

FAAC



AT-8

INSTALLATION GUIDE

CONTENTS

1 INTRODUCTION	3
1.2 TRANSPONDERS.....	3
1.3 VERSIONS	3
1.4 CHARACTERISTICS	4
1.5 SAFETY PRECAUTIONS	5
2 INSTALLATION	6
2.1 MOUNTING	6
2.2 BASIC CONNECTIONS	8
2.3 TRANSCEIVER BOARD	9
2.4 AT-8 BOARD.....	14
3 COMMUNICATION INTERFACES	19
3.4 RS-232	19
4 COVERAGE AREA	20
4.3 SPEED LIMITATIONS.....	21
4.4 USING MORE AT-8 SYSTEMS AT ONE LOCATION	21
4.5 READ RANGE CONTROL	22
4.5.2 POSITIONING GUIDELINE AT-8	23
5. CONNECTIONS COBRA.....	24
Appendix A TECHNICAL SPECIFICATIONS	27

1 INTRODUCTION

A high level of performance, security, reliability and convenience is required in various control and monitoring systems. AT-8 is a long-range automatic vehicle identification system. The AT-8 reader communicates with a broad range of tags in all environmental conditions.

AT-8 is based on proven microwave technology in the 2.45 GHz ISM band and allows identification of tags at a distance up to 10 meters, even at high speeding passage. The AT-8 system features radio frequency identification equipment using modulated backscatter. In this method, the tags send their code to the reader by modulating and reflecting the signal transmitted by the reader. To reduce the influence of unwanted reflections, applied circular polarization, which also allows orientation freedom of the tags.

1.2 TRANSPONDERS

AT-8 system has a wide range of tags characterized by an excellent design and suitability for various applications. The tag circuit is energized by lithium batteries with a lifetime of 5 years.

- The **Window Button** was especially designed to suit the interior of a passenger car and is characterized by exceptional design and excellent performance. The **Window Tag** is a windshield mounted tag that can easily be mounted behind the windshield of a vehicle. The window tags are available in various types and is designed for industrial applications such as the transport industry.
- The **Booster** is a special window-tag that can hold an inductive identification card. An inductive card can be placed in the Booster, which amplifies the read range of the card and transmits the card's id to the AT-8 reader.
- Additionally a separate vehicle ID can be programmed in the **Combi-Booster**, which allows a driver ID badge and vehicle ID badge to be read simultaneously.

1.3 VERSIONS

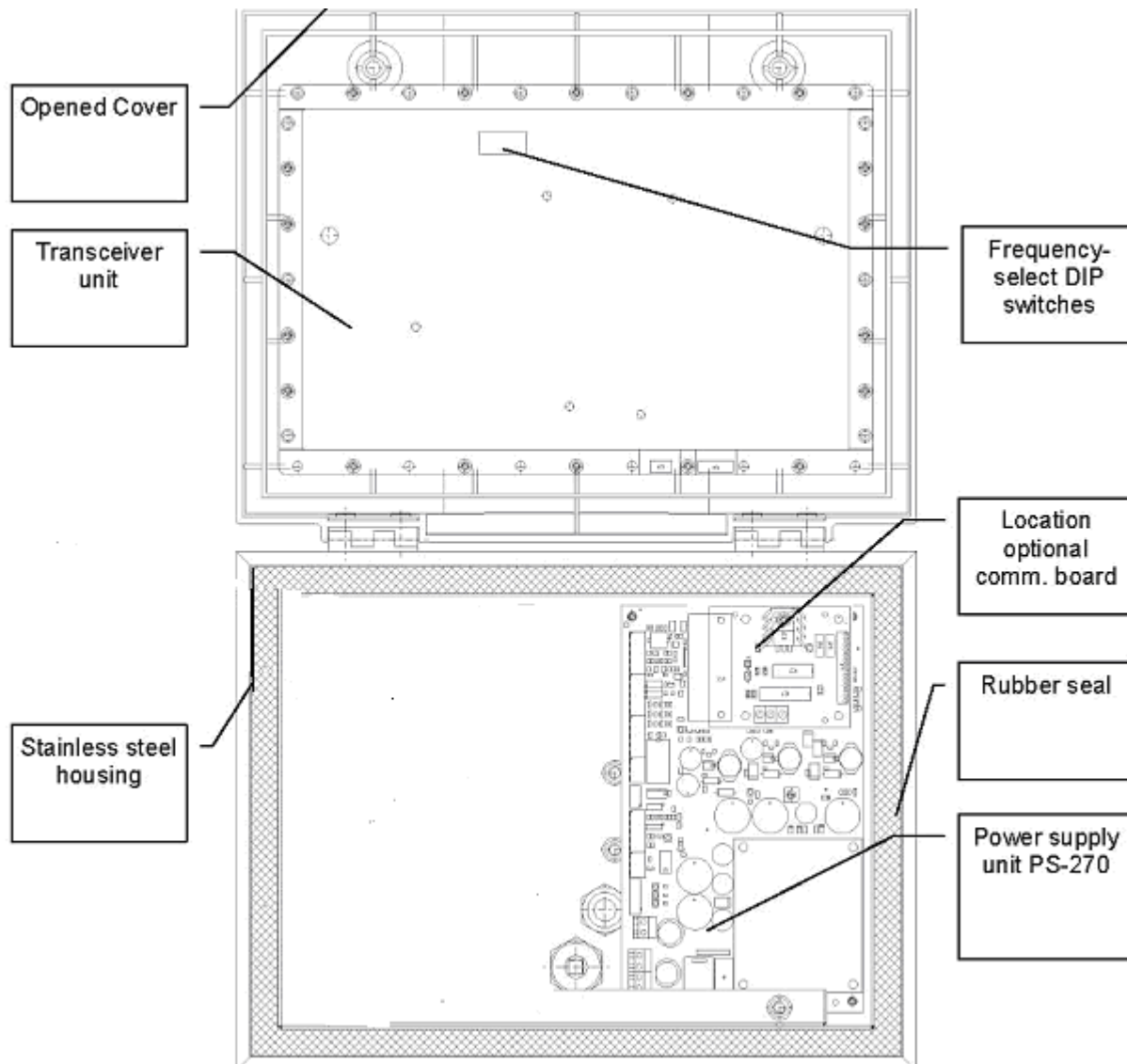
- AT-8 Long-range microwave reader with built-in antenna that can identify vehicles over distances up to 10 meters.

1.4 CHARACTERISTICS

The AT-8 consists of a stainless steel housing, covered by a synthetic material cover. The cover can be opened by removing the two screws on the cover front. After opening the unit the major components of the system will become visible. The Transceiver-unit is located in the cover of the housing. The Power-supply-unit is located on the bottom of the stainless steel housing. On the Power-supply-unit one of the optional communication boards can be placed. The backside of the unit hosts three PG-adapters;

- two PG-9, to be used for data communication cables
- one PG-13 adapter to be used for Mains connections

AT-8 reader with opened cover



1.5 SAFETY PRECAUTIONS

The following safety precautions shall be observed during normal use, service and repair.

- The AT-8 shall be connected to safety ground
- Disconnecting from main power supply before removing any parts
- The AT-8 shall only be installed and serviced by qualified service personnel
- To be sure of safety, do not modify or add anything other than mentioned in this manual or indicated by FAAC SpA
- Replace fuses only with the same type and rating
- Supply connections
- The AT-8 may be connected to 230 VAC or 24VDC

CAUTION !

For continued protection against risk of fire, replace only with same type of fuse.

AT-8 (PS-270) board (See par 2.4)

