Service Manual
for
Active RFID Compact Tag

Version: 2.00

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NOTE

This unit contains CMOS devices that may be damaged by electrostatic discharge (ESD). The following steps to minimize ESD must be taken before the unit is dismantled. To prevent any damage that could result if the unit or its parts are not handled properly, observe the following precautions during any handling procedures:

- Minimize all handling of static-sensitive components and assemblies.
- Transport and store static-sensitive components and assemblies in their original containers or anti-static bags.
- Label accordingly any package that contains static-sensitive components or assemblies.
- Discharge static electricity from the body by wearing a grounded anti-static wrist strap while handling these components. Servicing static-sensitive components or assemblies should be done only at a static-free workstation by qualified service technicians.
- Increasing the humidity in the work area minimizes static electricity problems.
- Do not allow anything that can generate or hold a static charge on the workstation surface.
- Pick up components by their bodies, never by their leads.
- Do not slide components over any surface.
- Avoid handling components in areas with a floor or work-surface covering that can generate static charge.

1 Introduction

The purpose of this service manual is to give an overview of the service procedures that may need to be performed by either a third party user, or an authorized ActiveWave service technician. It has been designed to be used by service and repair technicians who are responsible for maintaining the products.

The tag uses both conventional and high-density surface mount component technology, which requires specialist-servicing techniques. We therefore recommend that repairs be carried out at *circuit board* level, rather than at *component* level. Since the tag only consists of one board, we recommend replacing the entire tag for most issues related to hardware failures. We encourage service technicians to carry a small buffer stock of replaceable tags, to allow immediate exchange, should they need to be replaced.

2 Product Overview

ActiveWave tags can be used to track and monitor people, assets, or inventory items in an office, warehouse, or any other type of facility. For example, our tags can be configured to track employees in an office, locate heart monitors in a hospital, find specific pallets in a warehouse – basically any application that requires system monitoring of anything. When tags are used on both people and assets, all movement of valuable assets without an assigned owner will automatically generate system alarms and can securely lock exit doors.

ActiveWave offers the following different types of active RFID tags:
- cardTag
- compactTag
- wristbandTag
- miniTag
- jumboTag

All of these tags have the following features:
1. enable/disable
2. group calls
3. low battery indicator
4. configurable ID and type
5. configurable random response delays
6. configurable no. of transmit packets

7. configurable resend of data in field
8. configurable resend of data out of field (beacon)
9. configurable assigned reader ID

In addition, some or all of the tags have the following options:
1. optional temperature sensor
2. optional tamper switch
3. optional user-definable memory
4. optional LED
5. optional buzzer
6. replaceable battery

2.1 CardTag

Figure 1: ActiveWave CardTag

CardTag Specifications:

- User Memory: 0 - 256 Kbits
- Multi-Tag Read Capability: Yes
- Transmit Frequency: 916 MHz or 868 MHz or 927 MHz (depends on local specs)
- Receive Frequency: 433 MHz
- Read range (maximum under optimal conditions):
    o Field-initiated 30m (100 feet)
    o Tag-initiated 85m (279 feet)
- Power: 3V Lithium-ion coin battery
- Battery Life: 1 - 3 years depending on use (tag has low battery detection)
- Dimensions: 85 mm x 54 mm x 5.3 mm (3.3 in x 2.1 in x 0.21 in)
- Weight: 30 grams (1.1oz)
- Case Material: ABS (Acrylonitrile Butadiene Styrene)
- Tag options:
    o Tamper alarms if tag removed from magnet
    o Memory 0 - 256Kbit memory sizes available in 2^x increments

2.2 CompactTag

Figure 2: ActiveWave CompactTag

CompactTag Specifications:

- User Memory: 0 - 256 Kbits
- Multi-Tag Read Capability: Yes
- Transmit Frequency: 916 MHz or 868 MHz or 927 MHz (depends on local specs)
- Receive Frequency: 433 MHz
- Read range (maximum under optimal conditions):
  - Field-initiated 30m (100 feet)
  - Tag-initiated 45m (147 feet)
- Power: 3V Lithium-ion coin battery
- Battery Life: 1 - 3 years depending on use (tag has low battery detection)
- Dimensions: 59 mm x 30 mm x 10 mm (2.3 in x 1.2 in x 0.4 in)
- Weight: 14.2 grams (0.5oz)
- Case Material: ABS (Acrylonitrile Butadiene Styrene)
- Tag options:
  - Tamper Alarms if tag removed from magnet
  - Optional bracket
  - LED blinks when called
  - Buzzer beeps when called
  - Memory 0 - 256Kbit memory sizes available in 2^x increments

