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USER MANUAL
FOR THE
WAVETREND TAGS

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AMENDMENT HISTORY

Issue	Date	Amendment Details	Amended By
0.00	18 February 2002	Draft and Final	C.L. Neuhoff
1.10	26 March 2002	Orientation of L-TG800 corrected at movement	C.L. Neuhoff
1.20	9 September 2002	Tag Age at 15 seconds interval	C.L. Neuhoff
1.3	21 October 2002	Correct L-TG800 orientations	C.L. Neuhoff
1.4	12 November 2003	Update with new products	D. Rabe

Table 1: Amendment History

APPROVALS

Number	Name	Designation	Date	Signature
1.	A. Evangelidis	Technical Director		
2.	C.L. Neuhoff	Systems Engineer		
3.	D. Rabe	Product Manager		

Table 2: Approvals

REFERENCED DOCUMENTS

Number	Title	Document Number	Rev	Source
1.				
2.				
3.				
4.				
5.				

Table 3: Referenced Documents

ABBREVIATIONS

Abbreviation	Meaning
BCC	Block Check Character (Checksum)
CR	Carriage Return
EOM	End of Message
I/O	Input/Input
ID	Identity
LF	Line Feed
LSB	Least Significant Bit/Byte
m	Meter
mm	Millimetre
MSB	Most Significant Bit/Byte
NC	No Connection
PC	Personal Computer
PCB	Printed Circuit Board
Pwr	Power
RF	Radio Frequency
RFID	Radio Frequency Identification
Rx	Receive
SOM	Start of Message
TBA	To be Announced
Tx	Transmit
UPS	Uninterruptible Power Supply
VHB	Very High Bond

Table 4: Abbreviations

TABLE OF CONTENTS

1 SCOPE

1.1 IDENTIFICATION

Wavetrend Active Tags can be used in various applications such as access control, personnel monitoring, asset monitoring, vehicle monitoring and building management applications. Wavetrend Tags are suitably packaged to meet the various requirements for different applications.

L / W-TG100

L / W-TG501

L / W-TG800

L / W-TG800-IH

W-TG1000

L / W-TG1200

1.2 PRODUCT OVERVIEW

Wavetrend tags are Active Radio Frequency Identification tags (i.e. self-powered). Tags can be configured to transmit its unique identification with a predefined time-interval, and can report events such as tampering and movement. Each tag in the Wavetrend Tag range has unique properties that enable the user to tag a wide range of appliances and objects.

- L & W-TG100 → Tag plastic, wooden and rubber objects.
- L & W-TG501 → Tag people, access control.
- L & W-TG800 → Tag metal objects, computers and notebooks.

- L & W-TG800-IH → Tag outdoor metal objects, containers, tankers.
- W – TG1000 → Tag rounded objects, bicycles, barrels etc.
- L & W – TG1200 → Tag people, medical industry, theme parks, etc.

Wavetrend tags operate at a frequency of 433 MHz.

1.3 PRODUCT MODELS

Wavetrend tags consist of two basic series of tags, the L series and W series.

1.3.1 L-Series

The L series tags have got a fixed data structure consisting of:

- Transmit Interval – that is configurable to 0.4, 0.8, 1.5, 15 and 30 second intervals.
- Tag Id – that is a 4 byte configurable number and can be configured for standard Wiegand site code and Id.
- Site Code – that is a 3 byte configurable number.
- Tag Age (4 bytes).
- Movement Alarm Counter (1 byte) – only on Motion Sensor (MS) tags.
- Anti -Tamper Alarm Counter (1 byte).
- Alarm bit (1 bit).
- Tag type (1 byte).

1.3.2 W-Series

The W series tags have got a variable data structure consisting of:

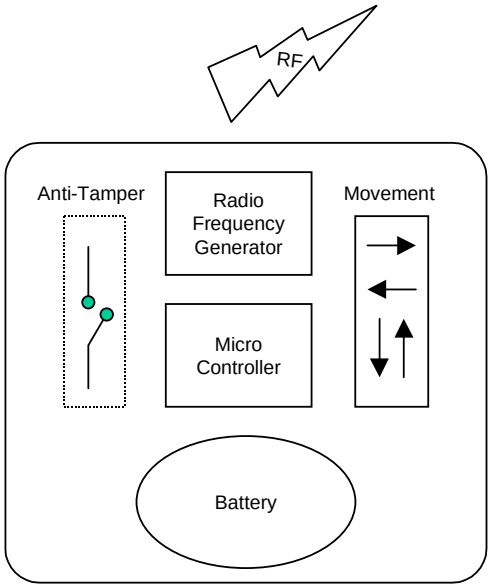
- Transmit Interval – that is configurable to 0.4, 0.8, 1, 1.5, 2, 5, 10, 15, 20, 30 and 45 second intervals as well as 1, 1.5, 2, 3, 5 and 10 minute intervals.
- Tag model and firmware version (1 byte).
- Tag type (1 byte).
- PUK Code – a fixed unique factory programmed serial number of 4 bytes.
- Tag Age – **optional** 4 byte incremental number.
- Tag Id – **optional** 4 byte configurable number and can be configured for standard Wiegand site code and Id.
- Site Code – **optional** 3 byte configurable number.
- Movement Alarm Counter - **optional** 1 byte number – only on Motion Sensor (MS) tags.
- Anti -Tamper Alarm Counter - **optional** 1 byte number with tamper latch facility.
- User Data - **optional** 1 to 32 byte user defined ASCII text data.