F1 : 250V, 100mA slow blow

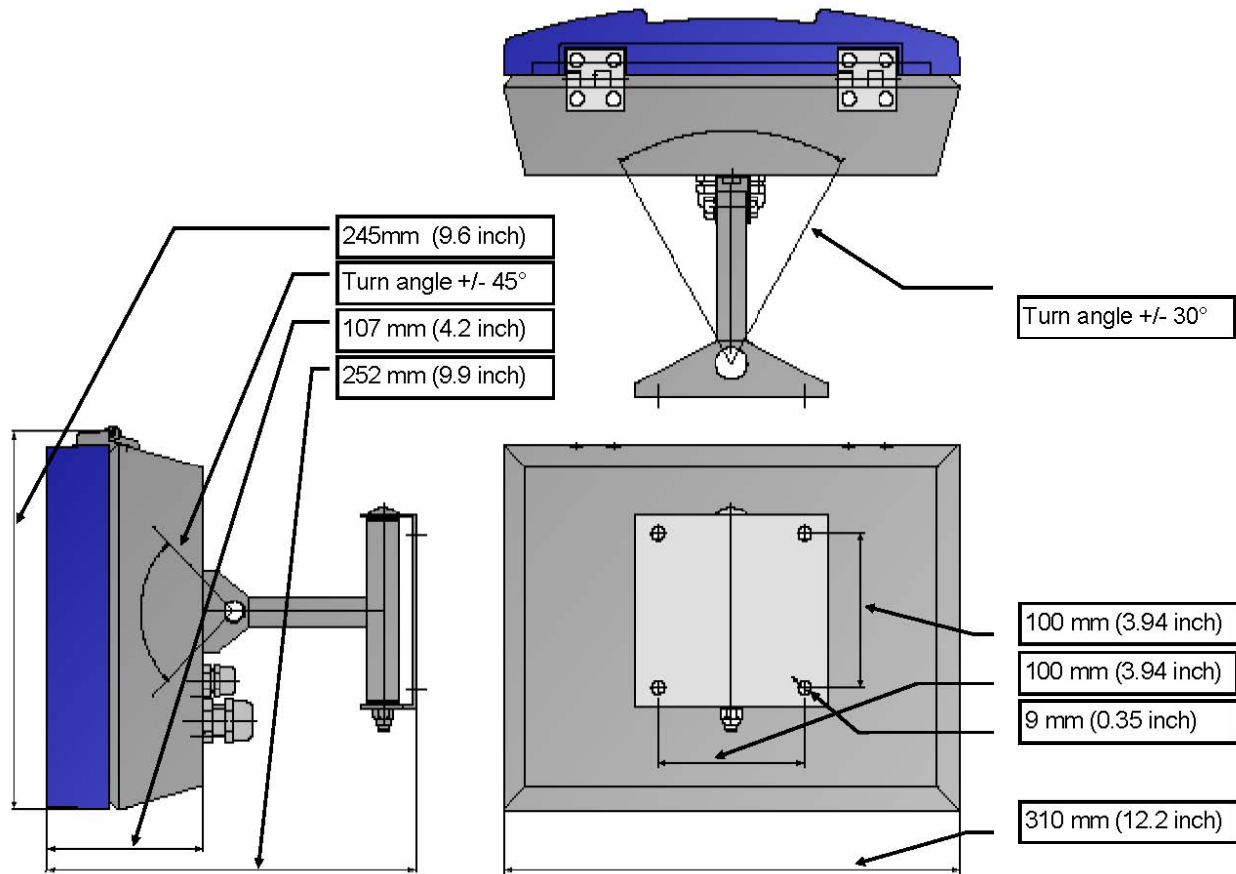
F2 : 250V, 1A slow blow

INSTALLATION

2.1 MOUNTING

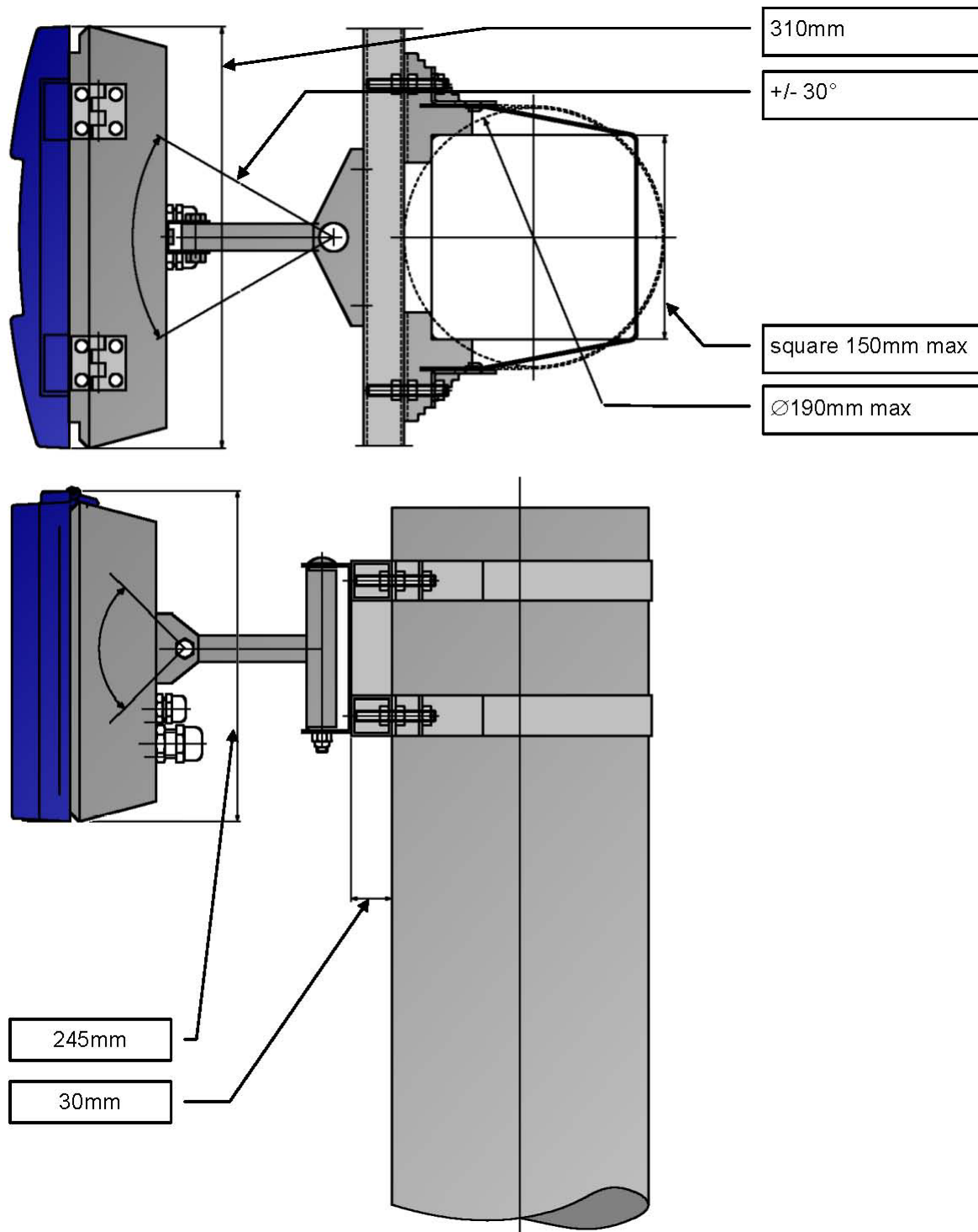
The AT-8 reader can be installed in any position. Normally the reader shall be mounted in a horizontal position, then the coverage area in the horizontal plane is maximized. In some applications a vertical installation is required to make use of the smaller beam width in the vertical plane. The mounting brackets which make rotation in the vertical and horizontal plane possible is standard included in every AT-8.

2.1.1 WALL MOUNTING



2.1.2 MAST MOUNTING

The AT-8 can be mounted to round masts (max. 190mm / 7.5 inch) and square masts (max. 150mm / 5.9 inch) using the universal mast mounting set .
This mounting set has to be ordered separately.



2.2 BASIC CONNECTIONS

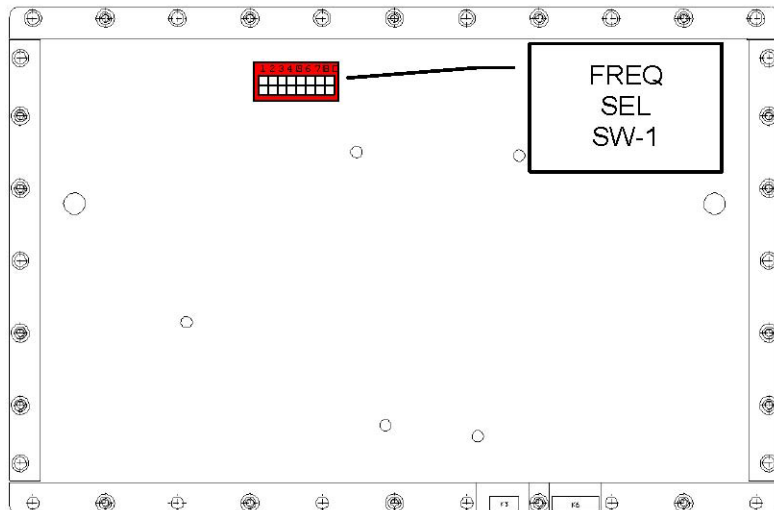
BASIC CONNECTIONS	CABLE TYPE	MAX LENGTH	FUNCTIONAL DESCRIPTION	SIGNAL NAMES
MAINS-SUPPLY (AT-8 PS-270)	3 * 0.75 mm ²	N/A.	System power supply. The safety ground shall be connected directly to the chassis. CAUTION: THIS UNIT MUST BE INSTALLED AND SERVICED BY A LICENSED AND CERTIFIED ELECTRICIAN, WHEN CONNECTED TO AN A/C POWER SOURCE.	Mains-L Mains-N Safety Ground
DC-SUPPLY (AT-8 PS-270)	2 * 1.5 mm ²	45 meter (140 ft USA only)	System power supply.	+24VDC GND

HOST-COM B-W-O-OUT	4 * 0.25 mm ² shielded	50 meter (140 ft USA only)	See firmware manual, special code emulation outputs.	O-1 O-2 O-3 GND
---------------------------	-----------------------------------	----------------------------	--	--------------------------

BASIC CONNECTIONS	CABLE TYPE	MAX LENGTH	FUNCTIONAL DESCRIPTION	SIGNAL NAMES
RS 232-C	3 * 0.25 mm ² shielded (cable capacity <= 100 pF/meter)	Maximum 15 meter (50 ft)	When RS-232 communication board is placed.	TX GND RX

1.3 TRANSCEIVER BOARD

2.3.1 TRANSCEIVER DIP-SWITCH SETTINGS



DIP-SWITCH	TYPE	FUNCTION	DESCRIPTION	NUMBER
SW-1	8 bit DIP-switch	Frequency selection. LSB changes results in 600 kHz frequency changes.	Channel select within sub band	S-1
			Channel select within sub band	S-2
			Channel select within sub band	S-3
			Channel select within sub band	S-4
			Sub band selection	S-5
			Sub band selection	S-6
			Sub band selection	S-7
			Sub band selection	S-8

See next pages for frequency selection tables.

