MODEL HE400 MICROWAVE BARRIER

(cod. HE400)

INTRODUCTION

The HE400 is a microwave barrier system for external protection that requires a simple and fast assembly. The maximum distance of the beam between a transmitter and a receiver is 200 meters. The HE400 barrier features four field selectable modulation frequencies to allow the installation of barriers within close proximity and to reduce the possibility of cross link modulation or mutual interference.

The HE400 barriers requires a low current absorption (40mA RX, 38mA TX) thus allowing autonomy for a long period of time with the use of the internal 12 Vcc – 2,1Ah battery (in each TX and RX units) in case of mains power failure. This battery gives an autonomy of over 36 hours.

Description

Each model HE400 consist of one model HE400T transmitter and one model HE400R receiver, each supplied with universal mounting bracket for pole mod. HE401 (diameter mm 70-100).

In order to satisfy more specific installation requirements, the following accessories for HE400 are available as option:

Part number	Model	Description
HE402	HE402	Horizontal wall mounting bracket
HE403	HE403	Pole mounting bracket for diameter 70-110 mm
HE405	HE405	Transformer for powering one HE400T or HE400R: 230Vac/19 Vac, 30 VA
HE410	HE410	Outdoor container for HE405 transformer. For pole mounting use HE403 bracket
HETS400	TS400	Test instrument for HE400
HE19-12	GP2.1-12	12V 2,1 Ah backup battery for HE400T and HE400R.

Principles of operation

The transmitter radiates amplitude modulated X-band energy to the receiver where the received energy is amplified and processed so that it causes an alarm relay to be energized. When an intruder approaches the beam, the energy detected by the receiver causes, if the predetermined level is reached, the relay to be de-energized and therefore an alarm. Operation of model HE400 is illustrated in Figure 1. A single model HE400 may cover a distance up to 200m.

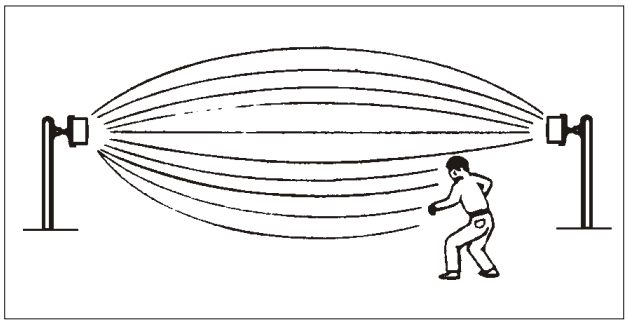


Fig. 1 - Detection pattern

The Receiver incorporates an automatic gain control circuit (AGC) that adequates the signal to the distance needed to be covered. Furthermore there are phased locked loop circuits (PLL) to detect the signal radiated within a specified frequency band.

Another possibility is the possibility to synchronize the transmitters: in case two or more TX units have to be installed on two or more parallel levels in the same direction, a connector is available in order to synchronize the start of the signals radiated to the different receivers.

Alignment and control

In order to perform a good alignment it is necessary only a standard voltmeter. On both the receiver and the transmitter it is available the J2 connector (10 PIN header) for controlling all the signal and the power supply levels. We suggest the use of the optional TS400 Test Instrument Interface that has onboard a connector, 3 LEDs and buzzer and the connection cable for the J2 header. This interface simplifies the connection of the voltmeter to the barrier. You can even connect a oscilloscope in order to determine the level of the received signal.

On the Receiver and the Transmitters boards there are also 5 LEDs that show the status of the alarm relay, the presence of the power supply, the correct oscillator operation and the use of the correct channel between the TX and the RX.

Installation

HESA advises to make an inspection of the site to protect considering the following elements:

Width pattern of detection area

The width of the beam varies depending on the distance between the receiver and the transmitter and the sensitivity level used. The following diagram (Figure 2) allows you to determine the maximum width of the beam that is at half of the distance of the barrier.

Mounting height

The mounting height from the ground of the barrier depends on the installation requirements but especially must be determined considering that the increase of the height increases also the the length of the uncovered area that is the area to the ground not covered by the beam of the barrier. This information is important also for determining the overlapping of two barriers that are crossing or that are installed in parallel. Please note that the uncovered area increases by decreasing the sensitivity (see Figure 4).

