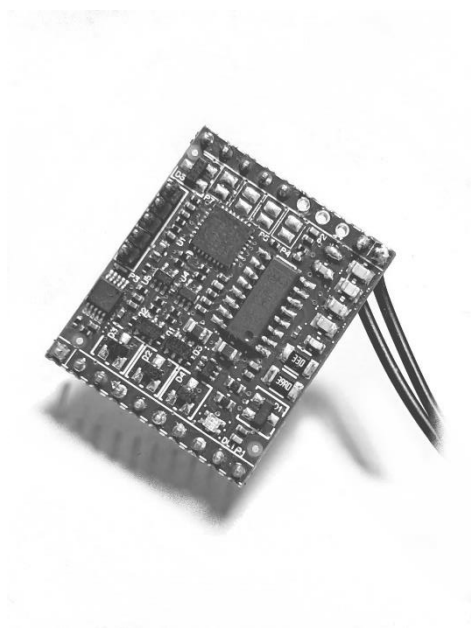




PM-R125

RFID LF INTERFACE MODULE



USER MANUAL

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1. Introduction

This manual describes the RFID LF Interface module type PM-R125.

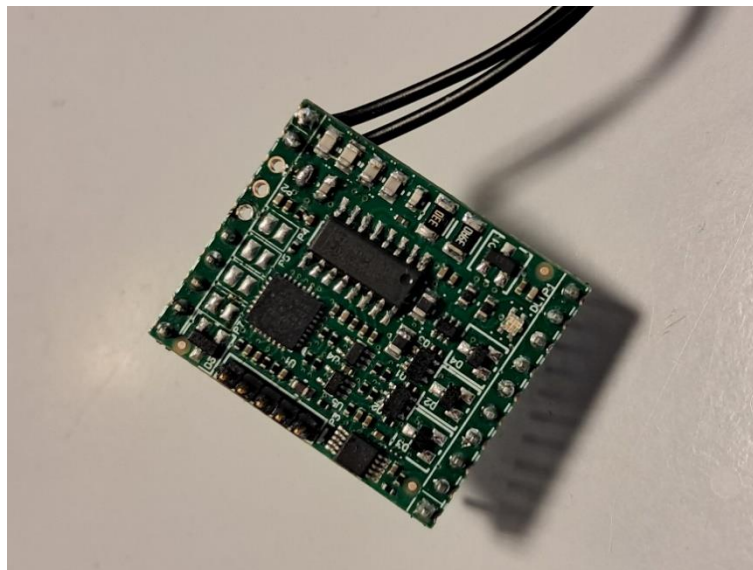
The module has been developed for an easy integration in OEM systems for RFID reading and writing. The module is intended as internal component of the OEM device; module supply, connection, prescribed antennas and programming are exposed in this manual.

1.1. Applicability

The module is available in two arrangements of the serial communication port: TTL or RS-232 buffered.

Model	Description
PM-R125-232	Version with RS-232 serial port for use with the prescribed LF (125kHz) tuned antennas.
PM-R125-TTL	Version with serial port at TTL level for use with the prescribed LF (125kHz) tuned antennas.

Fig. 1: Aspect



2. Regulatory

This device has been tested and complies with the following regulations

FCC CFR Part 15 (Title 47 of the Code of Federal Regulations, Chapter I, Subchapter A, Part 15, “Radio Frequency Devices”)

ISED Radio Standards Specification RSS-210, Issue 11

Radio Equipment Directive 2014/53/EU and amendments

Restriction of Hazardous Substances Directive 2011/65/EU and amendments

2.1. Intended Use

The device is intended as LF (125kHz) interface module for LF RFID reading/writing to be integrated into OEM equipment.