2.3 MiniTag

Figure 3: ActiveWave MiniTag

MiniTag Specifications:

- User Memory: 0 - 256 Kbits
- Multi-Tag Read Capability: Yes
- Transmit Frequency: 916 MHz or 868 MHz or 927 MHz (depends on local specs)
- Receive Frequency: 433 MHz
- Read range (maximum under optimal conditions):
    - o Field-initiated 30m (100 feet)
    - o Tag-initiated 30m (100 feet)
- Power: 3V Lithium-ion coin battery
- Battery Life: 1 - 3 years depending on use (tag has low battery detection)
- Dimensions: 34 mm x 30 mm x 12 mm (1.3 in x 1.2 in x 0.5 in)
- Weight: 11.3 grams (0.4oz)
- Case Material: ABS (Acrylonitrile Butadiene Styrene)
- Tag options:
    - o Tamper Alarms if tag removed from contact
    - o Optional bracket
    - o Temperature Alarms if exceeds predefined limits
    - o Memory 0 - 256Kbit memory sizes available in 2^x increments

2.4 WristbandTag

Figure 4: ActiveWave WristbandTag

WristbandTag Specifications:

- User Memory: 0 - 256 Kbits
- Multi-Tag Read Capability: Yes
- Transmit Frequency: 916 MHz or 868 MHz or 927 MHz (depends on local specs)
- Receive Frequency: 433 MHz
- Read range (maximum under optimal conditions):
    - Field-initiated 30m (100 feet)
    - Tag-initiated 30m (100 feet)
- Power: 3V Lithium-ion coin battery
- Battery Life: 1 - 3 years depending on use (tag has low battery detection)
- Dimensions: 34 mm x 30 mm x 12 mm (1.3 in x 1.2 in x 0.5 in) – without band
- Weight: 11.5 grams (0.4oz)
- Case Material: ABS (Acrylonitrile Butadiene Styrene)
- Tag options:
    - Tamper Alarms if tag removed from band or band cut
    - Temperature Alarms if exceeds predefined limits
    - Memory 0 - 256Kbit memory sizes available in 2^x increments

2.5 Jumbo Tag

Figure 5: ActiveWave Jumbo Tag

Jumbo Tag Specifications:

- User Memory: 0 - 256 Kbits
- Multi-Tag Read Capability: Yes
- Transmit Frequency: 916 MHz or 868 MHz or 927 MHz (depends on local specs)
- Receive Frequency: 433 MHz
- Read range (maximum under optimal conditions):
  - Field-initiated 30m (100 feet)
  - Tag-initiated 30m (100 feet)
- Power: 3V Lithium-ion coin battery
- Battery Life: 1 - 3 years depending on use (tag has low battery detection)
- Dimensions: 85 mm x 54 mm x 9.0 mm (3.3 in x 2.1 in x 0.35 in)
- Weight: 34 grams (1.2oz)
- Case Material: ABS (Acrylonitrile Butadiene Styrene)
- Tag options:
  - Tamper Alarms if tag removed from magnet
  - Optional bracket
  - LED blinks when called
  - Buzzer beeps when called
  - Memory 0 - 256Kbit memory sizes available in 2^x increments

3 Part Numbers

The following chart lists the part numbers for the ActiveWave active RFID tag boards, wristbands, and complete tags. Note that the numbers designate different frequencies and types of tags, antennas, housing, etc.