Frequency selection table sub band 1 and 2.

SUBBAND 1					SUBBAND 2				
SW1	S-5	S-6	S-7	S-8	SW1	S-5	S-6	S-7	S-8
1	0	1	0		0	0	1	0	
Frequency kHz	S-1	S-2	S-3	S-4	Frequency kHz	S-1	S-2	S-3	S-4
2.400.600	0	1	1	1	2.409.600	1	1	1	1
2.401.200	1	0	1	1	2.410.200	0	1	1	1
2.401.800	0	0	1	1	2.410.800	1	0	1	1
2.402.400	1	1	0	1	2.411.400	0	0	1	1
2.403.000	0	1	0	1	2.412.000	1	1	0	1
2.403.600	1	0	0	1	2.412.600	0	1	0	1
2.404.200	0	0	0	1	2.413.200	1	0	0	1
2.404.800	1	1	1	0	2.413.800	0	0	0	1
2.405.400	0	1	1	0	2.414.400	1	1	1	0
2.406.000	1	0	1	0	2.415.000	0	1	1	0
2.406.600	0	0	1	0	2.415.600	1	0	1	0
2.407.200	1	1	0	0	2.416.200	0	0	1	0
2.407.800	0	1	0	0	2.416.800	1	1	0	0
2.408.400	1	0	0	0	2.417.400	0	1	0	0
2.409.000	0	0	0	0	2.418.000	1	0	0	0
					2.418.600	0	0	0	0

Frequency selection table sub band 3 and 4.

SUBBAND 3					SUBBAND 4				
SW1	S-5	S-6	S-7	S-8	SW1	S-5	S-6	S-7	S-8
1	1	0	0		0	1	0	0	
Frequency kHz	S-1	S-2	S-3	S-4	Frequency kHz	S-1	S-2	S-3	S-4
2.419.200	1	1	1	1	2.428.800	1	1	1	1
2.419.800	0	1	1	1	2.429.400	0	1	1	1
2.420.400	1	0	1	1	2.430.000	1	0	1	1
2.421.000	0	0	1	1	2.430.600	0	0	1	1
2.421.600	1	1	0	1	2.431.200	1	1	0	1
2.422.200	0	1	0	1	2.431.800	0	1	0	1
2.422.800	1	0	0	1	2.432.400	1	0	0	1
2.423.400	0	0	0	1	2.433.000	0	0	0	1
2.424.000	1	1	1	0	2.433.600	1	1	1	0
2.424.600	0	1	1	0	2.434.200	0	1	1	0
2.425.200	1	0	1	0	2.434.800	1	0	1	0
2.425.800	0	0	1	0	2.435.400	0	0	1	0
2.426.400	1	1	0	0	2.436.000	1	1	0	0
2.427.000	0	1	0	0	2.436.600	0	1	0	0
2.427.600	1	0	0	0	2.437.200	1	0	0	0
2.428.200	0	0	0	0	2.437.800	0	0	0	0

Frequency selection table sub band 5 and 6.

SUBBAND 5					SUBBAND 6				
S-5	S-6	S-7	S-8		S-5	S-6	S-7	S-8	
1	0	0	0	SW1	0	0	0	0	
Frequency kHz	S-1	S-2	S-3	S-4	Frequency kHz	S-1	S-2	S-3	S-4
2.438.400	1	1	1	1	2.448.000	1	1	1	1
2.439.000	0	1	1	1	2.448.600	0	1	1	1
2.439.600	1	0	1	1	2.449.200	1	0	1	1
2.440.200	0	0	1	1	2.449.800	0	0	1	1
2.440.800	1	1	0	1	2.450.400	1	1	0	1
2.441.400	0	1	0	1	2.451.000	0	1	0	1
2.442.000	1	0	0	1	2.451.600	1	0	0	1
2.442.600	0	0	0	1	2.452.200	0	0	0	1
2.443.200	1	1	1	0	2.452.800	1	1	1	0
2.443.800	0	1	1	0	2.453.400	0	1	1	0
2.444.400	1	0	1	0	2.454.000	1	0	1	0
2.445.000	0	0	1	0	2.454.600	0	0	1	0
2.445.600	1	1	0	0	2.455.200	1	1	0	0
2.446.200	0	1	0	0	2.455.800	0	1	0	0
2.446.800	1	0	0	0	2.456.400	1	0	0	0
2.447.400	0	0	0	0	2.457.000	0	0	0	0

Frequency selection table sub band 7 and 8.

SUBBAND 7					SUBBAND 8				
S-5	S-6	S-7	S-8		S-5	S-6	S-7	S-8	
1	1	1	1	SW1	0	1	1	1	
Frequency kHz	S-1	S-2	S-3	S-4	Frequency kHz	S-1	S-2	S-3	S-4
2.457.600	1	1	1	1	2.467.200	1	1	1	1
2.458.200	0	1	1	1	2.467.800	0	1	1	1
2.458.800	1	0	1	1	2.468.400	1	0	1	1
2.459.400	0	0	1	1	2.469.000	0	0	1	1
2.460.000	1	1	0	1	2.469.600	1	1	0	1
2.460.600	0	1	0	1	2.470.200	0	1	0	1
2.461.200	1	0	0	1	2.470.800	1	0	0	1
2.461.800	0	0	0	1	2.471.400	0	0	0	1
2.462.400	1	1	1	0	2.472.000	1	1	1	0
2.463.000	0	1	1	0	2.472.600	0	1	1	0
2.463.600	1	0	1	0	2.473.200	1	0	1	0
2.464.200	0	0	1	0	2.473.800	0	0	1	0
2.464.800	1	1	0	0	2.474.400	1	1	0	0
2.465.400	0	1	0	0	2.475.000	0	1	0	0
2.466.000	1	0	0	0	2.475.600	1	0	0	0
2.466.600	0	0	0	0	2.476.200	0	0	0	0

Frequency selection table sub band 9.

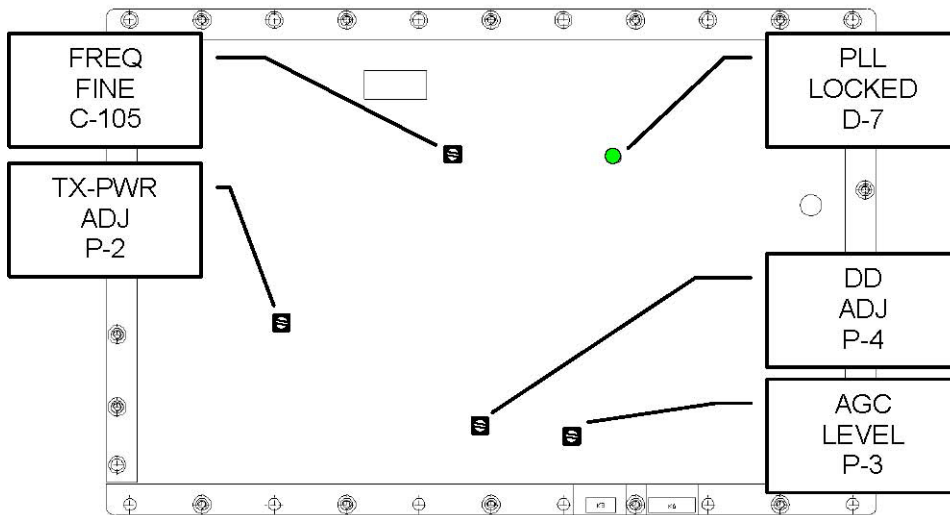
SUBBAND 9		S-5	S-6	S-7	S-8
SW1		1	0	1	1
Frequency kHz	S-1	S-2	S-3	S-4	
2.476.800	1	1	1	1	
2.477.400	0	1	1	1	
2.478.000	1	0	1	1	
2.478.600	0	0	1	1	
2.479.200	1	1	0	1	
2.479.800	0	1	0	1	
2.480.400	1	0	0	1	
2.481.000	0	0	0	1	
2.481.600	1	1	1	0	
2.482.200	0	1	1	0	
2.482.800	1	0	1	0	