2.2. Warranty

Tecnint HTE Srl grants to repair or, at their own discretion, to replace every and all parts recognized as defective for materials or construction under normal operating conditions for a period of 1 year from purchase date, as it can be inferred from the User’s purchase documents. Warranty does not cover faults due to:

- Usage that differs from the **intended use** as reported in this manual.
- Tampering or misuse of the appliance.
- Improper installation.
- Operation under out-of-specification environmental condition for this appliance.

ATTENTION

Warranty is effected at Tecnint HTE Srl Factory. Back shipment shall be arranged by the Customer; in this case a shipping covered by insurance is recommended. The customer will be responsible for damages due to inadequate packaging.

Responsibility

Tecnint HTE Srl is not liable for damages due to:

- External causes (mechanical/electrical damages due to any events which exceed the specification limits)
- Different usage from the intended use of the device.
- Any improper use or misuse of the device not compliant with the indications of this manual
- Servicing or tampering by unauthorized personnel.

2.3. FCC Statement

This device complies with part 15 of the FCC rules.

Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a **Class B** digital device, pursuant to **part 15** of the **FCC Rules**. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*



Important Note:

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. Country Code selection feature to be disabled for products marketed to the US/Canada.

This device is intended only for OEM integrators under the following conditions:

1. *The antenna must be installed such that 20 cm is maintained between the antenna and users, and*
2. *The transmitter module may not be co-located with any other transmitter or antenna*



Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01.

2.1 End Product Labelling

The final end product must be labelled in a visible area with the following “**Contains FCC ID: 2BOIL-PMR125**”

2.2 List of applicable FCC rules

Designed for professional integration into host devices, PM-R125 radio module complies with the following FCC Rules:
47 CFR FCC Part 15, Subpart C

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

The module requires the host integrator to file a Class II permissive change for each specific host, considering the test plan detailed in chapter 2.3 (§2.9 and §2.10).
A host manufacture is recommended to use FCC’s KDB 996369 D04 Module Integration Guide V01 as “best practice” for RF design engineering, testing and evaluation.

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

This modular transmitter complies with FCC radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated at a minimum distance of 20 cm between the radiator and the human body.

This device and its antenna(s) must not be co-located or operated in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

2.7 Antennas

This radio transmitter **FCC ID: 2BOIL-PMR125** has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

<i>P/N Identification</i>	<i>Antenna type</i>	<i>Operate frequency band</i>	<i>Max. antenna gain</i>	<i>Notes</i>
PM-R125-ANT7043L	Loop antenna	LF 125kHz	0 dBi	Pre-tuned
PM-R125-ANT7044L124	Loop antenna	LF 124kHz	0 dBi	Pre-tuned

2.8 Label and compliance information

The final end product must be labelled in a visible area with the following “**Contains FCC ID: 2BOIL-PMR125**”.

2.9 Information on test modes and additional testing requirements

The host manufacturer installing this limited-approved module must perform radiated emission and spurious emission testing according to FCC Part 15C, section 15.209 as detailed below; only if the test result complies with FCC Part 15C, section 15.209 can the host be legally sold.

End devices (EUTs) embedding this radio module shall be tested according to the specifications set forth in CFR 47, Part 15C, §15.209 “Radiated emission limits; general requirements”, properly powered and connected to one of the following approved antennas:

- loop antenna 7043L
- loop antenna 7044L-124.0

Host manufacturer is responsible to assess conformity of the end product as detailed below:

Test plan:

- a) consider the measurement detector functions and bandwidths stated by §15.35 and follow ANSI C63.10 measurement procedures for setup
- b) measurements must be carried out in an anechoic chamber, or similar approved site
- c) place the EUT on the turn platform (e.g. turning table) within the anechoic chamber
- d) measuring antenna positioning:
 - in the 9 kHz-30 MHz frequency band, the recommended calibrated antenna connected to the sweep analyzer (RF receiver) should be a loop antenna positioned 10m away from the EUT
 - above 30 MHz, the calibrated antenna should be a broadband antenna (e.g. type log periodic) positioned 3m away from the EUT
- e) the RFID must be set in continuous transmission
- f) spectrum must be investigated for maximum spurious/harmonics emissions from 9 kHz up to 1 GHz
- g) limits are set forth in §15.209(a), by also considering that only spurious emissions are permitted in any of the frequency bands listed in §15.205 (restricted frequency bands).
- h) if EUT is AC powered, perform line conducted emissions using LISN per §15.207 and ANSI C63.10. If battery only, indicate “exemption”.

