

S1470 CableTag Data Sheet and Mounting Instructions

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1 Introduction

This section introduces the TagMaster S1470 CableTag, a Heavy-Duty (HD) ID-tag and defines the target group for this manual.

An ID-tag is a device for carrying ID information that can be read at a long distance by TagMaster's long range Radio Frequency Identification (RFID) Readers. The CableTag is specially designed for harsh environments and train applications.



Figure 1 TagMaster CableTag

The target group for this document is personnel involved in specifying and mounting the CableTag.

The aim of this document is to present an engineer, who has the necessary education and training, with the information needed to correctly use, connect to and mount CableTags within rail applications.

Local requirements may necessitate variations to the actual mounting solutions presented in this manual. If in doubt, consult the system integrator or contact TagMaster.

This manual refers to the tags in the S1470 CableTag series, with part numbers such as 147000 and 147001.

2 General Information

The CableTag is a Heavy-Duty 2.45 GHz identification ID-tag suitable for both train and track mounting. The CableTag complies with a wide range of rail standards.

The CableTag has the following features:

- Powered by external supply via the cable
- Updatable programmable memory via a RS485 Serial Interface
- Fixed Tag-ID plus up to 574 bits of programmable data

The current series of CableTags have a factory set and unique 8-digit ID number. In addition to the ID number and the programmable memory, a 32-bit checksum for automatic verification and error detection is included in the data string. Substitution errors are effectively eliminated even when ID-tags are read at long distances or exposed to extremely noisy electrical environments.

2.1 General Physical Properties

All the current series of CableTags have the same physical properties; see mechanical dimensions in this document.

Future variations of the CableTag will allow connection by alternative cable entry devices.

The CableTag is designed for harsh environments, with a completely sealed rigid polycarbonate plastic enclosure, which conforms to the IP67 classification.

Note! The CableTag has no serviceable parts and should not be opened.

2.2 Typical Applications

The CableTag can be used in rail and metro systems to enable variable train condition data to be sent to track or track side equipment. In this case the ID-tag is physically connected to an On-board System via the serial interface. This connection includes power and a serial interface. As the ID-tag is mounted on or under the train, the enclosure is designed to be suitable for this environment and provide suitable cable termination features.

Alternatively, the CableTag can be used in rail applications where the tag is mounted on the track, e.g. directly on the sleepers or ties. The variable data from track-side systems is programmed into the CableTag via the serial interface and is then read by reader mounted on the train.

3 Functional description

From the RFID reader's point of view, the CableTag is a read-only RFID tag. The information received from the CableTag via the RF air interface is the CableTag ID number followed by a string of configurable data (14 to 574 bits). The CableTag is powered and configured via an external cable connected to the 6-pin circular connector. This connection contains the power feed, ground, and a two-wire RS-485 serial interface. There are two currently unused pins in the connector.

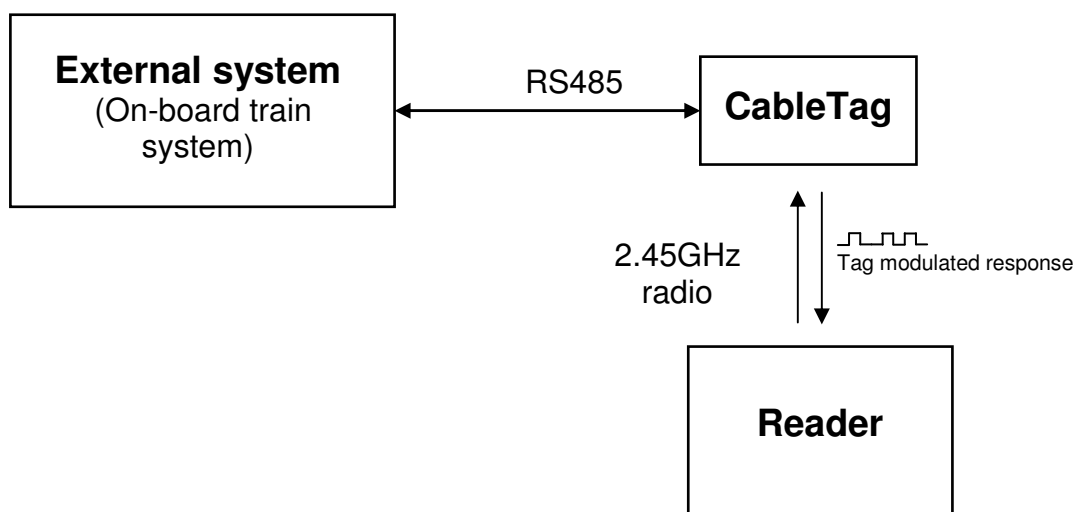


Figure 1: Schematic description of a CableTag and its relation to an external system and the Tag Reader.