Typically the height should be of 85 cm. The height is between ground and the middle of the device.

For security purposes we advise to overlap the ends of the barriers in order to eliminate the uncovered areas. Considering an average sensitivity and a mounting height of 85 cm, you should overlap for about 5,5 m in the corners and for about 11 m on the rectilinear protections. In case there are consecutive barriers, the distance between the centers should be of about 50 cm (see Figure 3).

Fig.2: Diameter of the sensitive zone

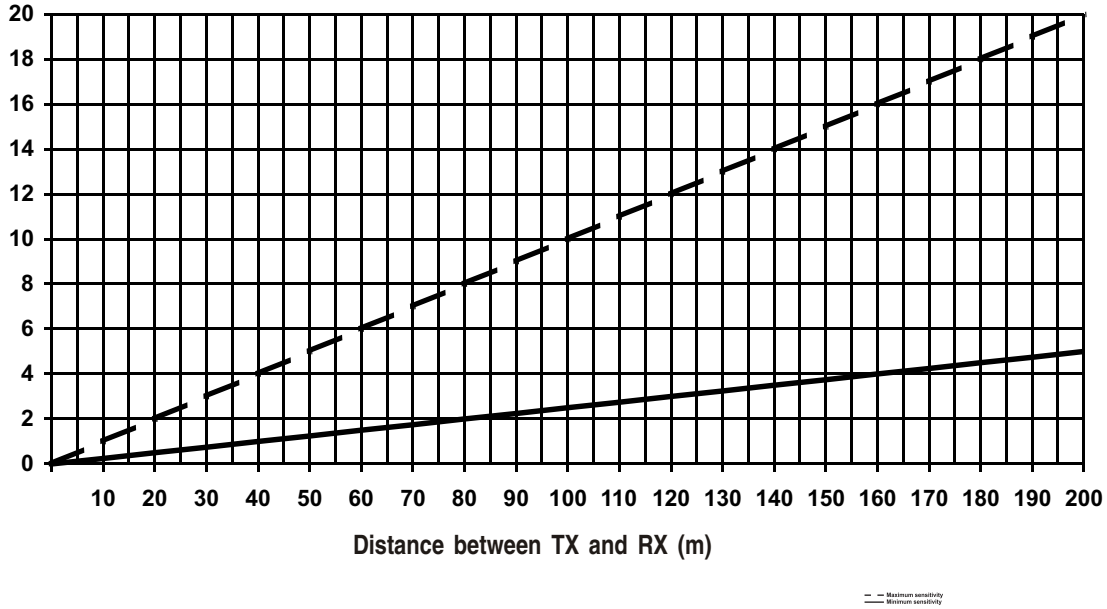


Fig. 3: Attention to dead zones!

