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Client: Identec Solutions Inc.  
Model Name: i-Mark 3  
Standards: FCC 15.209/IC RSS-210  
FCC/IC ID: O2E-ILR-IM3/3538B-IM3  
Report #: 2007198

## **Appendix H: Manual**

Please refer to the following pages.



## **i-MARK 2, i-MARK 3 Installation and Hardware Manual**

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## Radio Frequency Compliance Statement

IDEN TEC SOLUTIONS, Inc. is the responsible party for the compliance of the following devices:

MODEL:	i-MARK 2	i-MARK 3
FCC ID:	O2E-ILR-IM2	O2E-ILR-IM3
CANADA:	3538B-IM2	3538B-IM3
EUROPE:	CE 0678(!)	CE 0678(!)

The user(s) of these products are cautioned to only use accessories and peripherals approved, in advance, by IDEN TEC SOLUTIONS, Inc. The use of accessories and peripherals, other than those approved by IDEN TEC SOLUTIONS, Inc., or unauthorized changes to approved products, may void the compliance of these products and may result in the loss of the user(s) authority to operate the equipment.

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

### FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communication. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

For FCC compliance, the supplied ferrite cores must be placed onto the driver loops where the leads attach to the i-MARK 3.

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

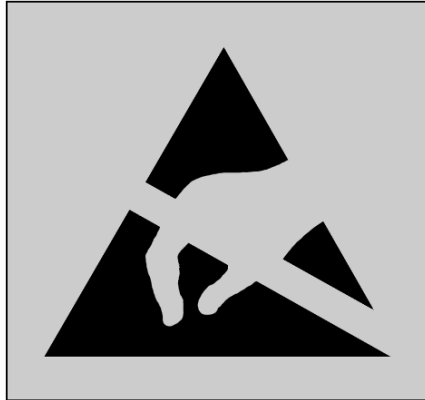
### Industry Canada Compliance

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

### European Notification according R&TTE Directive

This equipment complies to Art. 6.4 of R&TTE Directive (1999/5/EC). It is tested for compliance with the following standards:  
EN 300 220-1 V1.3.1 (2000-09), EN 300 220-3 V1.3.1 (2000-09), ETSI EN 301 489 V1.4.1 (2002-08), ETSI EN 301 489 V1.4.1 (2002-08)



This product contains components that are sensitive to electrostatic discharges. Please observe the special instructions for their protection. Incorrect handling can damage the unit and cause the invalidation of the warranty.

**Minimum safety precautions against electrostatic discharge:**

- Establish earth contact before you touch the unit. For example, touch the earthing screw on the unit. Even better: Use an antistatic ribbon and earth yourself permanently for the time you handle the unit.
- Avoid unnecessary contact with the unit connectors and assemblies inside the unit.
- Only open the unit if the operational settings (as described in the manual) expressly require this.
- Use antistatic tools for the setting of the unit. (Warning: Do not touch life-threatening voltages with these tools).
- Do not store unit and components without protective packaging.
- Only remove unit and components from the packaging immediately prior to installation.

**These notes are not sufficient to guarantee complete protection from electrostatic discharges! We recommend the use of suitable protective equipment.**

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## 1 Safety Instructions

The system described in this manual is for exclusive operation by trained employees. Only qualified personnel that know the potential dangers involved should perform the installation, settings, maintenance and repair of the units used.

### Operational Safety

The correct and safe use of these systems assumes that operating and service personnel follow the safety measures described in the manual alongside the generally acceptable safety procedures. If there is a possibility that safe operation cannot be guaranteed the system must be switched off and secured against accidental use. Then the service unit responsible must be informed.

### Safety Documents

This ILR system was designed, tested and supplied in perfect condition according to document IEC348 Safety Requirements for Electronic Units of Class 1.

### Condensate / Change of Temperature

Moving the systems from a cold to a warm environment could lead to dangerous situations due to condensation. Therefore it must be ensured that the system can adjust itself to the warmer temperature.

### Do not open the housing

There is no need to open the housing in order to set any ILR unit. No unit has any internal setting elements or displays. All settings are performed using software via the Service Interface.

### Earthing

Before establishing any connections the housing of the system must be earthed.