The CableTag ID number and the full data contents are transmitted continuously. Currently the CableTag series emulates a TagMaster ScriptTag (S1450).

Note: The CableTag emulates "mini", "quarter" or "full" memory mode; see sections below for more details on use of memory.

3.1 ID-tag to Reader Relationship

The front side of the CableTag must be oriented towards the front side of the Reader. For maximum reading range, the front surface of the CableTag should be parallel with the front side of the Reader. If the CableTag is misaligned relative to the front side of the Reader, the reading range is reduced.

The CableTag may be rotated freely around the prolonged axis between the Reader and the CableTag.

The horizontal and vertical tolerances are a function of the reading range of the Reader and the distance between the CableTag and the Reader. Typically the widest reading zone, both horizontally and vertically, is obtained at a distance of 2–4 meters from the Reader.

4 Cable Connection

The common power and communication cable is terminated at the CableTag via a 6-pin Male Connector. The Male connector on the CableTag conforms to the MIL standard and is a multi-source connector available from several manufactures that produce MIL compliant variations of the specified shell size. These in turn have with various female back parts and cable fixing alternatives to suit the application.

Note: The mating female cable and connector is not supplied with the CableTag.

4.1 CableTag Connector data:

- Connector type: Male connector to MIL-C-5015 and VG95234 (IP67)
 - Fixing: 1/4 turn bayonet
 - Shell size: 14
 - Number of contacts: 6
 - Contact size: 16*
 - Contact cable size: 0.51mm to 1,29mm Diameter (24 up to 16 AWG)*
- *Subject to selected version from cable connector manufacture

Note: The cable length between the CableTag and the external system should not exceed 100m.

4.2 Pin Connections

The following table indicates the CableTag male connector pin connections.

| Pin No. | Description | Comments |
|---------|---------------|---|
| 1 (A) | + VDC | Positive DC Supply voltage |
| 2 (B) | 0 VDC | Common Ground |
| 3 (C) | TX/RX+ | RS485 half-duplex Transmit Receive data |
| 4 (D) | TX/RX- | RS485 half-duplex Transmit Receive data |
| 5 (E) | No-connection | Spare for future use |
| 6 (F) | No-connection | Spare for future use |

Note: This data applies to CableTag part numbers such as 147000 and 147001

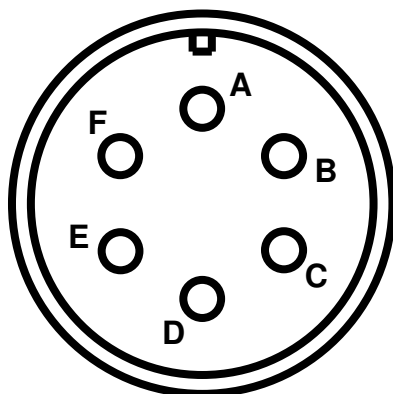


Figure 2: Schematic of a CableTag male connector pin identifications.

5 Operating Frequency

The CableTag is passive from a radio perspective, and is using backscattering technology to reflect the incoming energy from the reader. The operating frequency of the CableTag is 2.435 GHz to 2.465 GHz.

6 Supply Voltage

The CableTag use an external variable supply voltage, supplied via the common power and interface multi-core cable:

6.1 Part Number 147000

Supply voltage: Between 10 and 30 VDC

Current consumption (at 10 to 30 volts): Between 50 to 100 mA

6.2 Part Number 147001

Supply voltage: Between 10 and 37.5 VDC
(for the North American market)

Current consumption (at 10 to 37.5 volts): Between 50 to 100 mA

The 37.5 VDC version of the CableTag will not exceed a 3.5 A max inrush current.

7 Serial Communication

The CableTag use a TagMaster defined serial communication protocol. This communication protocol is defined in a separate document:
S1470 CableTag Serial Communication Specification (Doc. No. 04-129)

The communication protocol supports an number of message types, both to and from the CableTag. Theses messages allow the onboard system to send data to the CableTag and receive status and acknowledge messages back from the CableTag.

8 Programmable Memory

The current versions of the CableTag emulate "mini", "quarter" or "full" memory modes which are defined in the TagMaster GEN4 Readers and can be read by all the HD and LR-series readers.