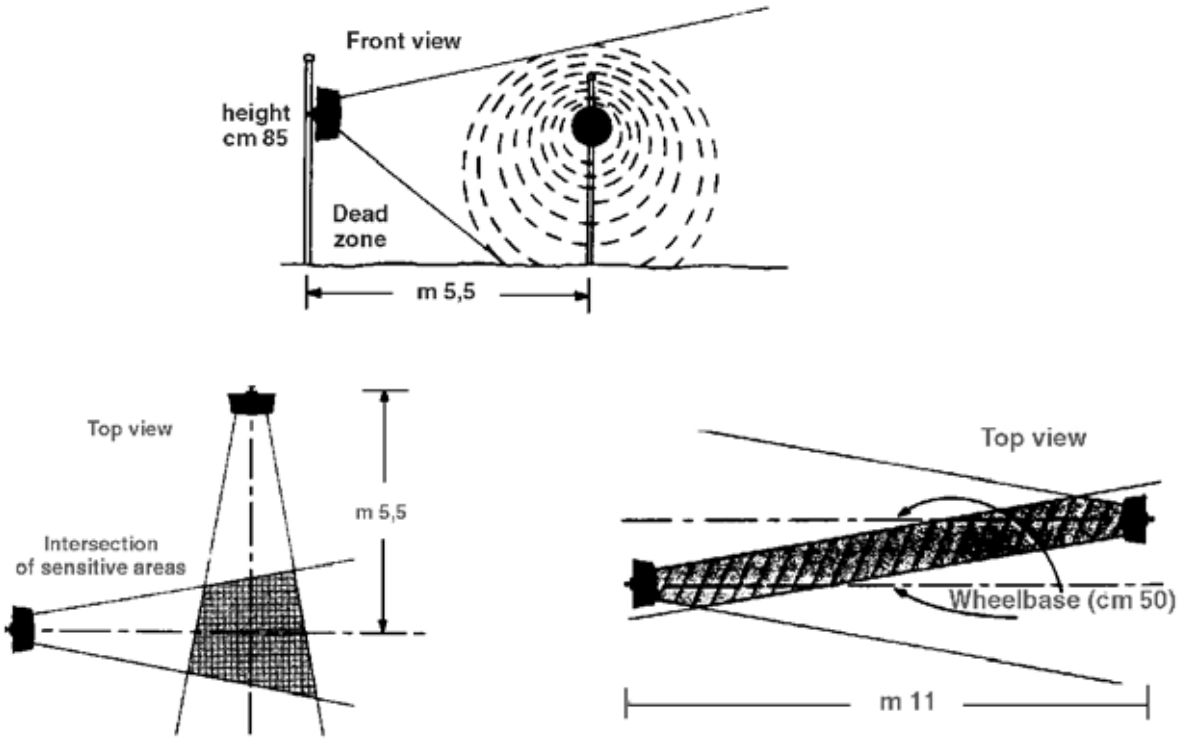
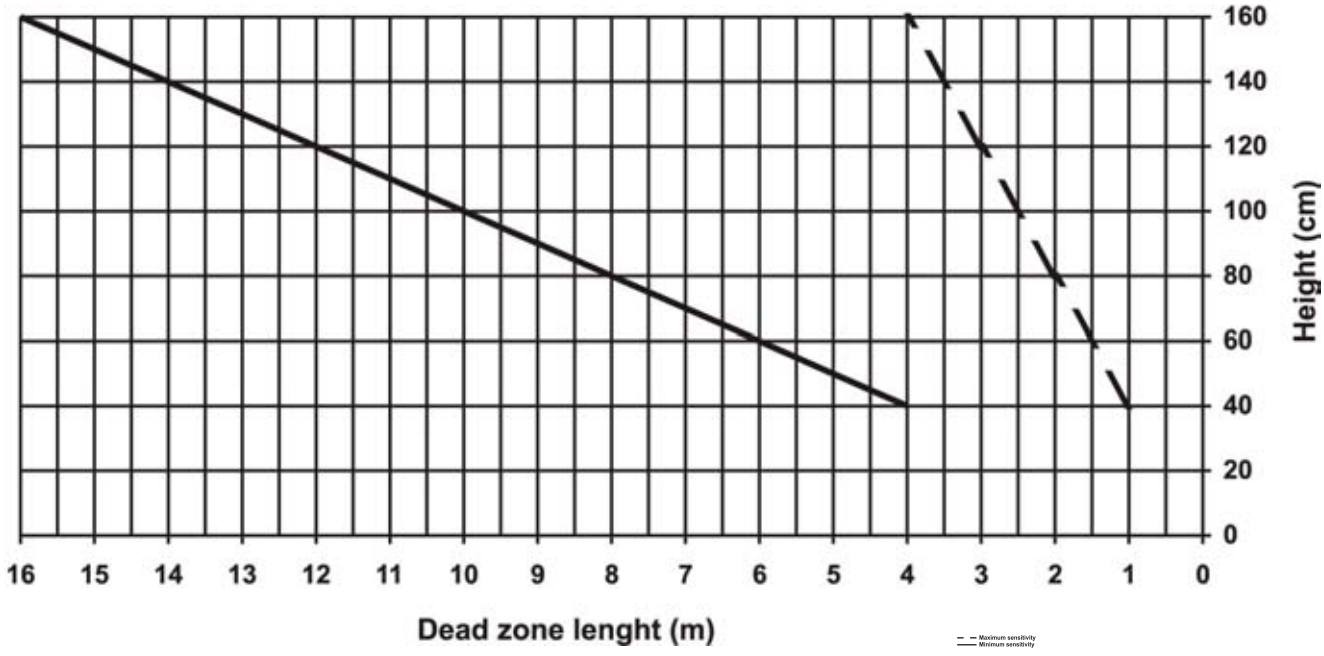


Fig. 4: Installation height of devices



Installation of the HE400 barriers

Required area. Model HE400 barrier must be located in an area which is free of moving object such as chain link fences, trees, bushes and large area of water (see Fig. 5). Large moving objects within the protection pattern will be indistinguishable from an intruder and will cause nuissance alarms. The clear area required for a model HE400 installation depends upon the distance to be covered by the link. In each installation the cleared area must be at least as large as the protection pattern.