RF exposure (MPE) for mobile devices:

evaluate maximum permissible exposure per FCC OET Bulletin 65 and FCC rules according to §1.1310 and §2.1091.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

2.11 Information to the End User

The end user manual shall include all required Regulatory information/warning as follows:

Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

RF Radiation Exposure Statement:

This product complies with FCC radiation exposure limits set forth for an uncontrolled environment. The antenna should be installed and operated at a minimum distance of 20 cm between the radiator and the human body.

This device and its antenna(s) must not be co-located or operated in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

2.4. ISED Statement / Déclaration

• **English:** This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference, and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

The digital apparatus complies with Canadian CAN ICES-3 (B)/NMB-3(B).

This device meets the exemption from the routine evaluation limits in section 6.6 of RSS 102 and compliance with RSS 102 RF exposure, users can obtain Canadian information on RF exposure and compliance.

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

This device and its antenna(s) must not be co-located or operated in conjunction with any other antenna or transmitter except in accordance with ISED multi-transmitter product procedures.

This device complies with Health Canada's Safety Code. The installer of this device should ensure that RF radiation is not emitted in excess of the Health Canada's requirement.

Warning on the approved antennas

This radio transmitter has been approved by Innovation, Science and Economic Development Canada for operation with the antenna types listed in Section 6 of this manual, with the maximum allowable gain indicated. Antenna types not included in that list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

ISED Modular Usage Statement

NOTE 1: When the ISED certification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label shall use a sentence like "Contains transmitter module IC: 33762-PMR125" or "Contains IC: 33762-PMR125".

• **Français** : Le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) L'appareil ne doit pas produire de brouillage, et
- (2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement du dispositif.

Cet appareil numérique classe B est conforme à la norme NMB-003 du Canada.

Cet appareil est conforme à l'exemption des limites d'évaluation courante dans la section 6.6 du CNR - 102 et conformité avec RSS 102 de l'exposition aux RF, les utilisateurs peuvent obtenir des données canadiennes sur l'exposition aux champs RF et la conformité.

Cet équipement est conforme aux Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à une distance minimale de 20 cm entre le radiateur et votre corps.

Cet appareil et son (ses) antenne(s) ne doivent pas être co-localisés ou utilisés en conjonction avec une autre antenne ou un autre émetteur, sauf en conformité avec les procédures du produit multi-émetteur de la ISED.

Cet appareil est conforme avec Santé Canada Code de sécurité 6. Le programme d'installation de cet appareil doit s'assurer que les rayonnements RF n'est pas émis au-delà de l'exigence de Santé Canada.

Avertissement sur les antennes homologuées

Le présent émetteur radio a été validé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés dans la section 6 de ce manuel avec indication du gain maximum autorisé. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour fonctionner avec cet appareil.

ISED Déclaration d'utilisation modulaire

NOTE 1 : Lorsque le numéro de la certification ISED n'est pas visible ou bien lorsque le module est installé dans un autre appareil, l'extérieur de l'appareil dans lequel le module est installé doit également afficher une étiquette faisant référence au module inclus. Cette étiquette extérieure doit être libellée « Contient le module émetteur IC : 33762-PMR125 » ou « Contient IC : 33762-PMR125 ».

2.5. End of life



At end of life, in accordance with European Directive 2012/19/EU related to recycling of Waste Electrical and Electronic Equipment (WEEE), in case of replacement and dismantling, this device is not admitted for disposal, it shall be collected to local WEEE Centre; refer to local rules/information for the site where it will be installed. Refer the local WEEE laws for the EOL disposal in other country outer the European Community.