2.3.2 TRANSCEIVER INDICATIONS

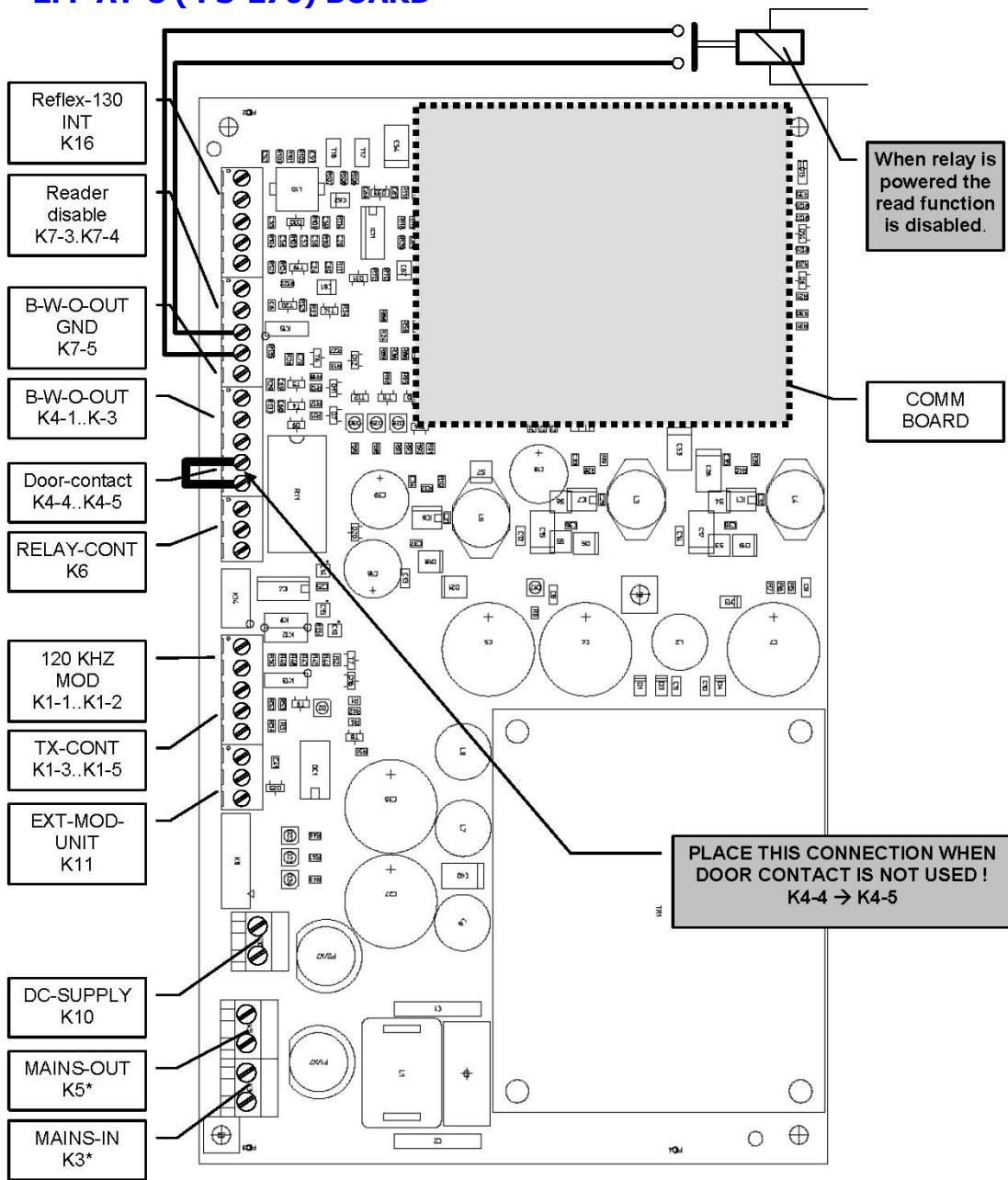
Indications Transceiver unit	Indication type	Description	Indication number
PLL LOCKED	Dual color LED	Red indicates PLL is unlocked. Green indicates PLL is locked.	D-7

2.3.3 TRANSCEIVER ADJUSTMENTS

ADJUSTMENT	TYPE	FUNCTION	DESCRIPTION	NUMBER
FREQ –FINE	Trim cap.	Factory setting	Fine tuning reference frequency for synthesizer.	C-105
TX-PWR	Trim pot.	Customer setting	Reduction transmitter power by maximum 20 dB. Maximum EIRP < 18 dBm .	P-2
DD-ADJ	Trim pot.	Factory setting	Received data duty cycle correction.	P-4
AGC-LEVEL	Trim pot.	Factory setting	AGC reference level adjustment.	P-3