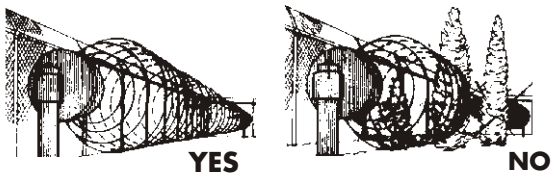


Fig. 5: Attention to trees!

Terrain. Since operation of the link requires trasmission of energy from Trasmitter to Receiver, it is important to maintain a clear line of sight between the units. Therefore, the ground must be flat across the protected area. Any bumps, hills or ditches in the area will shadow the beam and may provide crawl space for an intruder. Bumps or hills must be leveled, and dithches filled so that the area is flat to within 15 cm. The protected area can be any stable, reasonably smooth material such as concrete, asphalt, tilled earth, or gravel. If there is grass or vegetation in the protected area, it must be kept cut to a maximum of 8 cm in height. All the bushes or branches must be cut in order to have a free area as large as the clear area.

Fig. 6: Installation on flat grounds only

Physical protection. Install the trasmitter and receiver in locations which provide protection from accidental damage as well as from tampering. Simple devices such as bumper posts or parking guards may be used to protect equipment from damage from vehicles (see Figure 7).

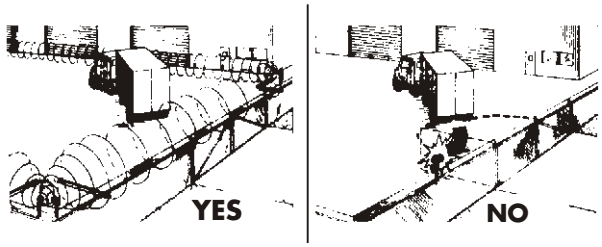


Fig. 7: Avoid interferences with moving objects

Best security. Choose the location that will provide best security, yet be free from nuisance alarms. Always locate model HE400 inside a fence or inside a controlled access area to prevent unwanted alarms due to random foot traffic, vehicles, or large animals. Typically, units should be mounted between 0.75 and 1.0m above ground level and far enough inside fence to provide a clear area of protection (see Figure 8). For maximum security it is necessary to overlap the ends of links so that the dead spot below and immediately in front of the adjoining link is protected. This type of location gives maximum possible security. A 11m overlap is recommended at intermediate points, and a 5.5m overlap is recommended at corners. If site demands shorter overlap, increased sensitivity will reduce dead zone, but will also widen beam. The offset of overlapping links in line should be approximately 50cm; this distance should be measured from center of each unit.

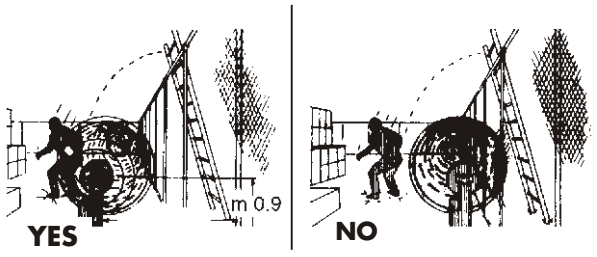


Fig. 8: Distance from the fence

Connection of the device to the AC supply

The apparatus work with AC supply at a maximum voltage of 19Vac. The connection between the receiver or transmitter and the transformer should be the shortest possible (less than 4 m) with a wire not less than 1.5mm^2. The wires which connect the transformer to the 220 VDC must have a section of 2.5mm^2. In case