3. Specifications

3.1. Electrical characteristics

<i>Model</i>	<i>PM-R125-TTL</i>	<i>PM-R125-232</i>
Power supply	5V _{DC} ± 0.25V	
Power consumption	< 1W	
RF frequency	LF RFID BAND 125kHz ± 2kHz	
Antenna	External, inductive	
Antenna connection	Molex 51191-0300	
Data port	Serial, TTL	Serial RS-232
Data speed	1200...38400bps	
I/O port	2; open collector with 100k pull-up	
TAG protocols	Q5, T5557, EM410X, EM4X50, EM4305, HITAG-1, HITAG-2, HITAG-S	
Connectors	100mils/2.54mm pitch strips to the host PCB	

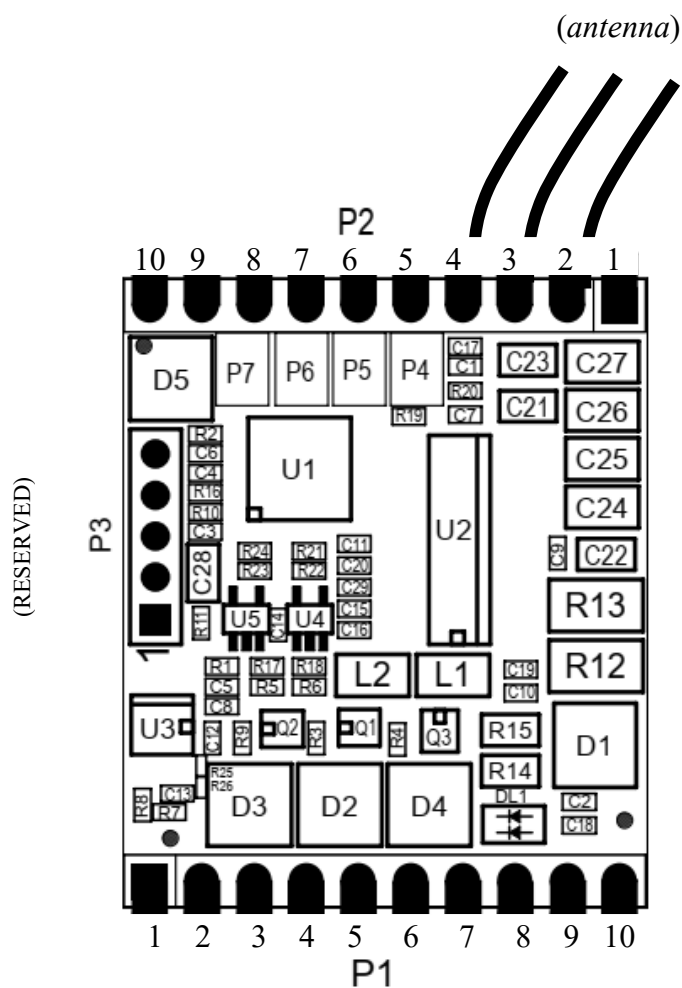
3.2. Mechanical and environmental characteristics

Operating temperature range	-4...+149°F / -20...+65°C
Storage temperature range	-12...+185°F / -25...+85°C
Humidity (non-condensing)	<95 RH
Dimensions	(WxLxH) 1”7/32x1”1/32x”23/64 31x26x9mm (from the host PCB plane) Strip pins are ¼” / 6.3mm long

IMPORTANT NOTE: The module is not suitable for outdoor installation.