It must be noted that the more data transmitted the longer it will take for the transmission and the more power is required. Thus battery life will deteriorate with increase in data transmission.

2 TECHNICAL INFORMATION

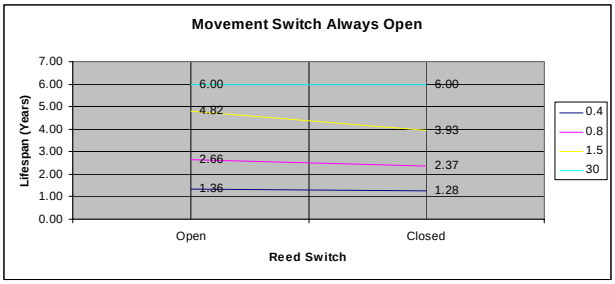
All tags consist of the same functional blocks. This functionality is illustrated in the figure below.

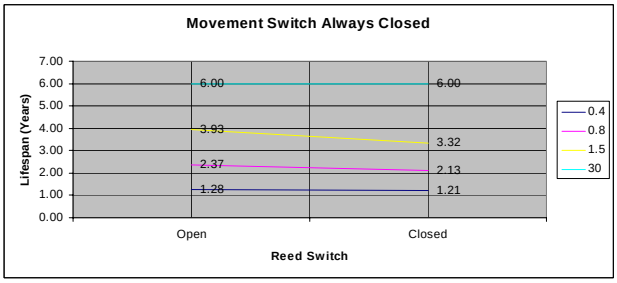
- **Battery**: Lithium Battery provides life-span of up to 10 years depending on the battery used and the way the tag is used and configured.
- **Micro-Controller**: Handles communications and sensors.
- **Radio Frequency Generator**: Modulates digital data for transmission over free air.
- **Anti-Tamper**: Magnetic sensor used for tamper detection, auto-wake functionality and to configure the tag with unique properties.
- **Movement Sensor**: Detect and report movement (Only MS options).
- **RF**: Modulated Radio signal transports data over free air via the antenna.