### Connections / Power Supply

The supply circuits must comply with the conditions set out for the SELV circuits (see EN 60950). The signal circuits must comply with the conditions set out for the SELV circuits (see EN 60950). Use screened cables for the power supply. This is the only way to achieve the prescribed EMC. During maintenance damage could occur if printed circuit boards or cables are connected or disconnected whilst the power supply is still on. Therefore only work on the connection and the components when they are not live.

### Fuses

Only experts who are aware of the dangers involved may replace the fuses. It must be ensured that only fuses of the required current rating and the correct type are used for replacement. The use of repaired fuses and/or short-circuiting the fuse holders is prohibited.

### Spare Parts

We recommend that only personnel, original products, spare and replacement parts authorized by IDENTEC SOLUTIONS be used for installation, service and repair. Otherwise IDENTEC SOLUTIONS does not accept any responsibility for materials used, work carried out or possible consequences.



### **Electrostatic Discharge**

Semi-conductors of the type MOS or CMOS as well as two-pin types and precision resistance are sensitive to ESD. All components, printed circuit boards and auxiliary systems should therefore always be classed as sensitive to electrostatic discharge.

Before opening the cover the unit should be placed onto an ESD-protected surface. As with all work on modern electronic modules the use of ESD clamps and ESD mats during work on the unit is recommended.

- Sufficiently protect all printed circuit boards that were removed from the unit from damage.
- Observe all normal precautions for the use of tools.
- Use ESD-protected packaging material.

Never use measuring units with low impedance for measuring or testing systems with semi-conductor components. Never use high voltage testing units or dielectric test units to test systems with semi-conductor components.

If it is necessary to check the isolating properties of the field wiring, the assemblies (electronic units and sensors) should be disconnected.

Earth the test units.

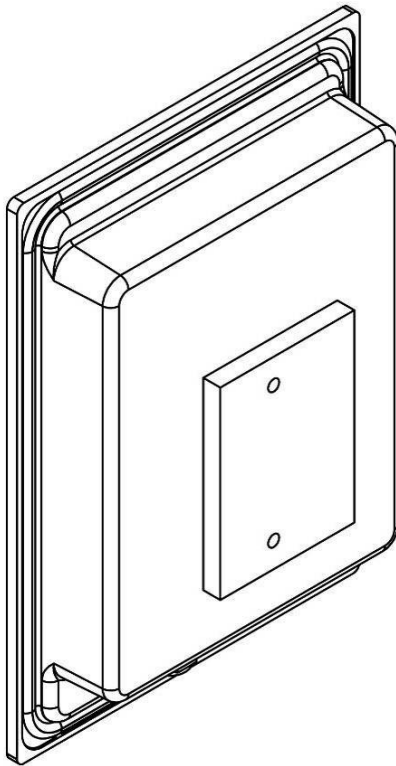
IDENTEC SOLUTIONS does not accept returns of products where the regulations concerning the ESD precautions and protective packaging materials were not followed.

ESD – Electrostatic Discharge

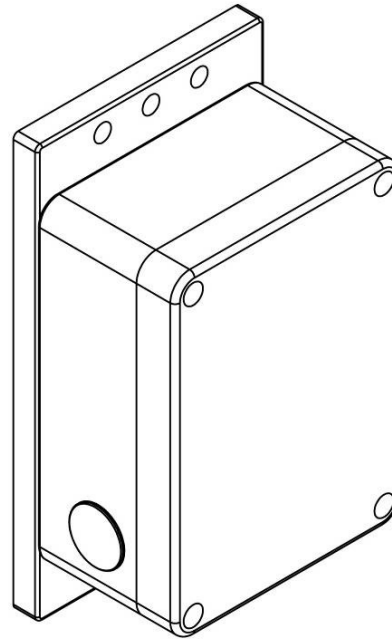
EMC – Electromagnetic Compatibility

SELV – Safety Extra Low Voltage – Protective measure against dangerous body currents, formerly: protective first voltage range

## 2 Introduction



Compact Unit i-MARK 2



Central unit i-MARK 3

### 2.1 Preparations

This installation manual must be read carefully prior to starting the installation. The described installation work assumes that installation materials like cable, antenna and data tag holder etc are available

### 2.2 Scope of This Document

This document is the hardware description of both the i-MARK 2 and i-MARK 3. This document is intended only for mechanical and electrical installation of this central units. A general system description, especially of the Position Marker technology can be found in the extra system description; please see below.