2.4 AT-8 (PS-270) BOARD

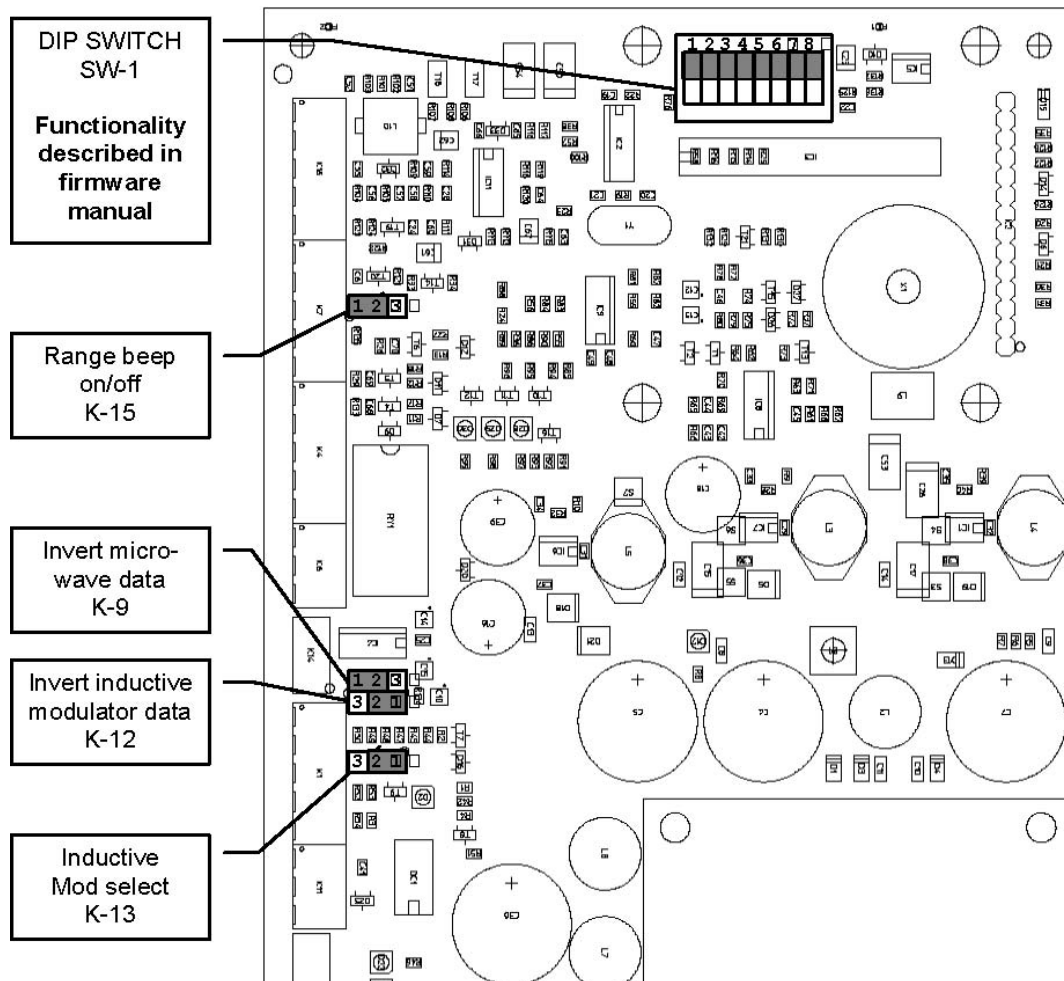


AT-8 (PS-270) CONNECTIONS

CONNECTION	TYPE	FUNCTION	DESCRIPTION	NAME	NUMBER
Reflex-130 INT (K16)	5-p mkds phoenix	External connection Reflex-130	120 kHz antenna con.	HF+	1
			120 kHz antenna con.	HF-	2
			LED cont. high pos. ID	UL	3
			Ground	GND	4
			LED cont. high neg. ID	NA	5
Reader disable (K7-1..K7-4)	5-p mkds phoenix	Controls the flow of data to the controller.	Spare	n.c.	1
			Spare	n.c.	2
			Reader disable	RDIS	3
			+5 VDC connection	5V	4
B-W-O-OUT GND (K7-5)	5-p mkds phoenix	Code emulation.	Ground to be used for Omron, Wiegand and Barcode output.	GND	5
B-W-O-OUT (K4-1..K4-3)	5-p mkds phoenix	Code emulation.	Output for Omron, Wiegand and Barcode Ground. Refer to the firmware manual.	O-1	1
				O-2	2
				O-3	3
Door contact (K4-4..K4-5)	5-p mkds phoenix	Door contact	Door contact	DOOR	4
			Ground	GND	5
RELAY-CONT (K6)	3-p mkds phoenix	Floating relay contacts	Center contact	COM	1
			Normally closed contact	NC	2
			Normally open contact	NO	3
120 KHZ-MOD (K1-1..K1-2)	2-p mkds phoenix	120 kHz output from external NEDAP inductive reader	120 kHz connection	HF+	1
			120 kHz ground con.	HF-	2
TX-CONT (K1-3..K1-5)	2-p mkds phoenix	Transmit-ter control	Ground for control sign.	GND	3
			TTL signal PLL locked	LCK	4
			TTL input to enable TX	TXD	5
EXT-MOD-UNIT (K11)	3-p mkds phoenix	Connects received tag data to external reader	Isolated ground	GND	1
			Optical isolated current loop connection	CLS	2
			5 VDC supply opto-	+5V	3

			coupler		
DC-SUPPLY (K10)	2-p mkds phoenix	External 24V Class 2 DC power connection	24 VDC input	+24VDC	1
			24 VDC supply ground	GND	2
MAINS-OUT (K5)*	2-p mkds phoenix	Internal connection to NX-500 optional board.	Mains output line	Mains-L	1
			Mains output neutral	Mains-N	2
MAINS-IN (K3)*	2-p mkds phoenix	External AC power connection	Mains output line	Mains-L	1
			Mains output neutral	Mains-N	2

2.4.2 AT-8 PS-270 U-LINKS

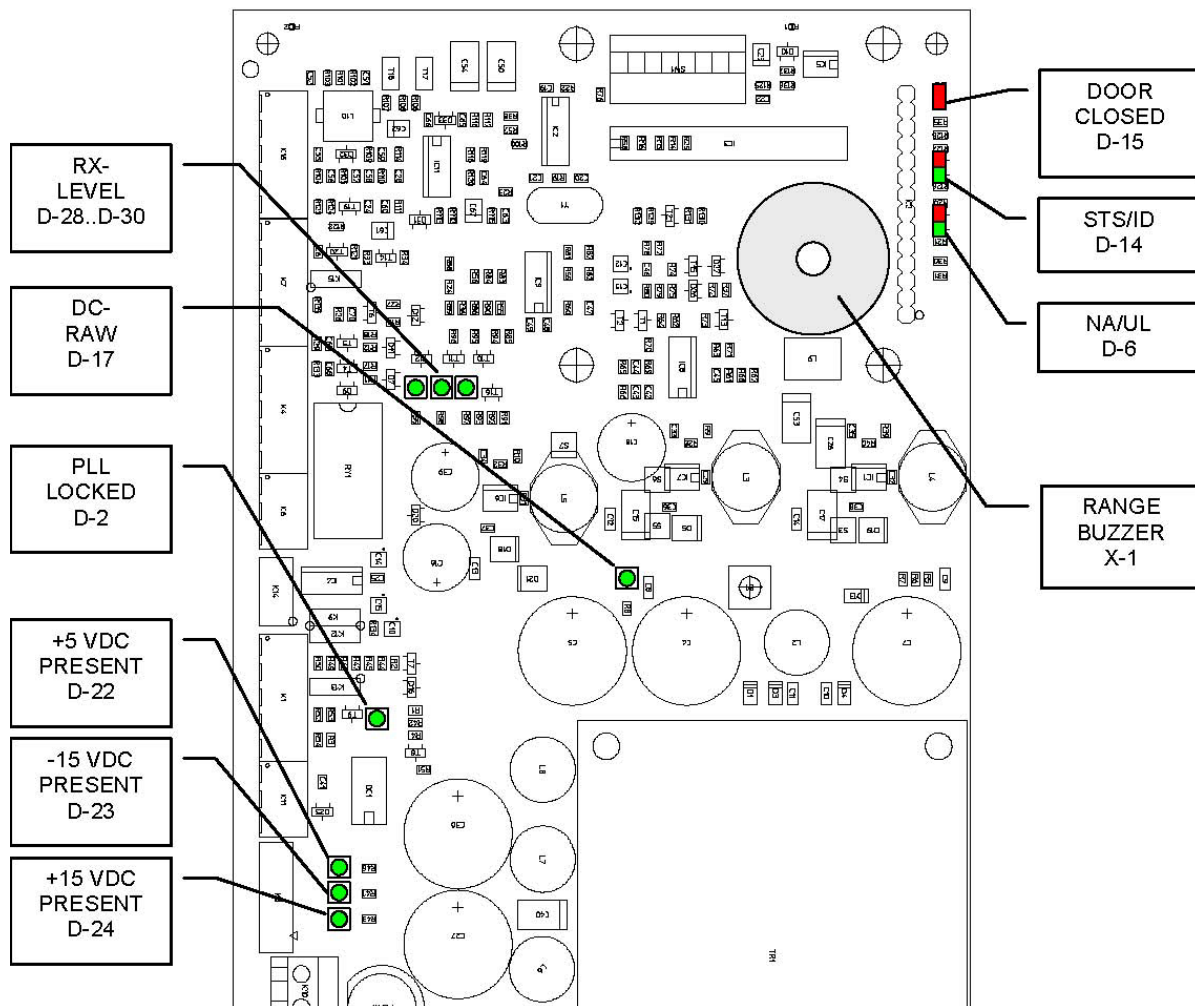


SETTING	POSITION	DESCRIPTION	NUMBER
Range beep function	12	Range beeper off (default)	K-15
	23	Range beeper on	
Invert microwave data	12	Microwave data not inverted (default)	K-9
	23	Microwave data inverted (may be required for AM)	
Invert inductive modulator data	12	TTL-data to modulator inverted (default)	K-12
	23	TTL-data to modulator not inverted	
Inductive modulator select	12	Selects modulator setting for current coupled receivers (as is needed for the NX500 or SimpleXS) (default)	K-13
	23	Selects modulator setting for voltage coupled receivers	

2.4.3 AT-8 PS-270 DIP-SWITCH SETTINGS

Refer to the firmware manual for a functional description of the DIP-switch settings.

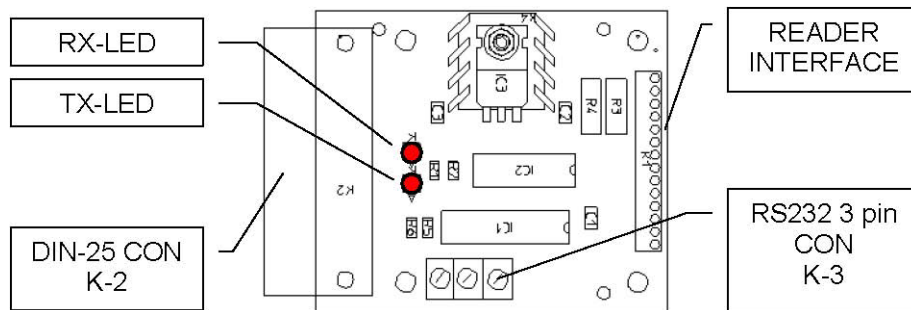
2.4.4 AT-8 PS-270 INDICATIONS



INDICATION	TYPE	DESCRIPTION	NUMBER
RX-LEVEL	LED green	LED bar indicating the received tag signal strength.	D-28..D-30
DC-RAW	LED green	LED active indicates that the DC supply is present.	D-17
PLL LOCKED	LED green	LED active indicates PLL is locked.	D-2
+5 VDC PRES	LED green	LED active indicates that this voltage is present.	D-22
-15 VDC PRES	LED green	LED active indicates that this voltage is present.	D-23
+15 VDC PRES	LED green	LED active indicates that this voltage is present.	D-24
NA	Dual color LED (red)	LED indicates that the AT-8 is standby and the door is locked	D-6
UL	Dual color LED (green)	LED indicates that a tag is detected, shall stay active during unlock time. The door is unlocked.	D-6
STS	Dual color LED (red)	Status LED indicates that processor is running (heartbeat).	D-14
ID	Dual color LED (green)	LED indicates tag recognition (fast blinking).	D-14
DOOR CLOSED	LED red	LED active indicates door contact closed.	D-15
RANGE BUZZER	Sound	When activated by U-link K-15 and a valid tag is present the beep repeat frequency gives an indication for the received signal strength from the tag.	X-1