4. Connections

4.1. Connections layout



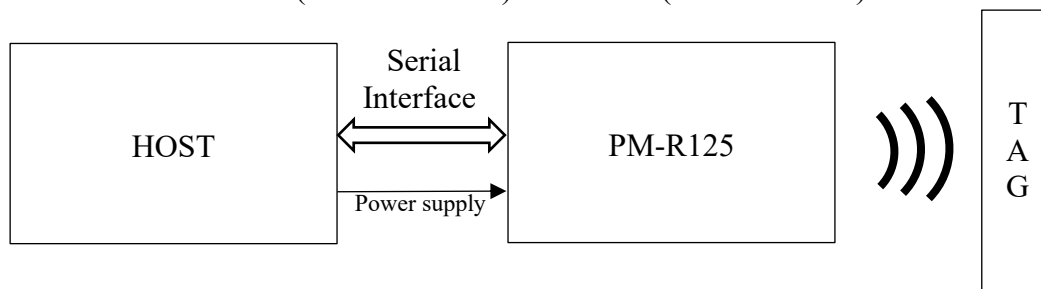
P1	
1	SERIAL RX
2	SERIAL TX
3	<i>Reserved</i>
4	I/O 1
5	N.C.
6	I/O 2
7	LED RED +
8	LED GREEN +
9	GND
10	+5VDC INPUT

P2	
1	ANTENNA HOT
2	ANTENNA RTN
3	+5VDC INPUT
4	GND
5	RF TX OUT
6	N.C.
7	N.C.
8	N.C.
9	<i>Reserved</i>
10	<i>Reserved</i>

N.C. - Not connected

Reserved - **LEAVE UNCONNECTED**

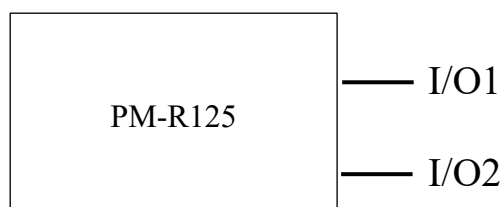
The serial interface is TTL (PM-R125-TTL) or RS-232 (PM-R125-232).



The 5V_{DC} ±0.25V is supplied by the Host.



CAUTION! DO NOT INVERT THE SUPPLY POLARITY TO AVOID SERIOUS DAMAGE TO THE MODULE.

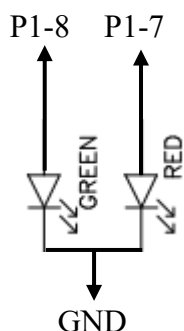


The I/O lines are generic open-collector outputs with related *activated-low* input, suitable for clean contact connection to GND.



CAUTION! AVOID NEGATIVE VOLTAGES WITH REFERENCE TO GROUND, MAX. POSITIVE VOLTAGE 40V. MAX SINK CURRENT WITH POSITIVE VOLTAGE 50mA.

The LED indicator signals are also available on the P1 connector: the external LEDs must be connected with the cathodes to the GND. When an external LED is connected, the on-board LEDs are disabled.



CAUTION! DO NOT APPLY ANY EXTERNAL VOLTAGE! EXTERNAL LEDS SHALL BE REFERRED TO THE GND.

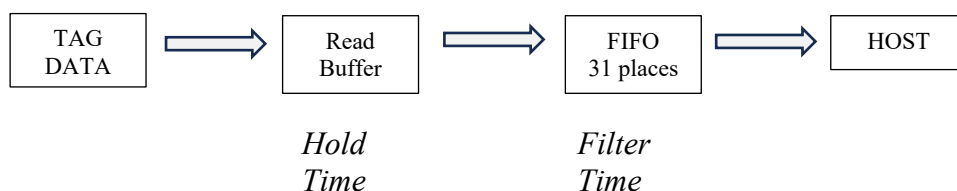
5. Operational description

The PM-R125 is a reading/writing module for LF RFID (125kHz) to be integrated into OEM equipment.

It consists of a printed circuit board carrying an LF RADIO FRONT-END, an ARM processor and an optional TTL to RS-232 translator. The FRONT-END is connected to the processor, which acts as buffer and controller and translates the data form/to the external host.