In the Mini Memory mode, 14 user defined bits

In the Quarter memory mode, 154 user defined bits

In the Full memory mode, 574 user defined bits

For more detailed information, refer to the S1470 CableTag Serial Communication Specification (Doc. No. 04-129)

9 Mechanical Properties

9.1 Enclosure format

The CableTag has the following mechanical properties:

- Rigid plastic enclosure. Material: Polycarbonate Flame class: V0
- Approximate weight: 180g +/- 15g
- Colour: Dark Grey (Customer definable label on front face)
- Overall Dimensions: 150 mm long 68 mm wide 40 mm high
- Environmental conditions IP rating: IP67

9.2 Temperature range

The CableTag has the following temperature properties.

Temperature Range

Operational: -40 °C to +70 °C

Storage: -55 °C to +85 °C

9.3 Dimensions

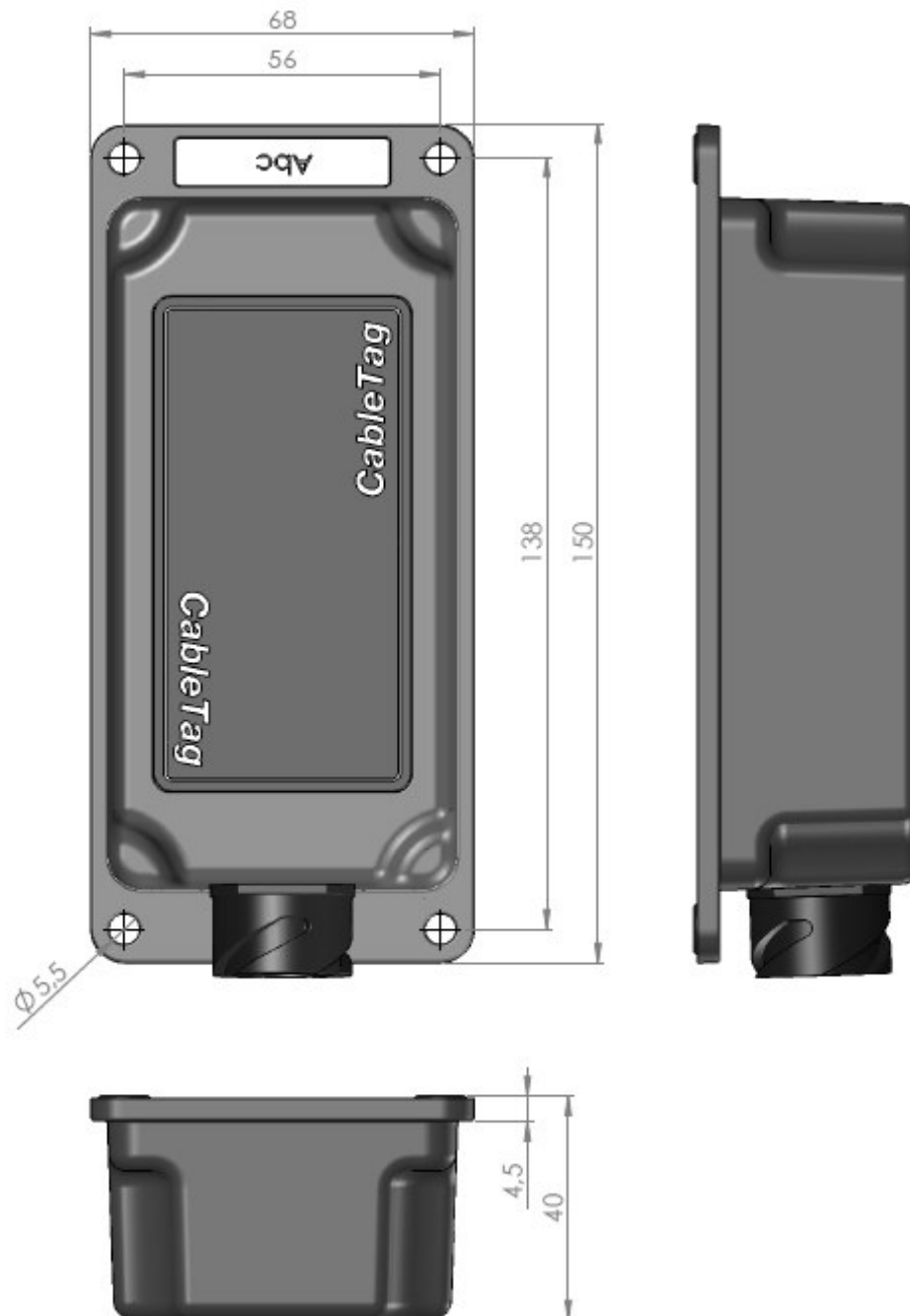


Figure 3: External CableTag dimensions.