No.	Part No.	Sub-Part No.	Sub-Part No.	Description
1	**TAG RAW-A**			**TAG RAW BOARD**
2		TAG RAW-A		
3			RAW-1	cardTag Raw Board
4			RAW-2	compactTag Raw Board
5			RAW-3	wristbandTag Raw Board
6			RAW-4	miniTag Raw Board
7			RAW-5	jumboTag Raw Board
8			RAW-6	tiewrapTag Raw Board

No.	Part No.	Sub-Part No.	Sub-Part No.	Description
1	**WBD-ABCDE**			**WRISTBAND**
2		WBD-A		Type Option
3			WBD-1	Disposable w ristband
4			WBD-2	Washable w ristband
		SNP-B		Snap Position Option
			SNP-0	No snaps
5			SNP-1	Snaps up (for tag facing up)
6			SNP-2	Snaps dow n (for temperature tag facing dow n)
7		COL-C		Color Option
8			COL-1	White Band
9			COL-2	Black Band
10			COL-3	Custom Band
11		SIZ-D		Size Option
12			SIZ-1	Small
13			SIZ-2	Medium
14			SIZ-3	Large
15		LOG-E		Logo Option
16			LOG-0	No Logo
17			LOG-1	ActiveWave Logo
18			LOG-2	Custom Logo

No.	Part No.	Sub-Part No.	Sub-Part No.	Description
1	**TAG-ABC-DEFGHIJ**			**TAG**
2		FRQ-A		Frequency Option (TX/RX)
3			FRQ-1	916/433
4			FRQ-2	868/433
5			FRQ-3	927/433
6		TYP-BC		Tag Type Option
7			TYP-01	cardTag
8			TYP-02	compactTag
9			TYP-03	wristbandTag
10			TYP-04	miniTag
11			TYP-05	jumboTag
12			TYP-06	tiewrapTag
13		TAM-D		Tamper Switch Option
14			TAM-0	No Tamper Switch
15			TAM-1	Tamper Switch (S1)
16		MEM-E		External Memory Option
17			MEM-0	No External Memory
18			MEM-1	1K Bits External Memory (128 Bytes)
19			MEM-2	2K Bits External Memory (256 Bytes)
20			MEM-3	4K Bits External Memory (512 Bytes)
21			MEM-4	8K Bits External Memory (1 KByte)
22			MEM-5	16K Bits External Memory (2 KBytes)
23			MEM-6	32K Bits External Memory (4KBytes)
24			MEM-7	64K Bits External Memory (8KBytes)
25			MEM-8	128K Bits External Memory (16KBytes)
26			MEM-9	256K Bits External Memory (32KBytes)
27		LED-F		LED Option
28			LED-0	No LED
29			LED-1	LED (R21,R22,Q4,D1)
30		BUZ-G		Buzzer Option
31			BUZ-0	No Buzzer
32			BUZ-1	Buzzer
33		TMP-H		Temperature Sensor Option
34			TMP-0	No Temperature
35			TMP-1	Temperature
36		BAT-I		Battery Option
37			BAT-0	No Battery
38			BAT-1	One Battery
39			BAT-2	Two Batteries
40		COL-J		Enclosure Option
41			COL-0	No Enclosure
42			COL-1	White Housing with ActiveWave logo
43			COL-2	Black Housing with ActiveWave logo
44			COL-3	Custom (logo, etc.)

4 Troubleshooting Guide

Problem	Reason	Remedy
Tag does not respond to call.	1. Tag not enabled. 2. Tag response blocked by metal or liquid. 3. Tag response corrupted by other tag responses. 4. Tag too far away. 5. Tag's "Assigned Reader ID is different from the user's Reader ID. 6. Tag battery dead. 7. Reader or FGen faulty.	1. Send enable command to tag. 2. Remove obstructions from tag. 3. Use long random delay when calling tags, or call single tag specifically. 4. Bring tag closer or increase transmit power of Reader or FGen. 5. Configure tag's "Assigned Reader ID" to 0. 6. Replace tag battery. 7. Check Reader or FGen.
Very large invalid tag IDs seen.	1. More than one Reader with the same Reader ID exists in the system.	1. Change Reader IDs so every Reader in the system has a unique ID from 1 – 255.
Only one Reader sees the tag – tag called by FGen.	1. Normal behavior. Only the Reader whose ID is assigned to the FGen can see the tag.	1. n/a
Only one Reader sees the tag – tag called by Reader.	1. Normal behavior. Only the Reader who calls the tag will see that tag response.	1. n/a
Only one Reader see tag – tag is auto-sending its data.	1. Tag has an assigned Reader ID. Tag uses this only when auto-sending so only one specified Reader will see it.	1. Configure the tag so the "Assigned Reader ID" is 0. Then any Reader will see the tag's data.
Tag's LED or buzzer does not activate when called.	1. Not sending the correct call tag command. 2. LED or buzzer is bad.	1. Send the LED or buzzer enable bit when calling the tag. 2. Replace LED or buzzer.
Cannot access external memory.	1. Not enough external memory is on the tag.	1. Order new tags with higher memory.