### 2.3 Responsibility

IDENTEC SOLUTIONS is not responsible for any errors occurring in this document.

## 2.4 Updates

Updates will be provided on request. The information in this document can be changed without prior notice from IDENTEC SOLUTIONS.

## 2.5 Scope of Delivery—Visual Inspection

Check delivery whether it is complete and for any damages. If the delivery is not complete or damaged immediately inform the carrier. The customer service department of IDENTEC SOLUTIONS should also be informed to facilitate the repair or exchange of the system.

## 2.6 Associated Documents

### System description

- Reg-No: IM.0721.DE, German, order code:
- Reg-No: IM.0731.EN, English, order code:

### Hardware description and installation manual (this document)

- Reg-No: IM.0732.DE, German, order code:
- Reg-No: IM.0732.EN, English, order code:

### Firmware description and Programmer's Guide

- Reg-No: IM.0733.DE, German, order code:
- Reg-No: IM.0733.EN, English, order code:

## 2.7 Bluetooth Module

The Bluetooth module is optional, when installed it enables any Bluetooth device to communicate with a position marker using the protocol described before via RF.

**Note:** The Bluetooth interface only allows communicating with the device itself and does not forward the messages on the RS422 bus.

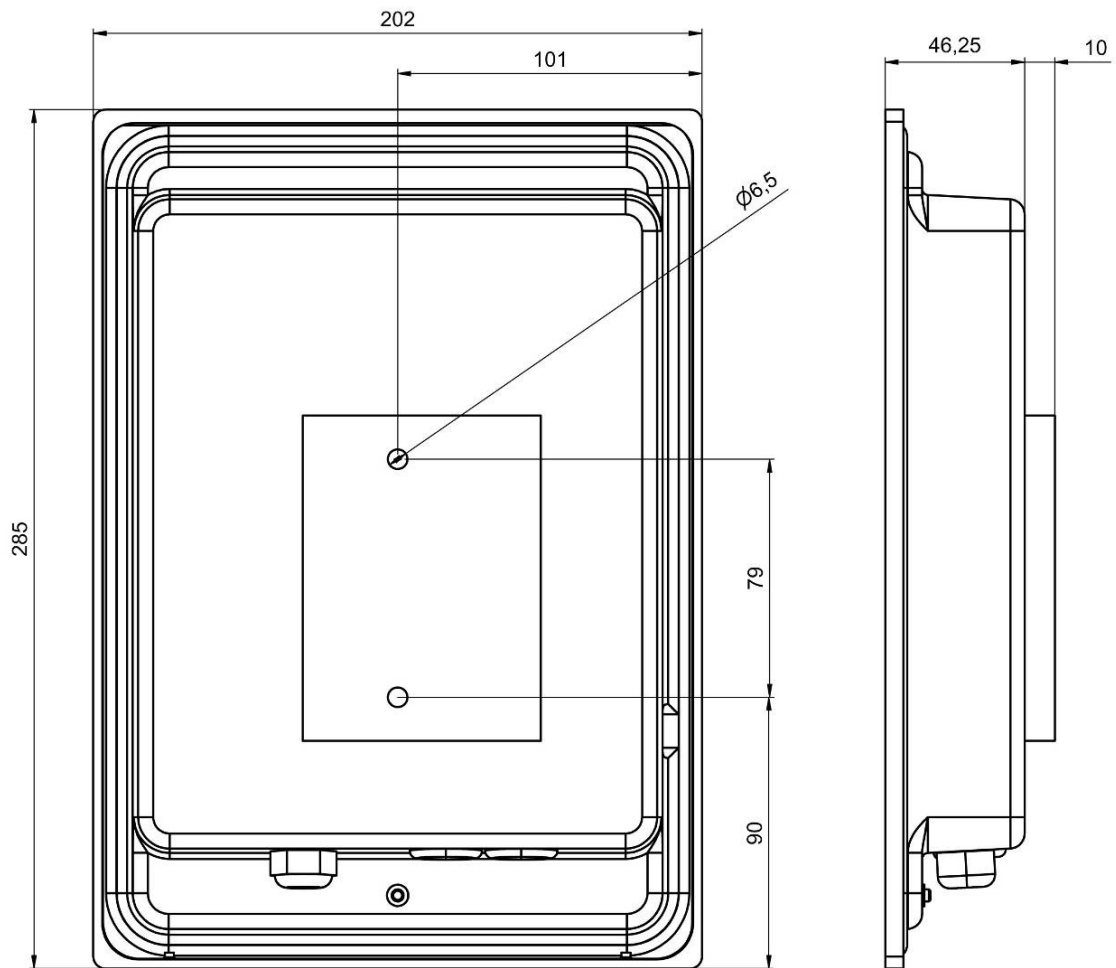
## 2.8 Internal Mains Supply

The compact unit i-MARK 2 is available with an internal power supply to operate at a mains voltage of 230 VAC (Europe).

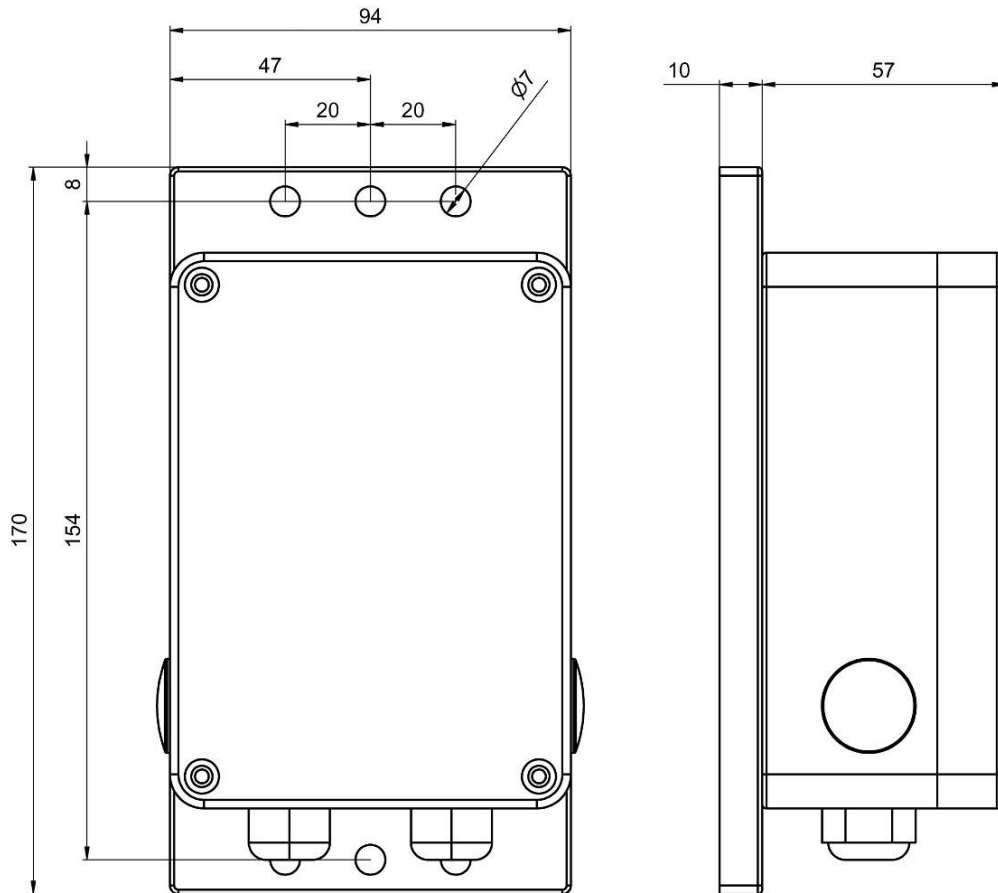
### 3 Installation

#### 3.1 Mechanical Installation

##### 3.1.1 i-MARK 2



### 3.1.2 i-MARK 3



## 3.2 Electrical Installation

### 3.2.1 Safety Instructions

The power supply circuit must comply with the requirements of the SELV circuits (see EN 60950).

The signal circuits must comply with the requirements of the SELV circuits (see EN 60950).

Use a ferrite core or rod for all cables and place it close to the units.

A screened cable must be used for the power supply. Only then is the required EMC achieved. The device uses RS422 levels on its RX and TX Pins, although Ethernet jack/plugs mechanically fit, the device is not Ethernet compatible!