9.3.1 Mounting Holes

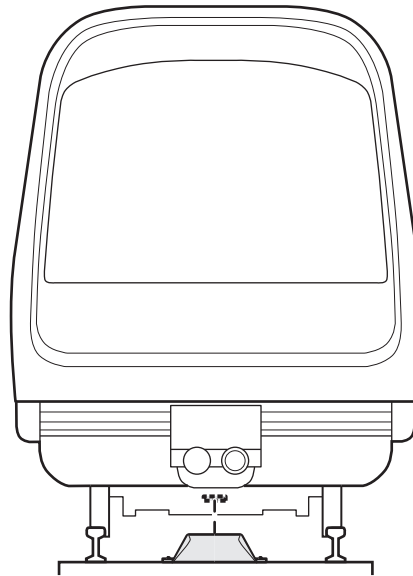
The CableTag enclosure provides 4 fixing holes for mounting the tag in place on a pitch of 138mm by 56mm.

10 Mounting Examples

The CableTag can be mounted in the following ways.

10.1 Train Mounted (Reader on Track)

In the case of train-mounted CableTags, mount the CableTag as near as possible to the centre line of the Reader position below the train.



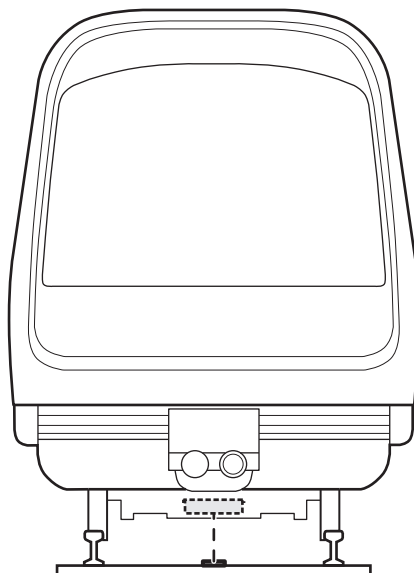
07-053 01

Figure 4 Train-mounted CableTag position

Note: As the reading zone is limited by the short reading range in this installation, the alignment along the centre line is more important in this type of installation.

10.2 Track-mounted (Reader on train)

In the case of track-mounted CableTags, mount the CableTag on the track as near as possible to the centre line of the Reader position.



07-054 01

Figure 5 Track-mounted CableTag position

Note: As the reading zone is limited by the short reading range in this installation, the alignment along the centre line is more important in this type of installation.

10.3 Mounting CableTag Using Mechanical Fasteners

The CableTag is provided with four holes. The holes suit M4 screws or similar mechanical fasteners, including rivets.

Tighten the screws to a torque of 3.3 Nm.

Note! Over-tightening the screws may damage the CableTag casing.

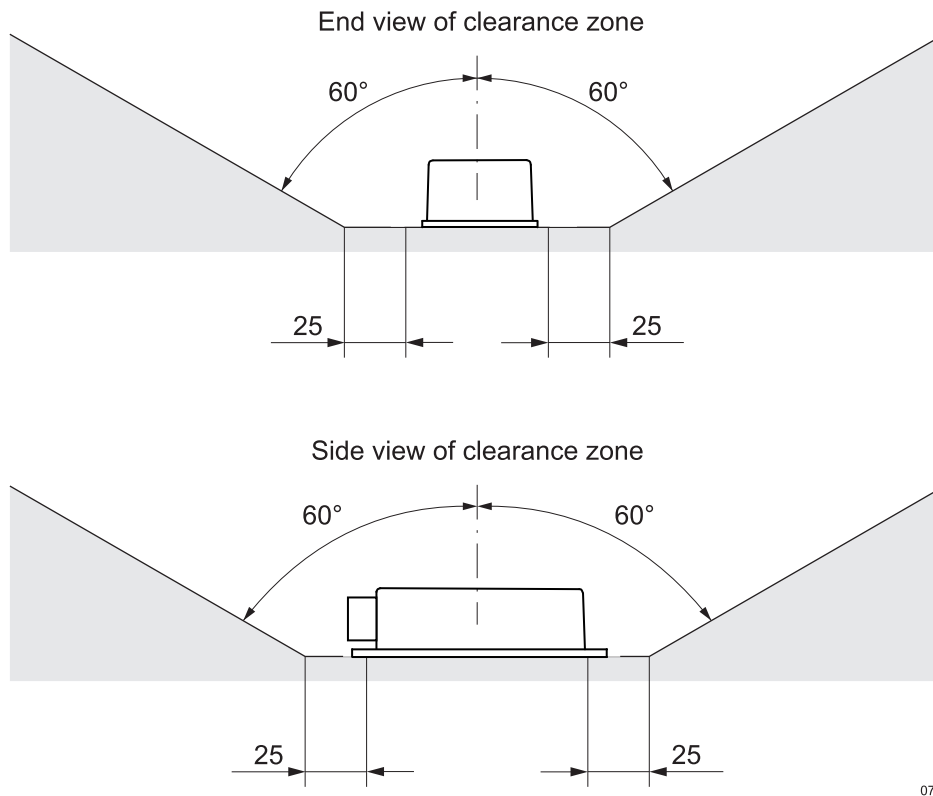
If the mounting surface is rigid or even slightly uneven, place a flexible material such as a rubber shim under the CableTag before fastening it in place.