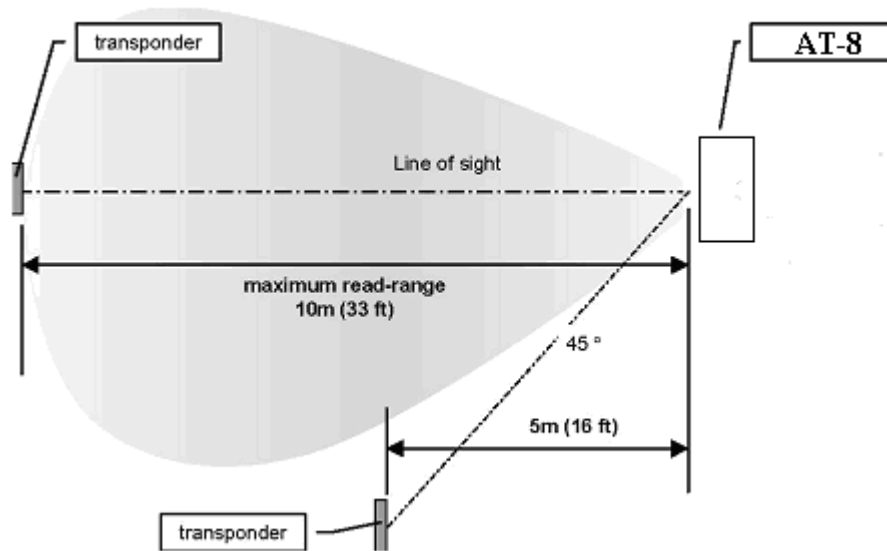
3 COMMUNICATION INTERFACES

3.4 RS-232



RS-232 CONN	TYPE	DESCRIPTION	NAME	PIN NO.
RS232 3 pin CON K-3	3 pin WECO PCB	Transmit (output)	TX	1
		Ground	GND	2
		Receive (input)	RX	3
DIN-25 CON K-2	DIN-25 connector female	Transmit (output)	TXD	2
		Receive (input)	RXD	3
		Ground (shield)	GND	7
		Identifier (max 100 mA)	+5VDC	9

4. COVERAGE AREA



The AT-8 system operates in the 2.4 to 2.45 GHz ISM band. The tags used with the AT-8 system are all equipped with lithium battery's to power the internal logic. The tags do not contain a transmitter but are using the received power from the reader, after modification, for re-transmission to the reader. This principle is called modulated backscatter. The tags are so called field modifying devices. The received RF power from the reader is modulated with the data from the chip containing the ID-number. To read a tag there has to be a line of sight to the tag from the reader. Most synthetic materials are transparent for RF energy with little attenuation and are forming no obstruction. Snow and ice are no problem as long as it is in crystal form. Closed water films are a problem for the detection range. Heavy rain shall be no problem as long as there is no closed water film on the AT-8 front cover or on the tag. To reduce the influence of unwanted reflections circular polarization is used, this brings also rotation freedom for the tag. Placing the tags on metal surface is not influencing the read range.

The antenna diagram of the AT-8 has a vertical beam width of 40° and a horizontal beam width of 80° . The tags are having a symmetrical diagram, 80° in the horizontal and vertical plane. The coverage area is based on the combination of the two diagrams. When defining the reading range between reader and tag one should take in account the misalignment between reader and tag. Good practice is to reduce the read range by a factor of two when the tag is on the -3 dB points of the reader antenna and the normal on the tag still parallel to the main axes of the reader.

One has to keep in mind that the misalignment is most of the time present in two planes. This makes simple evaluation of the coverage area difficult. A computer model has been developed in which most geometries can be evaluated. Contact FAAC when in doubt. In par. 4.5 the detection area for a number of practical situations is given.

4.3 SPEED LIMITATIONS

The maximum speed a transponder can pass the reader antenna and the transponder can be read is depended on the following factors:

- Length of the detection trajectory typical 6 meter
- Distance between reader and tag typical 5 meter
- Number of valid frames needed for valid read typical 3
- Length of code (frame length) typical 64 bits
- Data rate 1.875 KBPS
- Frame time 34 msec

In this situation the maximum transponder passage speed is 200 km/hour (125 mph). For every other geometry one should carefully consider the above mentioned parameters before a specification on the maximum speed is defined.

This speed can ONLY be obtained with firmware in the 64 bit detection mode. See firmware user manuals.

4.4 USING MORE AT-8 SYSTEMS AT ONE LOCATION

When two or more AT-8 readers are within a range of 15 meters (50 ft), these readers should have a frequency offset of at least 600 kHz with respect to each other. The frequency should be factory set. When in doubt or when two readers are 'looking' to each other, frequency offset is recommended. This frequency offset has to stay within the local radio regulations.

When two readers are heaving a frequency offset they can be mounted close together and they can read the same tag at the same time.