The PM-R125 can read by command or in continuous mode (which is selectable in the general setup); if Continuous mode is disabled, tags can be detected at the moment of a Data Read command, in Continuous mode all tags into the capture field are recognized and listed into the buffer.

When set in continuous mode, the PM-R125 acknowledges the tags regardless of data reading by the Host through the serial port.



Data captured from tags are stored into a buffer; the *Hold* time defines both the stored time in the buffer for a recognized tag and the *ignore* time, after which the tag is recognizable again. When the buffer is empty a data value 0 is returned.

Data into the buffer are compared with the readings, each tag is written just once and the countdown of the *Hold* time is activated for it (default time is 1 second).

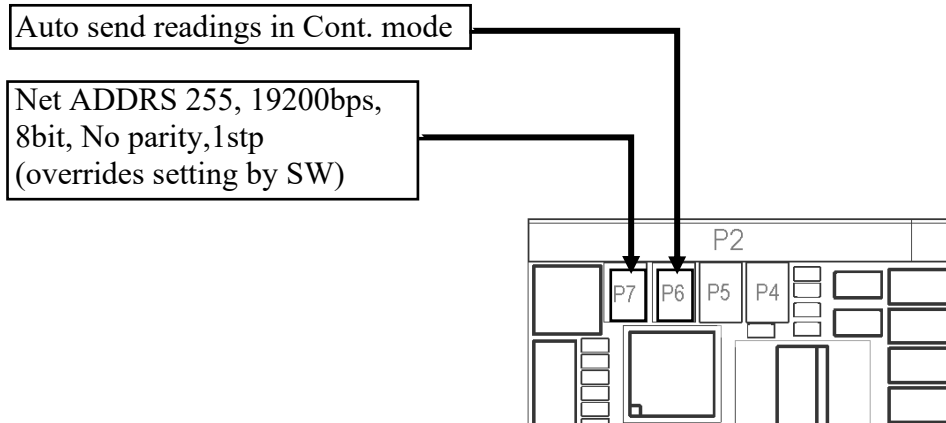
As the *Hold* time for a tag expires, its data are removed from the buffer and the tag is recognizable again.

When the Host performs a Data Read command, it accesses a data read FIFO with 31 places, which stores data of each tag for the time set as *Filter* Time, when the *Filter* time for a given tag expires, the tag data are removed from the FIFO automatically (default time is 1 second).

The I/O1 can be configured as “New tag” flag, every time a new tag is added to the buffer, this output is active (closed to ground) for 0.5 sec.

It is possible to configure the PM-R125 as independent reader by closing with a solder link the contacts in the figure below (P6). In this way the PM-R125 set in Continuous mode sends the data of a new tag every time that tag is added into the buffer.

The contacts (P7) force the serial port to default, regardless of settings by SW.



5.1. LED Status messages

The PM-R125 provides a LED Status indicator.

Here below the list of messages

LED light	Mode	Meaning
GREEN	Blinking, 2Hz rate	RF active, Continuous mode, NO TAGS recognized.
	Blinking, 1Hz rate	Continuous mode disabled, waiting for Read Cmd.
	ON	Continuous mode, TAG recognized!
YELLOW	Blinking, 2Hz rate	(P7 closed) RF active, Continuous mode, NO TAGS recognized.
	Blinking, 1Hz rate	(P7 closed) Continuous mode disabled, waiting for Read Cmd.
	ON	(P7 closed) Continuous mode, TAG recognized!
		At power-on: Initializing... (for some seconds)
RED	ON	System Failure. SW update is running.
Off		Power supply not present hardware fault.