When using rivets, ensure they are the correct size for the holes in the CableTag and that they do not have an excessive fitting force (aluminium rivets are normally suitable).

10.4 Reading Angles

The CableTags can be mounted on trains and tracks in a number of ways. Finding a suitable position and a suitable fastening method is important when mounting the CableTag.

The CableTag may be mounted on any supporting material which is basically flat, including all metals. The performance of the ID-tags is not affected by the supporting material, as long as it is not obstructing the front face of the ID-tag.



07-055 01

Figure 6 CableTag mounting clearance zone (units of measurement: mm)

The figure above illustrates the clearance zone in front of the CableTag in the direction of the Reader. Obstructions in the clearance zone should be avoided since it can affect the reading performance of the reader, and its ability to read the CableTag.

11 Compliance with Railway Requirements

The CableTag has been designed to be compliant with the relevant parts of these standards.

11.1 Applicable standards

The CableTag has been designed to meet current CE standards, as well as the applicable Rail Standard's for EMC and Vibration, as used for the TagMaster HD-Tag family of tags.

These include:

- For EMC
 - Relevant EMC parts of EN 50121
 - EN 50121-3-2
- For Vibration and Shock
 - Relevant parts of EN 50125
 - IEC 613373 to Class B section 8, 9, & 10
As defined in IEC 60068-2-64 and IEC 60068-2-47
- Compliant to IEEE-1476 voltage requirements

The CableTag is designed to comply with a proposed set of standards, including: CE marked, which means compliance to several EU directives.

FCC

R&TTE 1999/5/EC annex IV

Health: 1999/519/EC

EI safety: EN60950

EMC: EN301489-3:2000

Radio: EN300440:2001

In addition, the CableTag is compliant with the existing TagMaster HD tag series requirements for environmental conditions, including as a minimum:

Temperature Range

Operational: -40 °C to +70 °C

Storage: -55 °C to +85 °C

Climatic cycling: 10 cycles (24h) of +65°C, 93%RH,
+25°C, >80%RH and -10°C

IEC 60068-2-38

Sealing: IP 67

IEC60529

Bump: 30 g 11 ms, 1000x 3 dir

IEC 60068-2-27 or -29 Eb

Shock: 500 g 1 ms, 100x3 dir

IEC 60068-2-29 or -27 Ea

Vibration: 5-2000 Hz, 0.23 grms, 5h in 3 dir

IEC 60068-2-64

Solar radiation: 1120 W/sqm (1.04 W/sqFt)

IEC68-2-5 Sa C 56 days

Immunity Acc. to CE leg.:

Pr-ETS 300 683

Emission Acc. to CE leg.:

I-ETS 300 440

Chemical resistance to: Oil, grease / Petrol / Triclorethylene / Acid / Alkali (bases)

12 Glossary

| | |
|-----------------|--|
| CableTag | Heavy-Duty ID-tag |
| ID-tag | ID-carrier In the TagMaster system, which is readable and writable via microwaves. |
| Reader | TagMaster HD-series ID-tag Reader. |
| RFID | Radio Frequency Identification |

13 References

- [1] *Specification: S1470 CableTag Serial Communication Specification*
(Doc. No. 04-129)

14 Contact

For any further inquiries, please contact TagMaster North America, Inc.

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