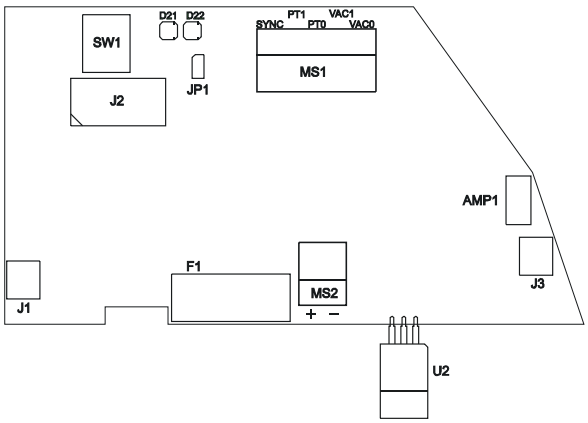


Fig. 9: Transmitter unit circuit board

the AC source is low voltage (19Vac), insulation transformers should be used, 20V: 20V of at least 80VA. The length of the connection and the possibility that each device can use a maximum current of 1A must be considered in the connection to the 19Vac power supply; in any case the section of the wires must not be less than 1.5mm^2.

Note: The cable which carries the barrier supply from the transformers to the battery heads must be shielded and the shield must be connected to the ground.

Connection of the backup battery

Inside each transmitter and receiver unit there is a space for installing a rechargeable battery of 12V 2,1 Ah. The battery is charged by the supplier inside each head and it is connected to it by red and black wires with supplied with clips wired to the wire terminal. This battery, when there is no mains supply, allows an autonomy of over 36 hours to the device (when fully charged). If a greater autonomy is necessary, a larger power supply should be installed very closed to each device. The connection of these power supply units should be done at the terminals of the device marked with the symbols of - and + 13,8 VDC. The sizing of these groups should done considering that the DC current drawn by each single receiver or transmitter unit is 70mA approx., including the current drawn by the backup battery.

The following information describe the wiring and the alignment of the barrier. Please read carefully the information about the connector J2.

HE400T Transmitter

MS1: terminal block of TX printed board

VAC0/VAC1: power supply, connect the 19 VAC output of the trasformer.

PT0/PT1: tamper circuit output N.C., for protection against unauthorized openings, movements or tampering. In normal conditions there is a NC circuit (0 ohm) voltage free. The opening of the contact is determined by a movement of the TX unit (by AMP1) or after a removal of the head cover (change of state of the switch connected to J3).

SYNC: With JP1 closed (default) in this block there is the signal for synchronizing other TX units when two or more TX devices are working near as in the case of a two levels protection.

-TX Master: close JP1 and make a connection between the terminal SYNC of the TX Master to the terminal SYNC of the TX Slaves.

-TX Slave: open JP1 and make connection the terminal SYNC of TX Slave to the terminal SYNC of TX Master.

Important!:

- do not make any connection to the terminal SYNC if the synchronization feature is not used.
- Use max three TX Slave with each TX Master, total length 60m max. (total) of wire connection (capacitance not higher than 150 pF/m).
- The TX Slave units, when synchronized, use the same frequency of the TX Master.
- Connect together GND terminals of TX Master and TX Slaves.

JP1: jumper setting for TX Master or Slave. See SYNC description, connector MS1.

AMP1: movement sensor device. See PT0/PT1 description, connector MS1.

J3: microswitch connector against unauthorized openings of the cover of the head. See PT0/PT1 description, connector MS1.

D22: green LED, monitors the 19Vac power supply presence. Without the power supply and with the backup battery installed, the LED is turned off but the device continues to work normally.

D21: red LED, TX monitors the oscillator. With the oscillator working correctly the LED is turned off. In case of an oscillator trouble, the LED is turned on. It is

turned on also with JP1 open (TX Slave) and without SYNC signal from the Master TX.

SW1: select one of the four modulation frequencies for the TX unit; the same feature is found on the RX heads.

Set TX and RX jumpers at the same positon for proper function.

J1: TX Antenna assembly connection

J2: TX measure connector.

Pin 1: reference voltage (13,8 VDC)

Pin 2: reference GND

Pin 3-8: not used

Pin 9: TX oscillator reference voltage:

- 0 V trouble on oscillator
- 9 V normal working

Pin 10: internal reference voltage (9 VDC)

Note:

The voltage on pins 1-2 is also applied to MS2 connector for recharging the backup battery.