5.2. Configuration

The **PM-R125** can be set as below

Parameter	Range	Default
Network ADDRESS	000 ... 255	255
Baud Rate	1200, 2400, 4800, 9600, 19200, 38400	19200
Data bits	7, 8	8
Stop bits	1, 2	1
Parity	No, Even, Odd	No parity
TAG hold-on	0 ... 99 s	1 s
Nibble encoding	Normal, Reverse	Normal
Queue Filter time	0 ... 99 s, 0 ... 99 min.	1 s
I/O 1 as "NEW TAG" Flag	Disabled, Enabled	Disabled
CONTINUOUS Mode ON	Disabled, Enabled	Disabled

Configuration can be read or written using commands

ReadGeneralParameters

WriteGeneralParameters as in the Protocol Manual (the 7 data fields as below).

1	2	3	4	5	6	7
Net ADDRS	Serial #1	Serial #2	Hold time	Standard	Filter time	Flags

where:

Net ADDR5	(0x00 ... 0xFF)	
Serial#1 & Serial#2	High nibble: BAUD RATE (bps)	0x0: 1200 0x1: 2400 0x2: 4800 0x3: 9600 0x4: 19200 0x5: 38400
	Low nibble: DATA BITS	0x7: 7 bits 0x8: 8 bits
Hold Time	Decimal 0 ... 99 (0 ... 99 sec)	
Standard	High nibble:	0x0: Normal 0x1: Reversed
	Low nibble:	0x3
Filter Time	Decimal 0 ... 99 (0 ... 99 sec)* or 100 ... 199 (0 ... 99 minutes)	
Flags	0 = Disabled / 1=Enabled Bit 7: Not used Bit 6: Output 1 auto management Bit 5: Not used Bit 4: Not used Bit 3: Not used Bit 2: Not used Bit 1: Not used Bit 0: Continuous mode	

6. APPENDIX

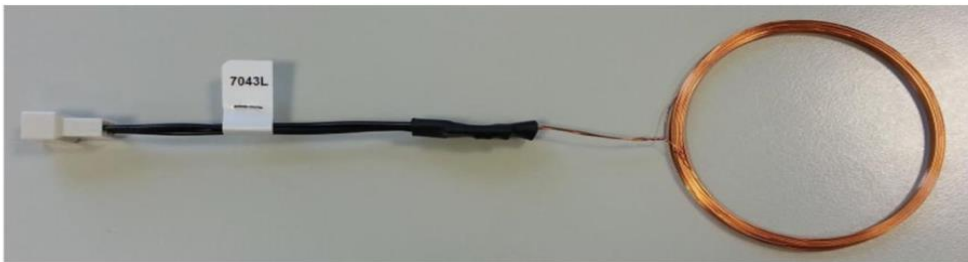
6.1. Recommended Antennas

PM-R125-ANT7043L

General data

LF OEM antenna, based on the coil antenna Tecint IND0045_350U
Includes tuning circuit.





Technical data

Ext. Dia.	68.0 ±1mm
Coil Dia.	63.0 ±1mm
Coil thickness	3.0 ±0.5mm
Working Temperature	-10°C... +55°C
Wire length	80mm (Connector- Tuning circuit) + 40mm from coil
Connector	MOLEX M29-11-0033
Tuning	125kHz ±500Hz (with PM-R125 connected)
Inductance	350μH
Impedance	1.85Ω
Quality Factor	145
Wire Dia.	Cu enamelled 0.4mm Dia.
Number of turns	51

PM-R125-ANT7044L124

General data

LF OEM antenna, based on the coil antenna Tecint IND0044_350U
Includes tuning circuit.





Technical data

Ext. Dia.	28.6 ±1mm
Coil Dia.	24.0 ±1mm
Coil thickness	2.8 ±0.5mm
Working Temperature	-10°C... +55°C
Wire length	250mm (Connector- Tuning circuit) + 40mm from coil
Connector	MOLEX M29-11-0033
Tuning	124kHz ±500Hz (with PM-R125 connected)
Inductance	350μH
Impedance	4Ω
Quality Factor	67
Wire Dia.	Cu enamelled 0.23mm Dia.
Number of turns	87



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