Industry standard Cat 5 straight patch cables can be used to daisy chain the devices.

### Glossary

SELV	Safety Extra Low Voltage – Protective measure against dangerous body currents. Protective first voltage, circuit not floating.
EMC	Electromagnetic Compatibility
RxD	Receive Data
TxD	Transmit Data

### 3.2.2 Maximum Overall Cable Runs of Daisy Chain Cabling

This tables is valid for Cat 5 cabling with gauge diameters of AWG24.

# of i-MARKs	Length	Remark
1	300 m	One 24V
2	600 m	One 24V
3	400 m	One 24V
4	250 m	One 24V
5	200 m	One 24V
8	100 m	One 24V
8	1000 m	GND potential free power supplies at every i-MARK

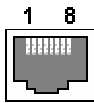
### 3.2.3 Position of Ports



According to the table before, the supply must only be connected in order to operate at long cables runs of the daisy chain.

### 3.2.4 Daisy Chain Connectors

To Master	RJ 45 connector to the Host computer or the Slave port of the previous i-MARK in the Daisy Chain.
To Slave	RJ 45 connector to the Master port of the next i-MARK in the Daisy Chain. Leave this connector open at the last device in the chain.



View into the connector = crimp/solder side of plug

Pin	To Master	To Slave	T568B color	Description
1	RxD+	TxD+	White/orange	
2	RxD-	TxD-	Orange	
3	TxD+	RxD+	White/Green	
4	V+ (10 ... 30V)	V+ (10 ... 30V)	Blue	Power supplied over bus
5	V+ (10 ... 30V)	V+ (10 ... 30V)	White/Blue	Power supplied over bus
6	TxD-	RxD-	Green	
7	GND	GND	White/Brown	Power supplied over bus
8	GND	GND	Brown	Power supplied over bus

As the TxD/RxD crossing is done on the i-MARK only straight-through cabling has to be used between i-MARKs.

#### Connection parameters

Signal levels: RS422  
 Baud rate: 115200 bits per second  
 Data bits: 8  
 Stop bits: 1  
 Parity: none  
 Mode: full duplex

## 4 Initial Operation

### 4.1 General

#### **Do not open the housing.**

Opening the housing is not necessary in order to set the i-MARK. The unit has no internal setting elements or displays. All settings are performed using software via the service interface.

### 4.2 Tools required

#### **Hardware**

PDA running Windows CE with installed Bluetooth interface or,  
PC running Windows XP with installed Bluetooth interface

#### **Software**

PDA Service Tool "i-MARK-Controller"  
PC Service Tool "i-MARK Config"

### 4.3 Configuration

In a standard installation only this settings need configuring:

- Adjust the inductive loop field
- Give every i-MARK a unique ID
- Set transmission slots (required only if several loops are in close proximity)

#### **4.3.1 Adjusting the Inductive Loop Field**

The size of the loop field is adjusted by adjusting the loop current using one of the Service tools.

#### **4.3.2 Adjusting the Inductive Loop Field**

Every i-MARK in the entire application must have a unique ID in order to avoid confusion. This unique ID value is an integer value.



### 4.3.3 Operation Mode—Continuous/host only

Note: The default operation mode is “continuous”, as most i-MARK installations will be autonomous.

In the continuous operation mode the i-MARK will transmit the LF telegram based on the slot configuration and synchronized time (refer to the section 4.3.5).

In cases where an application may need to have full control over when the i-MARK transmits the LF telegram the i-MARK can be switched into host only mode. The host is then responsible for telling the i-MARK when to transmit a LF telegram.

### 4.3.4 Operation Mode—Slave/master

Note: This default operation mode is master.

The recommended configuration is to have a host present on the RS422 bus. This allows for the retrieval of device status information and detection of device failure in real time. In this application, the host will be the master and must send the synchronization messages to the i-MARK and all of the i-MARKs must be configured as slaves.

In applications where an i-HUB or host is not required on the bus, but synchronization needs to occur, a single i-MARK on the bus can be configured as a master. An i-MARK which is configured as a master must be the first device in the bus hierarchy. When configured as a master it is only able to communicate with devices which are connected off of its slave port. As such, all other i-MARKs connected must be configured as a slave device. This single master on the bus will be in charge of broadcasting the synchronization messages on the bus.