It is possible to connect a LED to pin 9 (positive) and pin 2 (ground) with low current absorbtion (typical 2mA) to monitor the oscillator; in any case, since it is a CMOS device output, the max current output is 5mA.

MS2: connector for the backup battery; connect the 12V 2.1A rechargeable battery following the polarity indications marked on the printed circuit; the F1 fuse (1A) is in series with the positive of the battery.

The battery is automatically charged by the supplier inside each head. This battery gives the TX an autonomy of over 36 hours in case of mains failure.

F1: Battery protection fuse. See MS2 description.

U2: TO-220 voltage regulator, provides voltage reference (13,8 VDC). TO-220 metal case is insulated from the metal case.

General note

The TX electronic board are available with the optional TEST function and Stand-By mode: see silk-screen circuit on MS1.

If these functions are active:

TEST: Apply a GND signal (take pin "-" from MS2) to activate the test function; the test will be positive if the correspondent RX will generate an intrusion alarm. The D20 red LED turns on when the test is active.

STBY: Apply a GND signal (take pin "-" from MS2) to activate Stand-by mode of the TX; this inhibits MW signal emission of TX. Do not modify the JP2 jumper setting (factory default) on the solder side of the PCB.

HE400R Receiver

MS1: terminal block of RX printed board

VAC0/VAC1: power supply, connect the 19 VAC output of the trasformer.

PT0/PT1: tamper circuit output N.C., for protection against unauthorized openings, movements or tampering. In normal conditions there is a NC circuit (0 ohm) voltage free. The opening of the contact is determined by a movement of the RX unit (by AMP1) or after a removal of the head cover (change of state of the switch connected to J3).

ALL0/ALL1: Alarm circuit output NC. In normal conditios the circuit is closed (35 ohm voltage free) while on the opposite it will be open (R=8). The output is connected to a photo coupler device and therefore the maximum current load must be lower than 100mA.

AMP1: movement sensor device. See PT0/PT1 description, connector MS1.

J3: microswitch connector again unauthorized openings of the cover of the head. See PT0/PT1 description, connector MS1.

D9: green LED, monitors the 19Vac power supply presence. Without the power supply and with the backup battery installed, the LED is turned off but the device continues to work normally.

D8: green LED, monitors the RX link to the TX signal.

D7: red LED. The LED turns on when an alarm is detected.

SW1: select one of the four modulation frequencies for the RX unit; the same feature is found on the TX heads.

Set TX and RX jumpers at the same positon for proper function.

J1: RX Antenna assembly connection

J2: RX measure connector.

Pin 1: reference voltage (13,8 VDC)

Pin 2: reference GND

Pin 3: 200mV signal. By connecting an oscilloscope (AC), it is possible to determine the quality of the signal received; after the normalization period it must stabilize to 200mVpp ±5%.

Pin 4: not used

Pin 5: threshold value. It indicates the threshold value set on the RX, selectable by PT5 trimmer.

This value is inversely proportional to the detection sensitivity and the value must be in the range 0.4-9 V measured with a digital voltmeter.

Pin 6: RX alarm output reference voltage:

- 0 V: not in alarm
- 9 V: in alarm

Pin 7: internal reference voltage (5 VDC)

Pin 8: AGC signal: barrier alignment voltage reference, inversely proportional to the quality of the barrier alignment.

For the best alignment, the signal **must be included in the range 2,5-6,5 VDC.**

Pin 9/10: not used.

