp.POKÓJ	
9	ENCAPSULATING COMPOUND	0.5l	CIBA	
8	COIL	1	Lgt' 0.75mm <sup>2</sup>	
7	FERRITE CORE	1pl.	EPGOS	
6	PROTECTIVE RING	1		
5	ROPE CLAMP	2	28.03.005	Fe/Zn6c
4	GLAND PG13.5	1		
3	SPRING WASHER Z8,2	2	PN-M-82008:1977	Fe/Zn6c
2	BOLT MBX40	2	28.03.002	Fe/Zn6c
1	ENCLOSURE	1	28.03.001	Fe/Zn6c
Item	Part (unit) name	Quantity	Drg.or Standard No.	Material
Designed by	T. Jackiewicz			Name
Drawn by	R. Rosik			Coupler SK
Checked by	R. Nowak			- outline drawing
Scale	1:1		Date	Drawing number
			07.2014	28P.03
				Sheet

MACHINE 1

SECTION 1

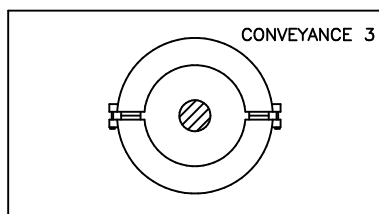


SECTION 2

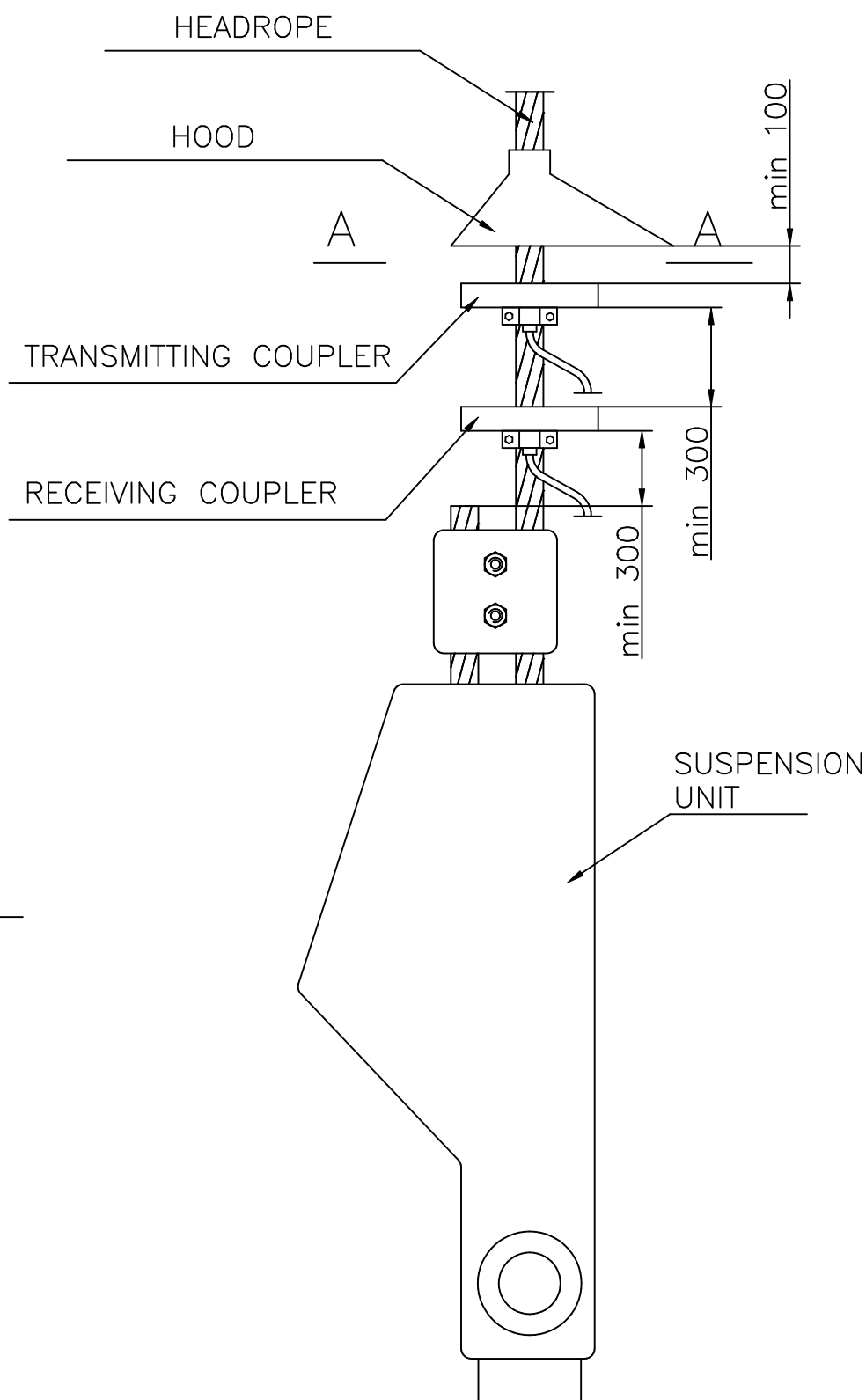
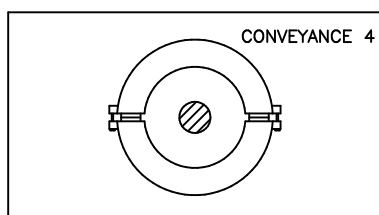