In slave mode the position marker will only transmit the LF telegram based on the synchronization scheme or host request depending in the operating mode.

In master mode the device will additionally transmit synchronization telegrams and this independently on the operating mode it is configured in.

### 4.3.5 Synchronization Mechanism

Note: This setting is only of importance if several i-MARKs are in close proximity to each other. The default factory setting is that all time slots are used.

The synchronization mechanism goal is to avoid having multiple i-MARKs in overlapped transmit areas transmit at the same time and disturb each other.

For this task, all the devices must be synchronized, and follow the synchronization mechanism described below.

The modules synchronization is done by having 1 master device (i-HUB or Host application or a i-MARK in master mode) to broadcast on the bus a synchronization telegram on a regular interval. Default configuration is, that a device send in each of the 12 slots.

The time is divided in 12 slots of 20 milliseconds each.

For each i-MARK the application must define in which slot the device will transmit the LF telegram making sure that the devices will not disturb each other. If all i-MARKs are synchronized, the slot sequences on all i-MARKs shall start at the same time.

### 4.3.6 Slot Configuration Examples

**Configuration example with two (2) i-MARKS, none of them can transmit at the same time.**

Slot Number	1	2	3	4	5	6	7	8	9	10	11	12
Marker 1	T		T		T		T		T		T	
Marker 2		T		T		T		T		T		T

**Configuration example with 4 i-MARKs, none of them can transmit at the same time.**

Slot number	1	2	3	4	5	6	7	8	9	10	11	12
Marker 1	T				T				T			
Marker 2		T				T				T		
Marker 3			T				T				T	
Marker 4				T				T				T

**Configuration example with 8 i-MARKs**

The cross table below defines which devices cannot transmit at the same time.

Marker	1	2	3	4	5	6	7	8
1		X	X	X				
2	X		X	X				
3	X	X		X	X	X		
4	X	X	X		X	X		
5			X	X		X	X	X
6			X	X	X		X	X
7					X	X		X
8					X	X	X	

Results in a slot configuration table:

Slot number	1	2	3	4	5	6	7	8	9	10	11	12
Marker 1	T				T				T			
Marker 2		T				T				T		
Marker 3			T				T				T	
Marker 4				T				T				T
Marker 5	T				T				T			
Marker 6		T				T				T		
Marker 7			T				T				T	
Marker 8				T				T				T

#### **4.4 Verifying the Installation**

After completing the installation the operation must be systematically checked. The installation check can be divided into three sections:

- Visual test
- Basic operational check
- Detailed operational check

If the basic check of the operational behavior is to be carried out using a (portable) PC a final check via the intended user control system should also be carried out.

## 5 Troubleshooting

### 5.1 General

This chapter covers how faults can be recognized and rectified. There are potentially four main problem sources:

- The user control system, including task requirements, communication cables, peripheral units with possible object recognition switches.
- The ILR system including peripheral units and their cables, also potential object recognition switches.
- The environment including large objects between antenna and tag, electrical disturbance sources, human intervention, etc.
- The quality of the technical design, including alignment between antenna, ratio of task requirements/available communication time etc. The information about system performance is contained in the relevant datasheets.

When planning the total system do not forget these problem sources and "Fault finding procedures on system level" should possibly be included in the host system. How this could look in detail depends on the relevant system concept and very likely varies from one system to another.

### 5.2 Status Display (LEDs)

LOOP	This LED lights green during sending a LF telegram (about 20 ms). In the case of a loop error (loop broken or the set point of the loop current couldn't be reached) the LED lights red when sending a LF telegram.
RUN	This LED blinks green, indicating the system is running normal.
BUS	Lights green during receive and orange during response – also for Bluetooth.
ERR	Blinking: system error on start-up, firmware execution failed.

### 5.3 Loop Error

There are three types of possible errors. Every of the following errors will switch the LOOP LED to red. Also the marker will try to continue sending.

Loop broken	Loop current is too low or near zero
Loop current out of range	When setting the loop current (power) the marker tries to control the output signal in a way, that the preset current is measured during LF transmission. This adjustment is only done once, if the loop current is changed by the user. During normal operation the loop current is observed every telegram. If then the loop current is $\pm 20\%$ out of range the error condition will set.
Loop shorten	

## 6 Maintenance

### 6.1 General

In principle, the ILR system is maintenance-free. When correctly installed it operates for many years without any problems.