5 Dismantling the Tag

The tag is not designed for disassembly. The only time the tag should be opened is when the battery cover is removed for easy battery replacement. For cardTags which do not have a battery cover, the tags should be sent to an authorized ActiveWave dealer for battery replacement.

6 Re-assembly Instructions

Not applicable since we do not recommend that the tags be disassembled.

7 Preparing for First Time Use

When the tag is first received from the factory, it is programmed with a unique ID and default configuration values. The default values are listed below:

TIF (Time-in-field)	14 seconds
GC (Group Count)	8 times
Auto-send time	0 seconds
Assigned Reader ID	0
Tamper Reporting	none
Random Delay	short

Using the ActiveWave Programming Station software or other application that uses the ActiveWave API, the user should first enable the tag. The Enable screen for the Programming Station application is shown in Figure 6.
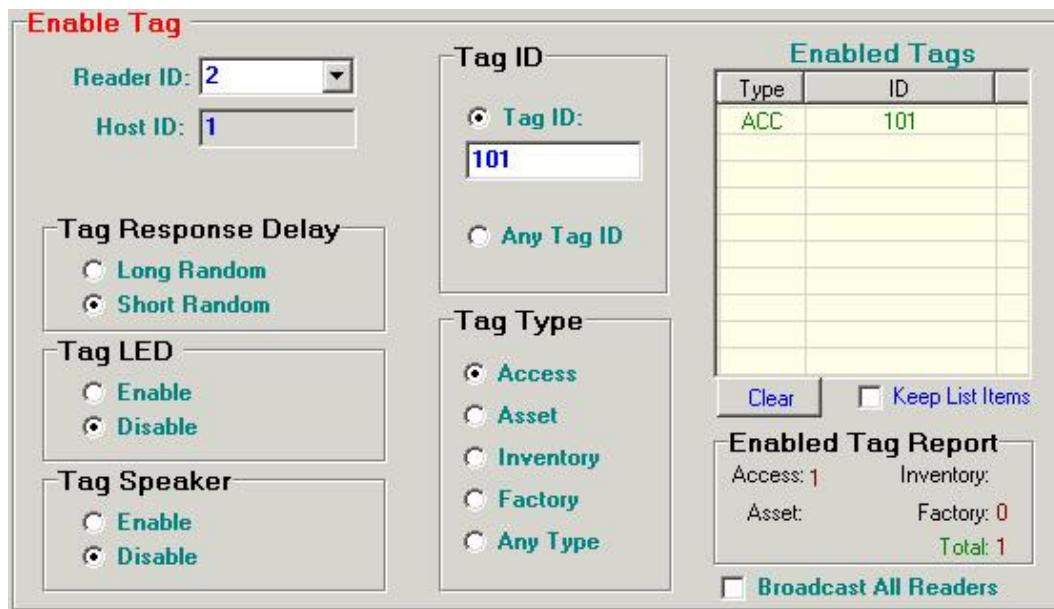
Figure 6: Programming Station Enable Tag Screen