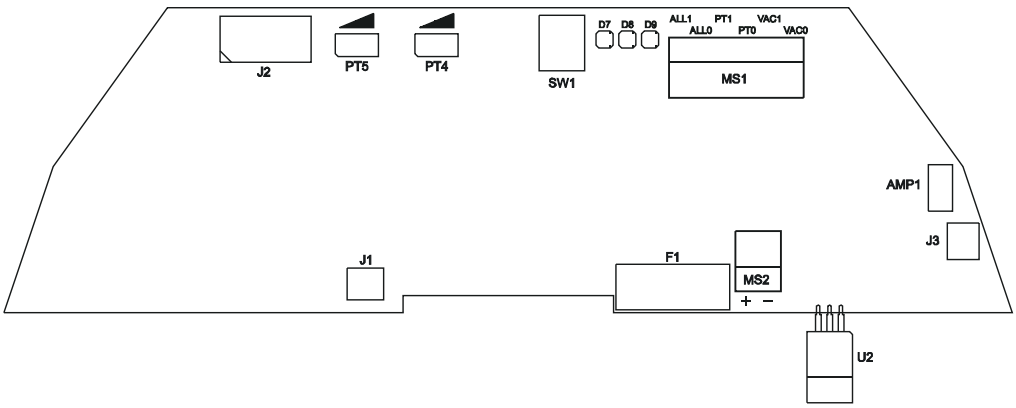


Fig. 10: Receiver unit circuit board

Notes on the above listed signals

- The voltage present on pins 1-2 is also used on the MS2 connector for recharging the backup battery.
- The signal on pin 3 must be monitored in those particular critical installations where it can happen to have a strong signal reflection. In normal installation conditions, it is sufficient to align the units using a digital voltmeter connected to pin 8 (AGC) and pin 2 (GND).
- It is possible to connect a LED with low current consumption (2 mA) directly to pin 6 in order to monitor the alarm output. Connect to this pin loads lower than 5mA.
- The AGC signal on pin 8 must be measured with a digital voltmeter. Wait at least for 10 seconds between each alignment test in order to consider valid the measure.

PT4: Trimmer for adjusting the RX speed detection: turn clockwise to lower this parameter and on the opposite for increasing it (see on the printed circuit for reference signals).

PT5: Trimmer for adjusting the RX sensitivity: turn clockwise to lower this parameter and on the opposite for increasing it (see on the printed circuit for reference signals).

MS2: connector for the backup battery; connect the 12V 2.1A rechargeable battery following the polarity indications marked on the printed circuit; the F1 fuse (1A) is in series with the positive of the battery.

The battery is automatically charged by the supplier inside each head. This battery gives the RX an autonomy of over 36 hours in case of mains failure.

F1: Battery protection fuse. See MS2 description.

U2: TO-220 voltage regulator, provides voltage reference (13,8 VDC). TO-220 metal case is insulated from the metal case.

TECHNICAL SPECIFICATIONS

	Min.	Norm.	Max.	Note
Working frequency	9.5 GHz	9.9 GHz	9.95 GHz	
Maximum power		3 mW		
Modulation				On/off
Duty-cycle		50/50		
Number of channels				4
General internal reference voltage		13.8 VDC		
RX current drain in stand-by mode		45 mA		
RX current drain in alarm condition		40 mA		
TX current drain		38 mA		
ALARM OUTPUTS				
TX tamper, opening and movement (NC)			30 VA	P max
RX tamper, opening and movement (NC)			30 VA	P max
RX alarm output (NC)			100 mA	I max
CONTROL				
RX sensitivity				Trimmer

The following statement will be provided with the equipent as required by Article 6.3 of the R&TTE Directive, 199/05/EC:
HE400T is in conformity with all essential requirements of the R&TTE Directive 1999/05/EC. This equipement has been assessed to the following standards:

- Draft ETSI EN 300 440 part 1&2, July 2000
- ETS 300 683: June 1997
- EN 60950: 1992, Incl Amdt 1,4, 11 (+EN 41003/1993)

This product is marked with CE **0682** ① wich signifies conformity with Class II product requirements specified in the R&TTE Directive.
Hesa S.p.a. also declare the product **HE400**, is in conformity with 89/336/EEC and 73/23/EEC directives .
The product. HE400 has been assessed to the following standards:

- ETS 300 683: June 1997
- EN 60950: 1992, Incl Amdt 1.4, 11 (+EN 41003/1993)

AZIENDA CON SISTEMA DI GESTIONE PER LA QUALITÀ CERTIFICATO DA DNV =UNI EN ISO 9001:2000=

HESA

HESA S.p.A.
Via Triboniano 25 - 20156 Milano
Tel. 02 38036 1 • Fax 02 38036 701
www.hesa.com *e-mail:hesa@hesa.com*

Roma Via Val Grana 14
Tel. 06 8861 415 • Fax 06 8861 391
Tavarnelle V. P. (FI) Via B. Cellini 178
Tel. 055 8070 303 • Fax 055 8070 505
Modugno (BA) S.S. 96, km 119.874
Tel. 080 5057 044 • Fax 080 5057 054