### 6.2 Tag Battery Life

The selected batteries are long life lithium batteries whose service life depends on the extent of the data communication and the ambient temperature of the application area. If this temperature is extreme the service life of the battery is slightly reduced.

The long-term load due to high temperatures should therefore be avoided. However, the service life of the batteries in most industrial environments should be at least 6 years depending on the type of the tag and the operating conditions mentioned on the data sheets of the tag.

### 6.3 Precautionary Maintenance

Regular checking of all ports and cables belonging to the system is recommended. Unstable connections could lead to damage and malfunctions of the system and therefore should be repaired as soon as possible.

A Brief Checklist

- Are all casing intact?
- Are all cables intact?
- Are all connectors intact?
- Are all connectors securely fastened?
- Are all screws still tight?
- Is there suddenly a malfunction at a specific unit?

### 6.4 Exchanging a marker within the daisy chain

- Stop the application program on the host
- Exchange the reader
- Restart the application program on the host. If the application on the host checks on startup the marker serial numbers as recommended, it will detect the changed configuration and require either manual intervention or automatically configure the new device.
- Firmware Update

The firmware is stored in a FLASH memory and can be updated if needed.

## **6.5 Spare Parts**

### **6.5.1 Recommended spare parts stock**

In order to keep the down time of the system during malfunctions as short as possible it is recommended to have certain spare parts in stock. At least one central unit, one antenna and one antenna cable should be available. With larger systems with more than approx. 15 i-MARKs the doubling of the recommended stock quantity should be considered. Furthermore, it is recommended to have several spare tags in stock, corresponding to approx. 0.5 – 1 % of the total number of tags.

### **6.5.2 Preparing the spare parts**

In general all spare parts can be used immediately after delivery from IDENTEC SOLUTIONS. However, for the compact communicator there are various settings of the communication parameters. In order to keep the down times short it is recommended to set these parameters before the component is entered into the spare part stock system. In most cases all units within an identification system are used in the same way so that only one setting is required.

### **6.5.3 Examination and repair of exchanged parts**

The data tags and compact communicators are complex electronic power units on which the customer can carry out only very limited repairs. Normally the repairs are carried out at IDENTEC SOLUTIONS or possibly at a distributor. Before a part is sent in for repair a short examination should be carried out.

## **6.6 Returns**

Parts or main components returned for repair or exchange must be handled with great care. PC cards must be returned in the appropriate ESD-protecting packaging material. All returns should include a completed returns form (see appendix) and be sent to the local distributor or to:

IDENTEC SOLUTIONS AG  
Service Department  
Millenium Park 2  
6890 Lustenau  
AUSTRIA / AUTRICHE

## 7 Technical Specifications

### 7.1 Operating Data

Range	i-MARK 2: Adjustable by the loop current up to app 3 m i-MARK 3: Depending on loop design and adjustable by the loop current
Operating Frequency	125 kHz
Number of loops	1
RF error protection	16 bit CRC
Certification	CE, EN 300220 (EU), FCC Part 15 (US)
Firmware updates	Via host computer interface
Configuration memory	Non-volatile EEPROM memory
Status display	4 LEDs
Maximum number of readers per daisy chain	16
Maximum cable runs between two i-MARKS	300 m
Maximum overall cable runs of daisy chain	1000 m (only with GND free power supplies at every i-MARK)

### 7.2 Electrical Data

Host interface	RS422, Daisy Chain
Baud rate	115 kBaud, fixed
Supply voltage	i-MARK 2: 10 to 30 V DC or 230 VAC (internal PSU, Europe only) i-MARK 3: 10 to 20 V DC
Power consumption	Max. 20 W per i-MARK

### 7.3 Mechanical Data

Overall dimensions	i-MARK 2: 285 × 202 × 56.25 mm i-MARK 3: 170 × 94 × 67 mm
Case material	Plastics

### 7.4 Environmental Conditions

Operating temperature	-20 °C to +60 °C
Humidity	Up to 90% non-condensing
Protection class	IP40, IP65 with additional protection for connector, Ref. IEC 529