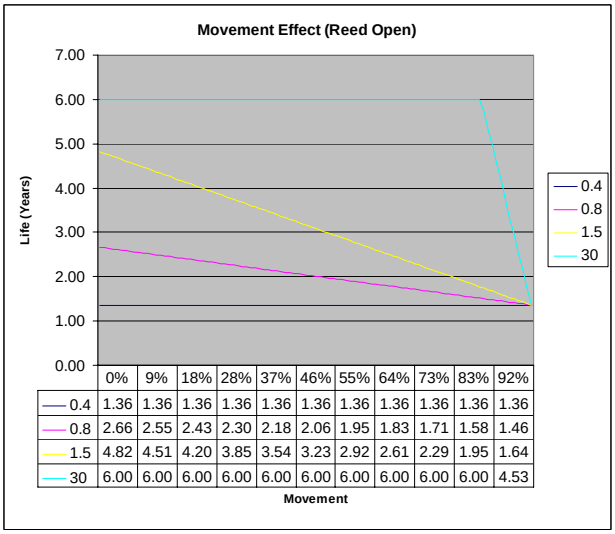


2.1 TAG LIFE-SPAN

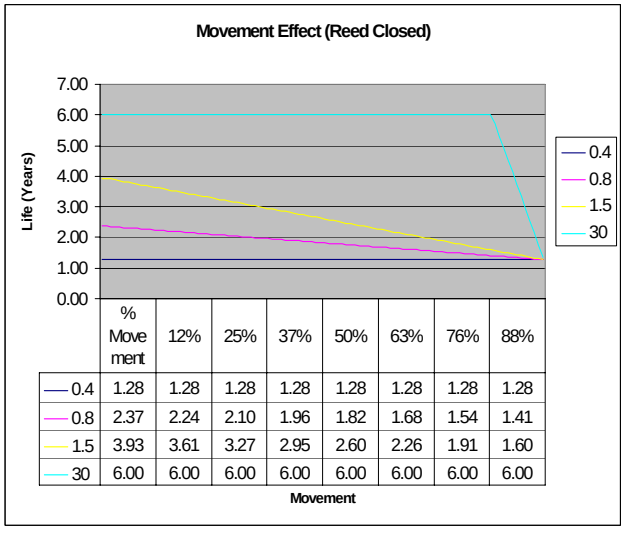
2.1.1 L-Series







	0%	9%	18%	28%	37%	46%	55%	64%	73%	83%	92%
0.4	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
0.8	2.66	2.55	2.43	2.30	2.18	2.06	1.95	1.83	1.71	1.58	1.46
1.5	4.82	4.51	4.20	3.85	3.54	3.23	2.92	2.61	2.29	1.95	1.64
30	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	4.53



% Movement	12%	25%	37%	50%	63%	76%	88%
0.4	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
0.8	2.37	2.24	2.10	1.96	1.82	1.68	1.54	1.41
1.5	3.93	3.61	3.27	2.95	2.60	2.26	1.91	1.60
30	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00

- Tag life span can vary up to 10%
- Tag life span can vary up to 25% from specification when anti-tamper and movement sensor options are used
- Movement sensor (Only MS option) is **open** when tag is mounted in least sensitive position, and **closed** when the tag is mounted in most sensitive position. See also paragraph 2.2 MOVEMENT SENSING.
- “Reed Switch” refers to the magnetic sensor in the tag.

2.1.2 W-Series

Repetition rate = 0.4 seconds

Class (Wavetrend info)	Tag transmitting	Expected life (Years)	Expected life (Years) with tamper armed
1	PUK	2.8	2.4
2	PUK + AGE	2.6	2.2
3	PUK + WIEGAND	2.2	1.9
4	PUK + USER DATA	**X**	**X**
5	PUK + WIEGAND + AGE	1.8	1.66
6	PUK + USER DATA + AGE	**X**	**X**
7	PUK + WIEGAND + USER DATA	**X**	**X**
8	PUK + WIEGAND + USER DATA + AGE	**X**	**X**

Repetition rate = 1 seconds

Class (Wavetrend info)	Tag transmitting	Expected life (Years)	Expected life (Years) with tamper armed
1	PUK	6.2	4.5
2	PUK + AGE	5.6	4.2
3	PUK + WIEGAND	4.88	3.7
4	PUK + USER DATA	**X**	**X**
5	PUK + WIEGAND + AGE	4.1	3.2
6	PUK + USER DATA + AGE	**X**	**X**
7	PUK + WIEGAND + USER DATA	**X**	**X**
8	PUK + WIEGAND + USER DATA + AGE	**X**	**X**

Repetition rate = 2 seconds

Class (Wavetrend info)	Tag transmitting	Expected life (Years)	Expected life (Years) with tamper armed
1	PUK	10	6.2
2	PUK + AGE	9.3	5.9
3	PUK + WIEGAND	8.2	5.4
4	PUK + USER DATA	**X**	**X**
5	PUK + WIEGAND + AGE	7.1	5
6	PUK + USER DATA + AGE	**X**	**X**
7	PUK + WIEGAND + USER DATA	**X**	**X**
8	PUK + WIEGAND + USER DATA + AGE	**X**	**X**

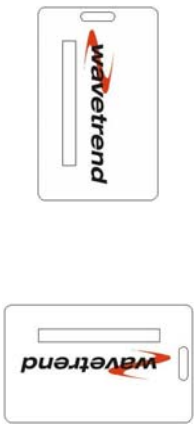
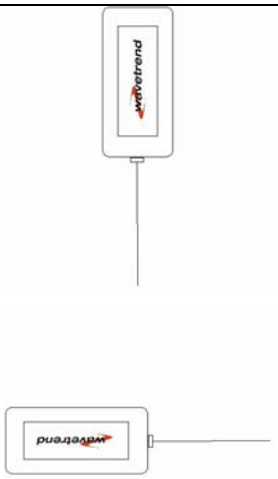
Repetition rate = 5 seconds

Class (Wavetrend info)	Tag transmitting	Expected life (Years)	Expected life (Years) with tamper armed
1	PUK	10	8
2	PUK + AGE	10	7.8
3	PUK + WIEGAND	10	7.5
4	PUK + USER DATA	**X**	**X**
5	PUK + WIEGAND + AGE	10	7.1
6	PUK + USER DATA + AGE	**X**	**X**
7	PUK + WIEGAND + USER DATA	**X**	**X**
8	PUK + WIEGAND + USER DATA + AGE	**X**	**X**

X – Contact Wavetrend for details.

2.2 MOVEMENT SENSING

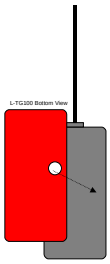
Tags can be rotated through 360° degrees to achieve various sensitivity levels of movement sensing. Note that the tag is rotated in the vertical plane (i.e. a wall mount).