MACHINE 2


SECTION 1

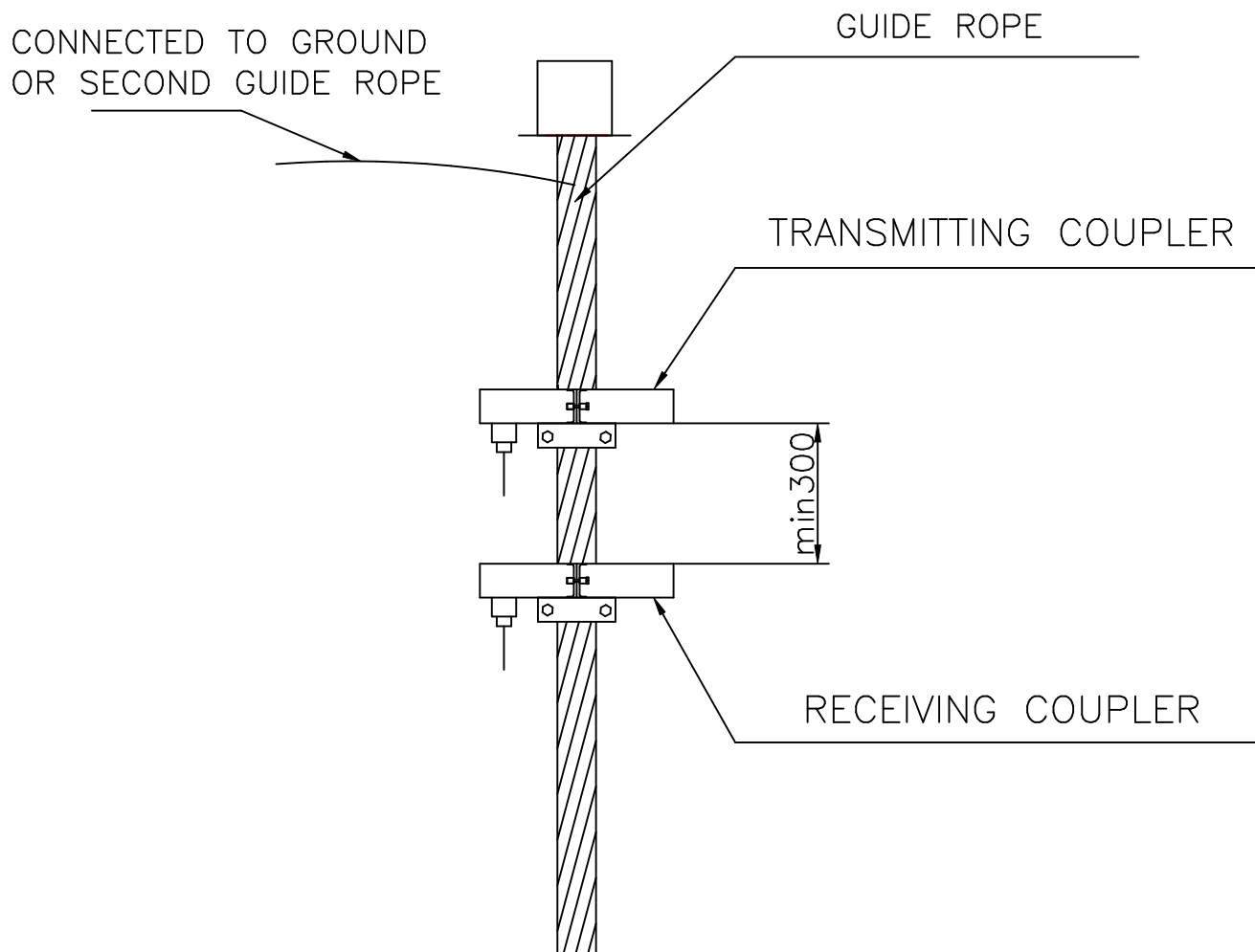


SECTION 2




NOTE:  
ALL DIMENSIONS IN MILLIMETERS

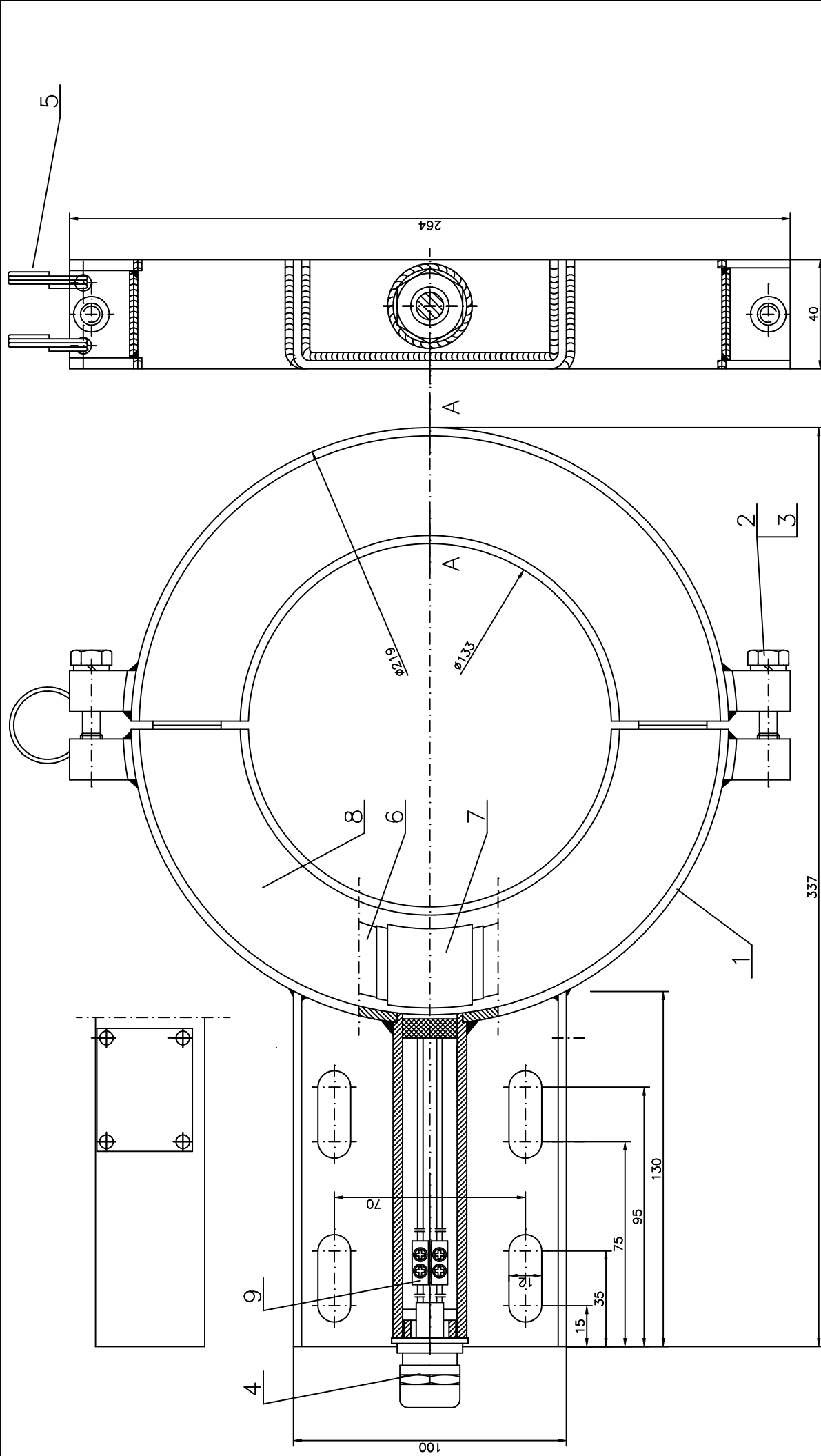
Item	Part ( unit) name			Quantity	Drg.or Standard No.		Material	Remarks
Designed by	T. Jackiewicz				Material	Name Coupler SK – installation drawing variant 1		Weight
Drawn by	R. Rosik							
Checked by	R. Nowak							
Scale	 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date	07.2014		Drawing number	Sheet
							28P.03.01	