After the tag is enabled, the user should make any desired configuration changes to the tag. Figure 6 shows the Programming Station's Tag Configure screen.
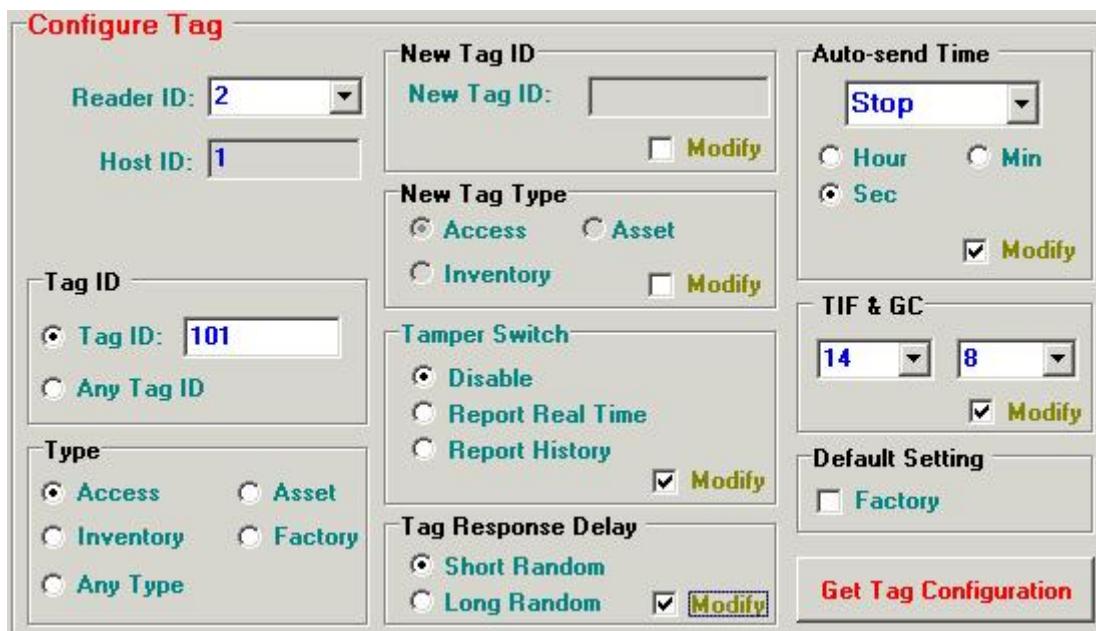
Figure 7: Programming Station Configure Tag Screen

The configure command will allow you to configure a tag in order to meet your specific application requirements. Many different characteristics of the tag can be adjusted. After choosing the specific Tag ID, Tag Type, and Reader ID, you can change the following information:

- New Reader ID
  Enter a new tag ID here.

- New Tag Type
  Enter a new tag type here.

- Tamper Switch
  - Disable – This will disable the tamper switch. If the tag is tampered with, the tag will not report it unless queried by the Host.
  - Report Real Time – This will report any tamper changes immediately.
  - Report History – This will mark if the tamper switch has ever been tampered. When the tag is queried, it will report if it were ever tampered, even if it is no longer tampered. To reset the status, configure the tamper switch setting again (to the same or something else).

- Tag Response Delay
  Each tags' random number generator determines the amount of time to wait between each group of transmitted tag responses (for Group Count > 1). A short random response delay will take less time to transmit data. A long random response delay will take longer to transmit data, but will ensure the tag's response is received in a multi-tag environment.

  For the Tag Configuration screen, this setting is only used by the tag when transmitting unsolicited or asynchronous packets (timer and event-driven transmissions as opposed to responses to commands from Readers or Field Generators). For example, this setting determines the response delay when the tag is transmitting due to:
  - Expiration of Auto-send timer
  - Expiration of Temperature report timer
  - Alarm if temperature exceeds upper or lower limits (and reporting in real-time)
  - Alarm if tamper switch is activated (and reporting in real-time)

  The Tag Response Delay for the acknowledgment to the Tag Configure command is always long and is not configurable

- Auto-send Time
  This time determines how long the tag waits before transmitting its data periodically. When configured, the tag acts like a beacon – periodically transmitting its data without waiting for a wake-up or call command.

- TIF & GC
  TIF stands for Time-in-Field. When a tag enters a constant field (a device is constantly calling it), the tag will transmit its data. If the tag is still being called continuously, the tag will wait for this amount of time (TIF) before resending its data. This feature is particularly useful for access control applications.
  GC stands for Group Count. This is the number of repeated packets that the tag transmits. The default is 8 times. For example, when the tag is called, it will respond 8 times (each time with the same packet). For environments with noise or high numbers of tags, increasing this value will improve reception.

- Default Setting
  By selecting Factory, you can revert the tag back to its original Factory Settings.

8 Testing

The easiest way to test the tag is to use the Programming Station software and a standard Reader. Place the tag close to the Reader (within a meter). Call this tag and observe the LEDs. The ACCESS LED will turn on for 4 seconds (default value) while the Reader is continuously sending a call tag command. When the tag responds, the RF LED will flash to indicate that a packet is being received by the Reader. Also, the HOST LED will flash to indicate that the received data has been validated and is being sent to the Host. The Programming Station will display the responding tag(s).

10. FCC ID VJRTAG-142

11. Warning

```
    FCC ID:  VJRTAG-142

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.
```

12. THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV
INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS
EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY
TO OPERATE THE EQUIPMENT.