Sensitivity	L&W-TG100-MS	L&W-TG501-MS	L&W-TG800-MS
 Most Sensitive 			
 Least Sensitive			

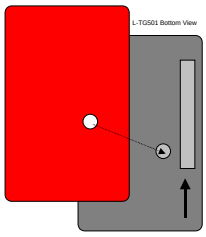
Once the movement sensor has been activated, the Movement Alarm Counter will be incremented and the tag will transmit four consecutive transmissions with a 0.4-second interval. Thereafter the tag movement sensor will be de-activated for 1 second. The tag will then return to its normal state again. (i.e. sensor activated)

2.3 TAG MOUNTING METHODS

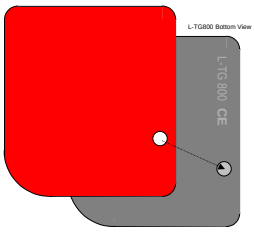
Very High Bondage (VHB) Tape can be used to affix Wavetrend Tags to various objects and appliances. The pictures below describe the method in which the tape is affixed to the tags. Note that the magnet for anti-tamper applications should be positioned as indicated. (Bottom view of tags)



L&W-TG100



L&W-TG501



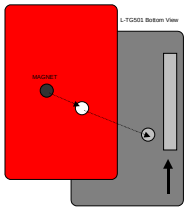
L&W-TG800

2.3.1 TAG ACCESSORIES

Code	Description	Note
L-TA100	L&W-TG501 Card Holder for personnel tagging	Plastic holder and clip
L-TA200	Double sided VHB fixing tape for L&W-TG501	VHB Tape cut to size (10 per pack)
L-TA300	Anti-tamper kit for L&W-TG501	VHB Tape cut to size and magnet (10 per pack)
L-TA400	Double sided VHB fixing tape for L&W-TG100	VHB Tape cut to size (10 per pack)
L-TA500	Anti-tamper kit for L&W-TG100	VHB Tape cut to size and magnet (10 per pack)
L-TA600	Double sided VHB fixing tape for L&W-TG800	VHB Tape cut to size (10 per pack)
L-TA700	Anti-tamper kit for L&W-TG800	VHB Tape cut to size and magnet (10 per pack)

2.4 ANTI-TAMPER

All tags have a magnetic sensor that can be used to detect the tampering of tags that have been affixed using VHB tape. The figure below illustrates how the magnet is placed in the VHB tape. For certain applications it is suggested that the magnet is affixed to the object with glue prior to mounting the tag.



3 TROUBLE SHOOTING

PROBLEM	DIAGNOSTIC	REMEDY
Tag is not transmitting	Tag is in sleep mode	Tag must be activated
	Life-span of tag expired	Tag must be replaced with a new tag
	L&W-TG100, L&W-TG501 on metallic surface	L&W-TG501 and L&W-TG100 do not work on metallic surfaces
Movement sensor not working	Movement sensor not fitted	Not a **MS** option tag
Tamper not working	Magnet not present	See paragraph 2.4 ANTI-TAMPER
Mounting and Affixing	No VHB tape	See paragraph 2.3 TAG MOUNTING METHODS

4 CERTIFICATION

4.1 FCC CERTIFICATION

All the tags in this document conforms to the following certification specifications

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.

4.2 CE CERTIFICATION

The following standards applied in accordance with Article 5 of the directive, 1999/5/EC:

EN 300 220-1 V1.2.1 (1997-11)

ETS 300 683 (1997-03).

Summary of tests:

Effective radiated power	25MHz-4GHz
Range of modulation bandwidth for wideband equipment	
Frequency stability under low voltage conditions	
EN55022	Radiated emissions 30MHz – 1GHz
EN61000-4-3	Radiated immunity 80MHz – 1GHz, excl 433.92MHz±20MHz
EN61000-4-2	Electrostatic discharge

4.3 RTCA / DO-160C CERTIFICATION

The tags conform to the specifications of section 21 Category Z of the EMC requirements on Aircraft Safety.

4.4 INTRINSIC SAFE CERTIFICATION

The tags conform to the following "Explosion Protection Classification" Ex ia I / II T4 according to the SANS 60079-0:2000 part 0 and the 60079-11:1999 part 11 requirements for "Electrical apparatus for explosive gas atmospheres".

4.5 HERO CERTIFICATION

The tags conform to the Hazards of Electromagnetic Radiation Ordnance requirements.

4.6 SAR CERTIFICATION

The tags conform to the Specific Absorption Rate regulations and has been tested and evaluated not to interfere with pacemakers according to the recommendations of the International Commission on Non-Ionising Radiation Protection (ICNIRP).