NOTE:

ALL DIMENSIONS IN MILIMETERS

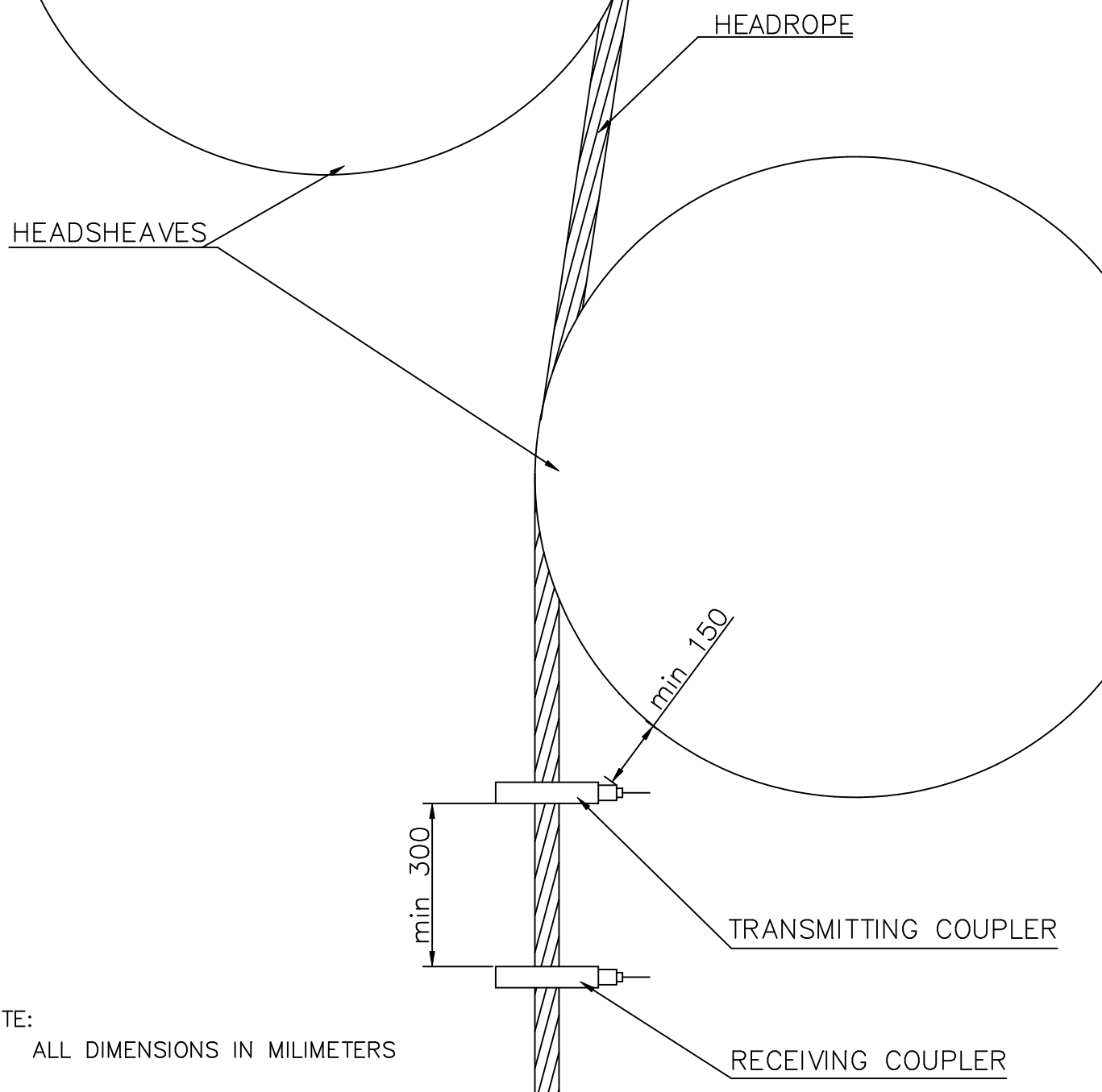
Item	Part ( unit) name			Quantity	Drg.or Standard No.		Material	Remarks	
Designed by	T. Jackiewicz				Material	Name Coupler SK – installation drawing variant 2		Weight	
Drawn by	R. Rosik								
Checked by	R. Nowak								
Scale		 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date 07.2014		Drawing number 28P.03.02		Sheet