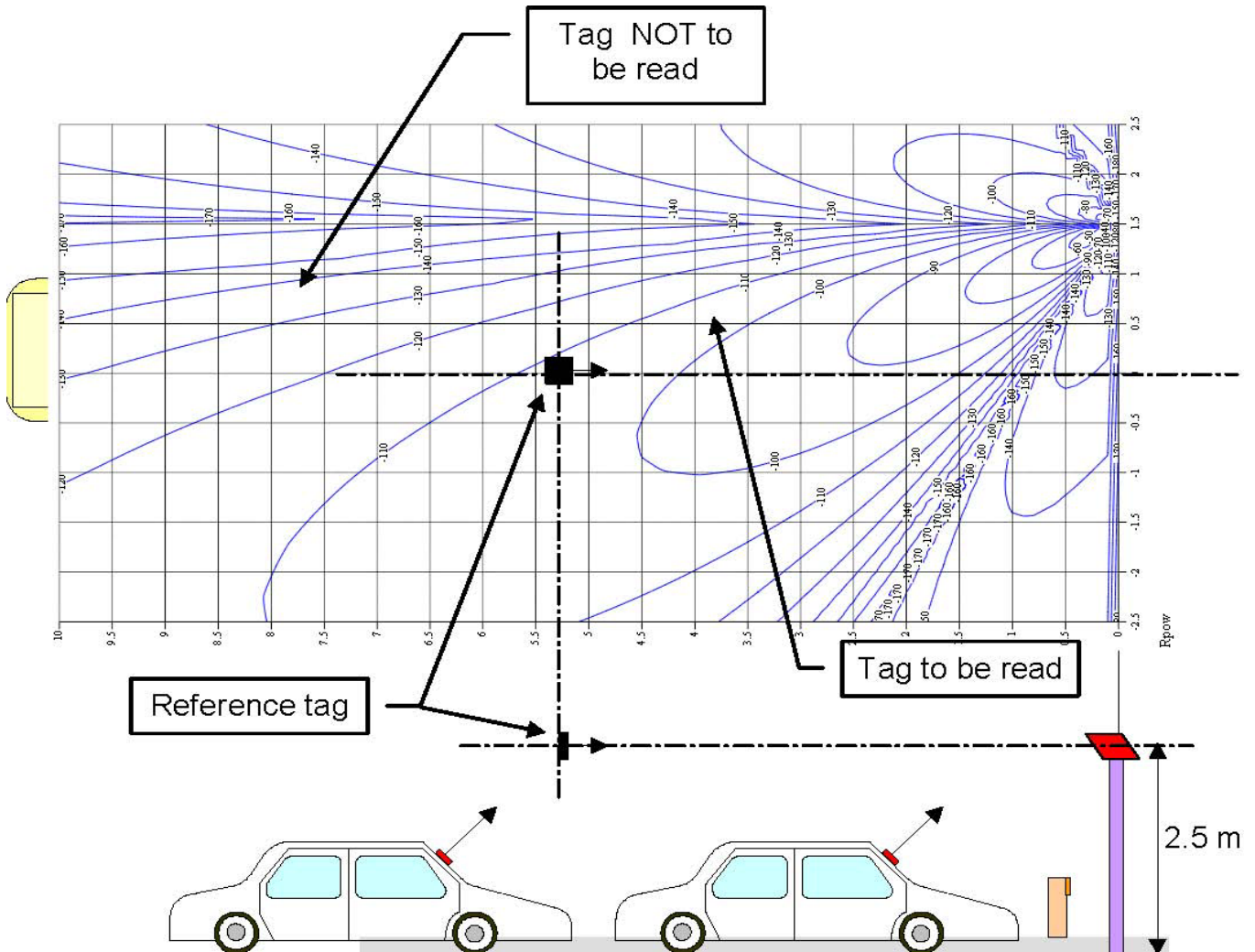
4.5 READ RANGE CONTROL

4.5.1 REFERENCE TAGS

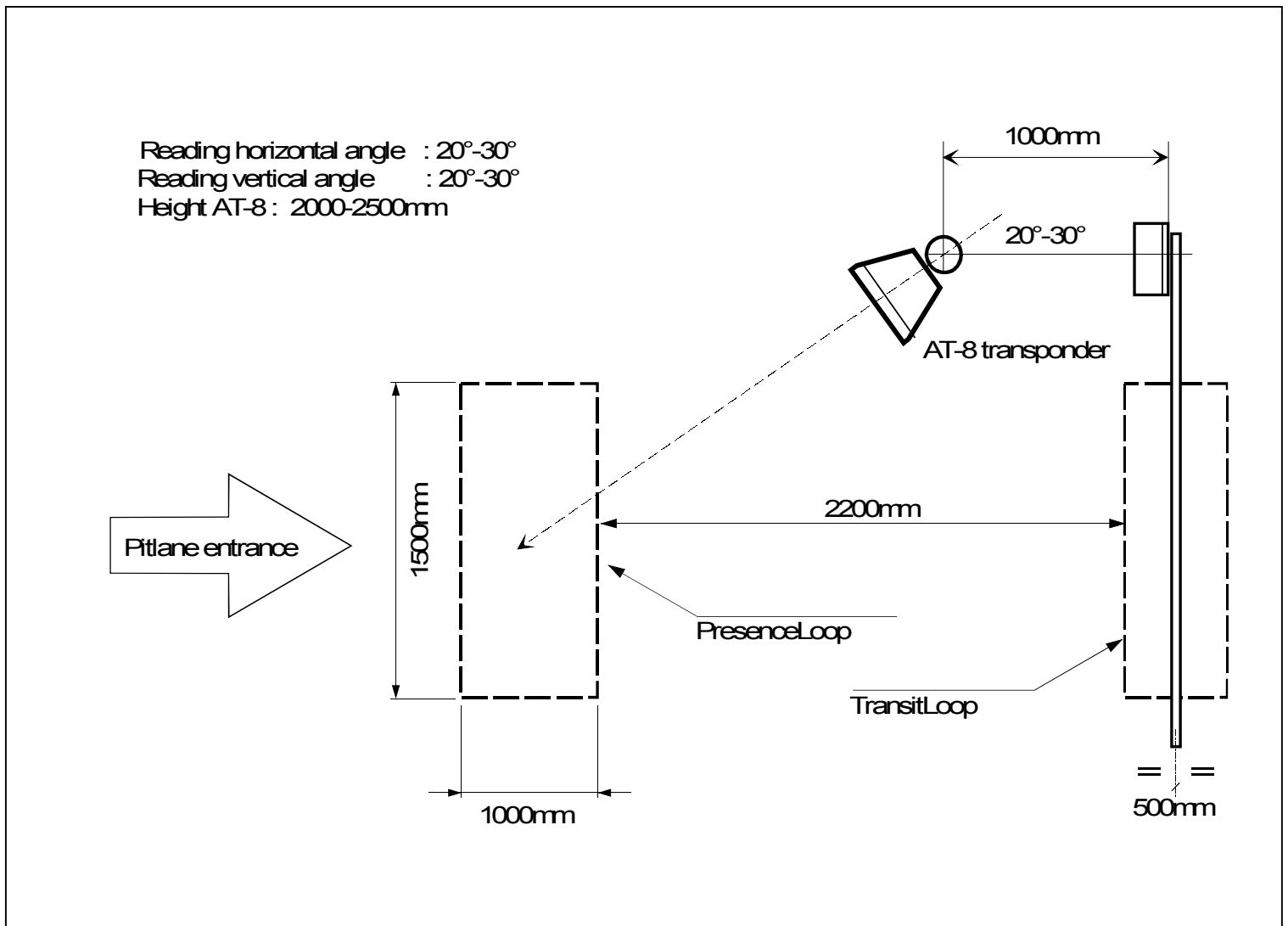
By means of so called reference tags, read range can be controlled in a practical manor. This can be necessary when no cross readings between adjacent lanes is allowed. Reference tags are normal tags which are programmed with a customer code that is different from the customer code used in the application.

By placing the reference tag in the reading zone of the AT-8 it sets a certain received signal level. A tag that is to be detected has to have a received signal level above the level set by the reference tag.

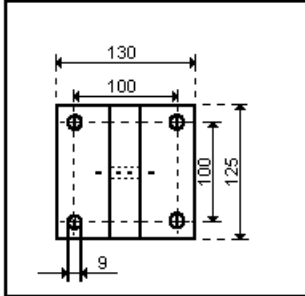
The example below shows how a reference tag is located to limit the AT-8 reading zone.



4.5.1 Positioning and guideline AT-8 reader



5. CONNECTIONS COBRA



Electric wiring

To wire the unit, unscrew the two screws located on the front side and open the cover.

Terminal clamps are now visible on the side of board.

Wiring scheme is shown below.

Please use the build in cable passage, located on the rear of the unit, to power the device and control board.

It is recommended the use of adequate cross section cables in order to ensure the watertight

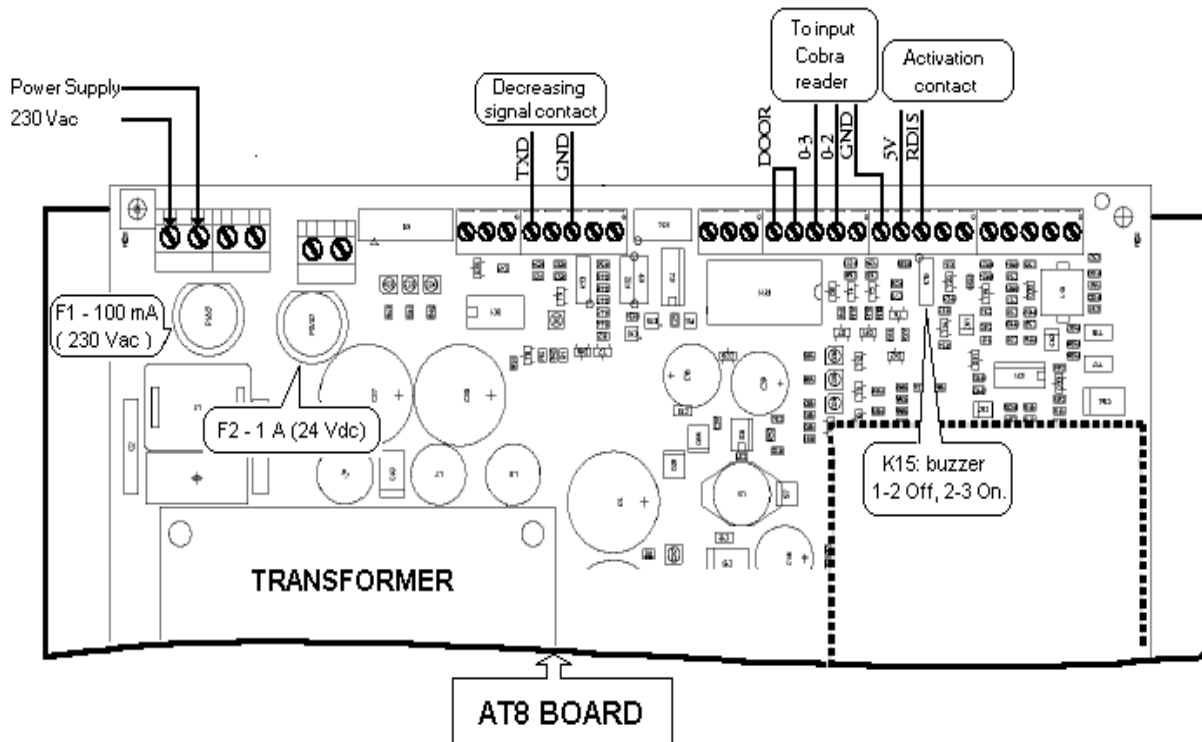
Cables to be used:

n°1 flameproof cable 2 X 1,5mm + GND for 230 Vac power.