NOTE:  
ALL DIMENSIONS IN MILLIMETERS

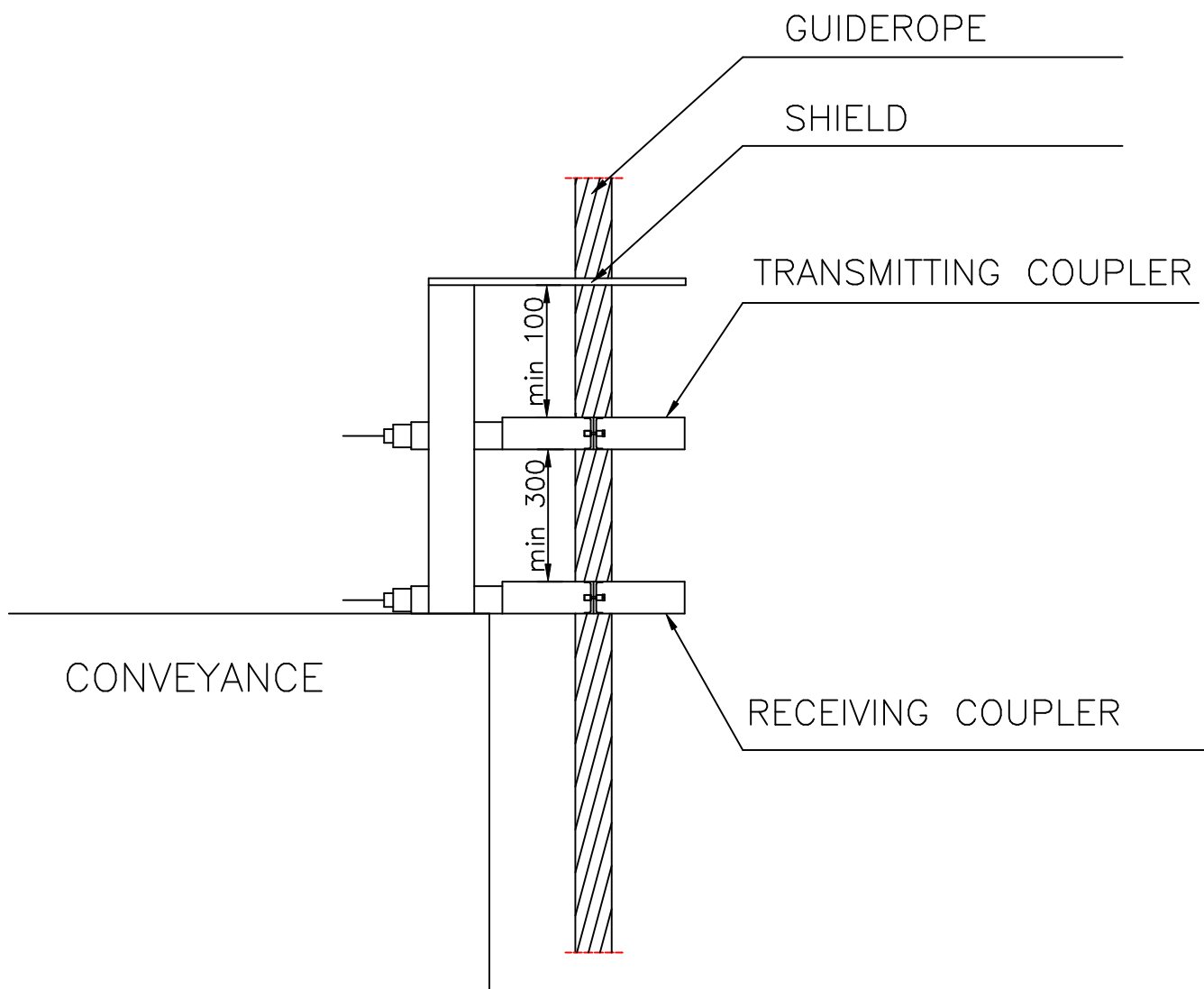
TERMINAL BLOCK		1	Sp.POK3	CBA
9	ENCAPSULATING COMPOUND	0.5l		
8	COIL	1	LgY 0,75mm <sup>2</sup>	
7	FERRITE CORE	1pl.	EPCOS	
6	PROTECTIVE RING	1		
5	GLAND PG13.5	1		
4	SPRING WASHER Z8.2	2	PN-M-82008:1977	Fe/Zn9c
3	BOLT MBX40	2	28.03.002	Fe/Zn9c
2	ENCLOSURE	1	28.03.001	Fe/Zn9c
1	Item	Part (unit) name	Qty	Remarks
Designed by	T. Jackiewicz			
Drawn by	R. Rosik			
Checked by	R. Nowak			
Scale	1:1			
CARBONEX Sp. z o.o.		Date	07.2014	Sheet
AutoCAD LT97 lic. 61000014570		Drawing number	28P.04	






NOTE:  
ALL DIMENSIONS IN MILIMETERS

Item	Part ( unit) name			Quantity	Drg.or Standard No.		Material	Remarks
Designed by	T. Jackiewicz			Material	Name Coupler SS – installation drawing variant 1		Weight	
Drawn by	R. Rosik							
Checked by	R. Nowak							
Scale	 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date 07.2014	Drawing number 28P.04.01		Sheet	



NOTE:

ALL DIMENSIONS IN MILIMETERS

Item	Part ( unit) name			Quantity	Drg.or Standard No.		Material	Remarks
Designed by	T. Jackiewicz			Material	Name Coupler SS – installation drawing variant 2		Weight	
Drawn by	R. Rosik							
Checked by	R. Giel							
Scale	 CARBONEX Sp. z o.o. AutoCAD LT97 lic 61000014570			Date 07.2014	Drawing number 28P.04.02		Sheet	