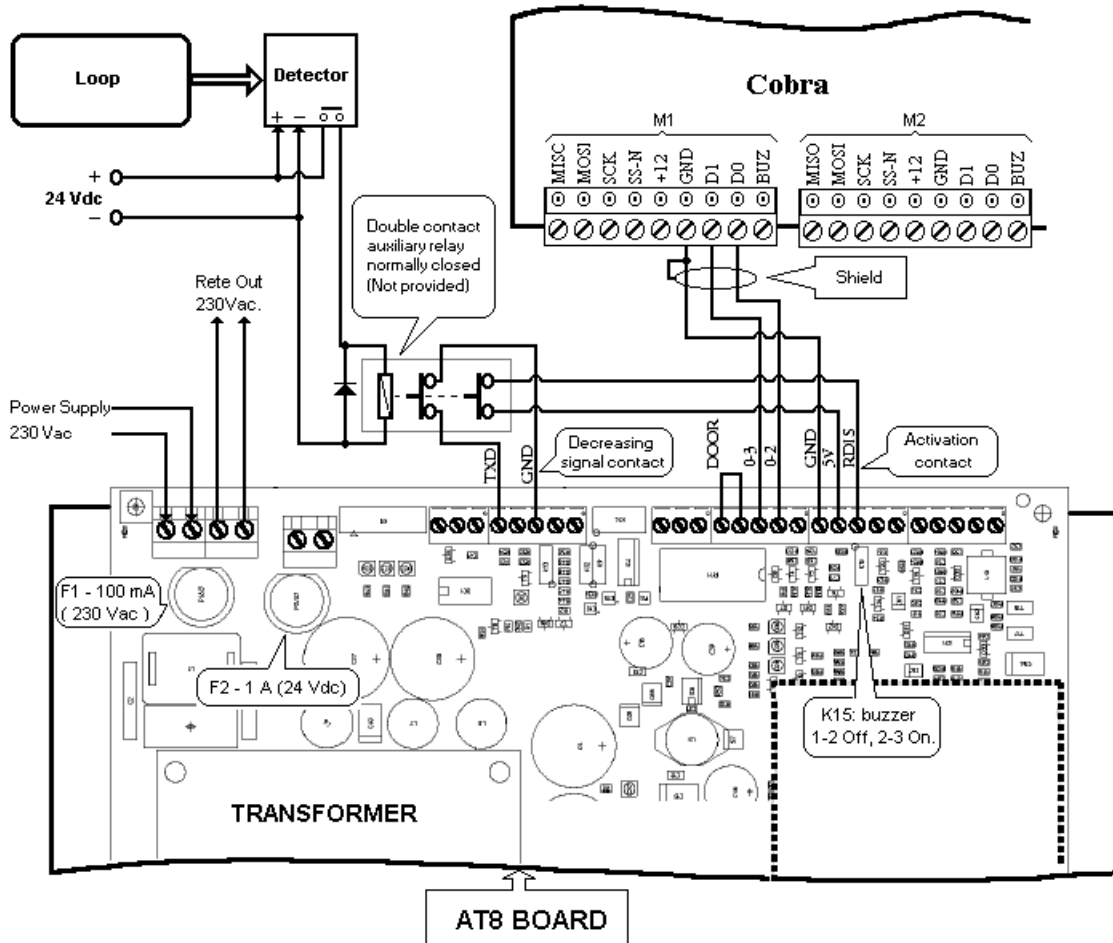
n°1 flameproof cable 3 X 0,50mm shielded to link output reader on Cobra (M1/M2) and reader AT8. Wire the shield only on Cobra side.

Max distance allowed between AT8 reader and Cobra is 50 mt. This distance is related to cable length between reader input on Cobra and reader AT8.

Terminal clamps on AT8 board



Emission power reduction and reader unabling when no cars are on the lane



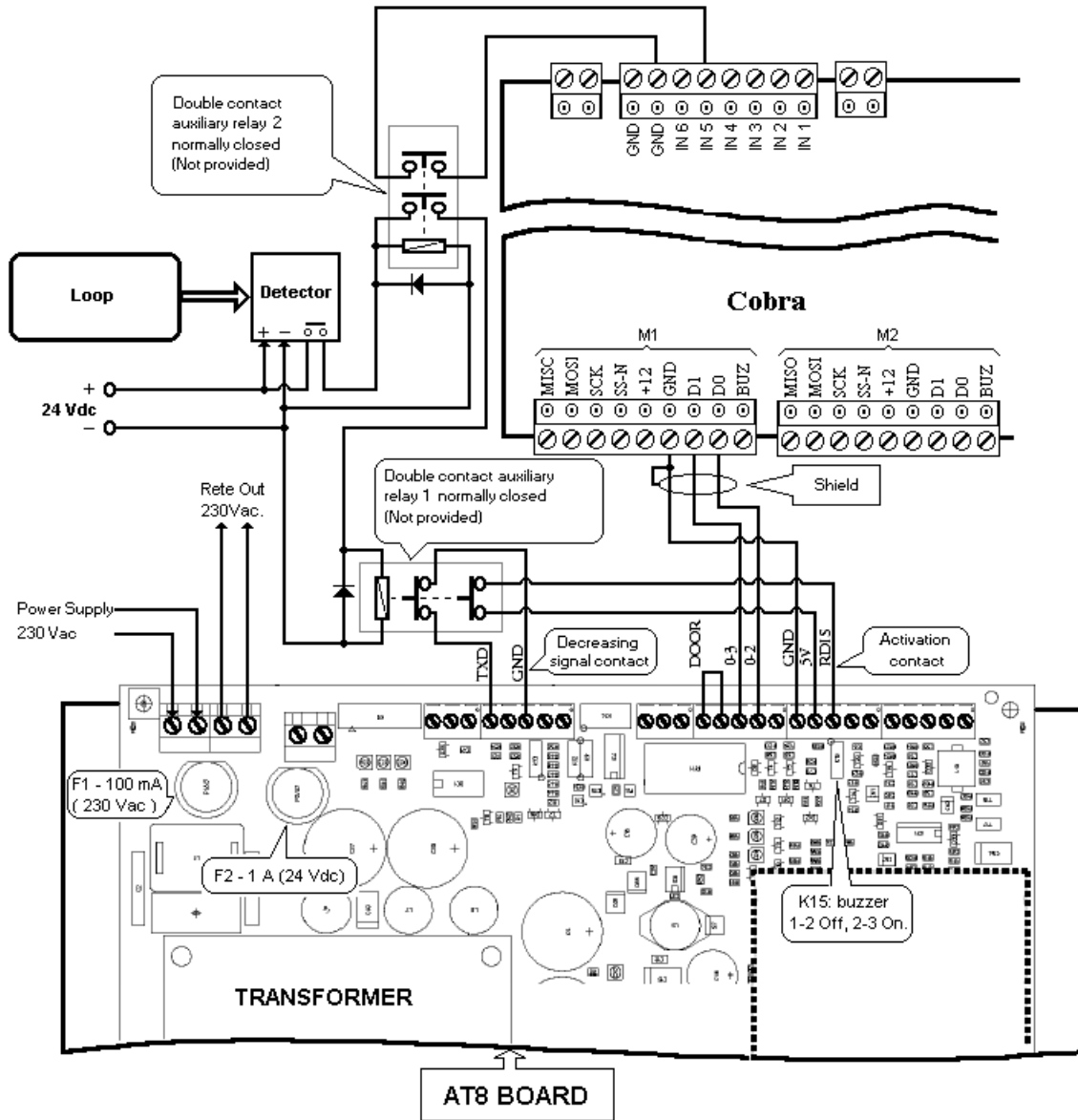
Technical notes:

Used relays are 24 V d.c. low enabling current, double exchange Normally closet contacts are used.

NB: connections on the above scheme refer to a reader on input A of Cobra.

IMPORTANT: aux.relay is not provided with the equipment and must be located on the AT8 cabinet (not close to aerial).

Emission power reduction, reader and Cobra unabling when no cars are on the lane



Technical notes:

Used relays are 24 V d.c. low enabling current, double exchange

Normally closet contacts are used on relay 1 an normally open on relay 2.

NB: connections on the above scheme refer to a reader on input A of Cobra.

If AT 8 is linked on input B, connect outputs of aux.relay 2 to GND and input 6 of Cobra.

IMPORTANT: aux.relay is not provided with the equipment. Relay 1 must be located on the AT8 cabinet (not close to aerial).Relay 2 must be located on the Cobra box.

Appendix A TECHNICAL SPECIFICATIONS

ITEM	SPECIFICATION	REMARKS
Housing	Stainless steel	
Dimensions	310 x 250 x 100 (12.2 x 9.8 x 3.9 inch)	
Weight	< 5 kg (9.9 pounds)	
Protection class	IP 65 / UL 50	
Temperature operational	-30°C .. +50°C	Ambient temperature, and under sun protection.
Temperature storage	-40°C .. +85°C	
Relative humidity	10 .. 93% non-condensing.	
Identification range	Typical 10 meters (33 ft)	Tag in line of sight.
Object speed	200 km/h (125 mph)	Identification trajectory > 5 meter, 64 bit tag only.
Power supply	230VAC +/- 10%, 100 mA, 50/60 Hz 24 VDC +/- 10 %, 500 mA	DC supply shall be capable of delivering a 1 A inrush current.
Power supply AT-8	24 VDC +/- 10 %, 500 mA	Class 2 power supply according local regulations
Power consumption	30 VA (AT-8 Extended) 18 VA (AT-8)	
Frequency range	2400.6 MHz..2482.8 MHz 2438.4 MHz..2457.0 MHz (USA only)	Selected by DIP-switch, sealed in factory.
Number of channels	138 / 32 (USA only)	
Channel spacing	600 kHz	To be used when systems are close together.
Polarization	Circular (LHC)	
EIRP	Max 18.7 dBm linear	
Receiver sensitivity	-100 dBm	
Antenna gain	> 8 dBi	Valid for RX-array and TX-array
EMC	In accordance with the 89/336/EEC European directive EN 50081-1, EN 50082-1 EN 50082-2, ETS 0908	
Safety	EN 60950 UL 60950	
Complies to the following regulations	FCC Part 15.245 ETS 300 440	