

## ***HD Track Reader Data Sheet*** ***15694x Series Reader***



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The HD Track Reader communicates with ID-tags through its built-in antennas. The receiver circuitry uses digital processing techniques, which enables it to be used in high-speed applications, at speeds of up to 400km/h.

The Reader is DC powered from an external source. The HD Track Reader is designed for installation in harsh environments and its construction protects it from water spray, dust and other environmental conditions.

## 1.2. Reading and Writing ID-Tags

The maximum reading and writing ranges are defined as the maximum communication distances along the radiation axis, presupposed that the ID-tag and Reader antenna face each other and there is free space in between.

The reading range can be reduced to avoid unwanted readings of ID-tags; see table below. The actual reading range depends on the type and position of the ID-tag and the settings in the Reader.

Table 1 Reading range

Reading range setting:	
1	Reading range is set to approximately 25% of the maximum reading range
2	Reading range is set to approximately 50% of the maximum reading range
3	Reading range is set to approximately 75% of the maximum reading range
4	Reading range is set to maximum

## 1.3. Reading Lobe

The Reader identifies ID-tags within the reading lobe that expands in front of the Reader antenna. The reading lobe is balloon shaped, where the widest part of the lobe is present at a distance which is approximately 60% of the total read range.

Readings can be performed at speeds of up to 400km/h, however, the reading speed is related to the selected ID-tag and the width of the reading lobe (which relates to the distance between the ID-tag and the Reader). Depending on the installation environment, the reading lobe might be affected by signal reflections and attenuation related to material penetration. Contact TagMaster for further information regarding reading lobe calculations and ID-tag selection.

The Reader under the protective cover is tilted relative the bottom plate. The reason for having the Reader tilted is to facilitate the detection of a train's direction of movement when it enters the reading lobe.

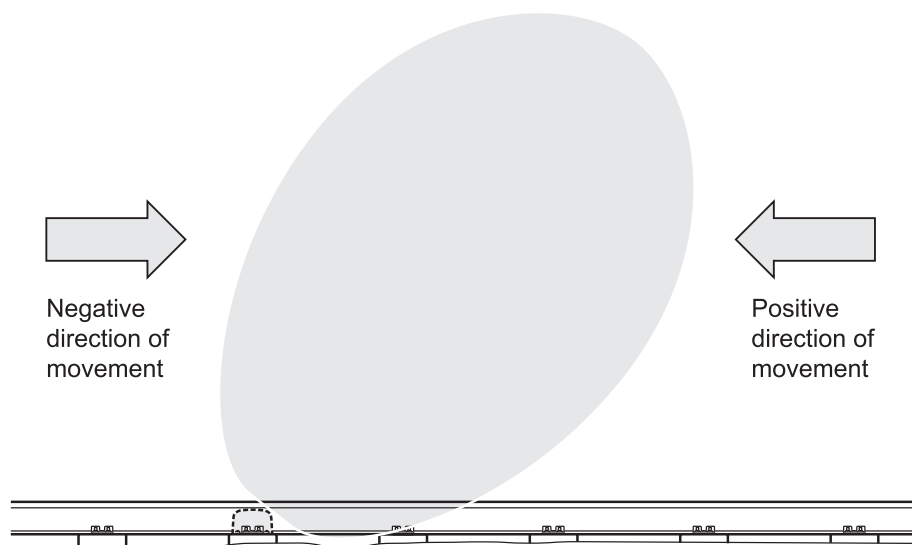
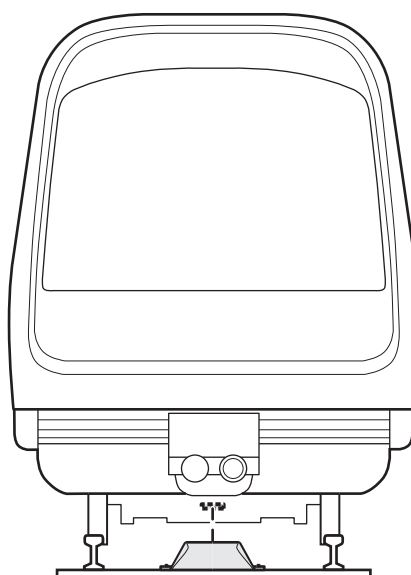


Figure 2 The reading lobe is tilted relative the Reader bottom plate

The Reader is capable of detecting moving objects without ID-tags. The Reader will indicate a positive or negative direction of movement depending on if the Reader is mounted so that the reading lobe tilts towards or away from the incoming object.

As the size of the reading lobe cross section is limited by the short distance present between a track-mounted Reader and a train-mounted ID-tag, the alignment along the centre line is more important in this case than in installations where a more optimal reading range can be achieved.



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Figure 3 Track-mounted Reader in relation to a train-mounted ID-tag

## 1.4. Communication Interface

The Reader has several communication alternatives and is easily integrated, for example using the following communication interfaces:

- RS232 serial communication interface
  - RS485 serial communication interface, both 4-wire (full-duplex) and 2-wire (half duplex)
  - Ethernet 10/100 Mbps
- Note:** If the internal Ethernet interface is required, then the Ethernet Connector Option should be ordered with the HD Track Reader.

Note: The Reader has two RS232 serial interfaces. The first RS232 interface is the communication interface available for connection to a host computer. The second RS232 interface is the Service Interface. The Service Interface is used for software maintenance and configuration and is not intended as an external system interface.

## 1.5. HD Track Reader Options

The following table lists the hardware and software options currently available for the HD Track Reader. All the options need to be ordered together with the Reader. The HD Track Reader includes the Linux operating system as standard and supports automatic transmission of tag data on the Ethernet interface (using TagMaster’s TAGP protocol).

Table 2 HD Track Reader options

Option	Description
<b>Hardware Options</b>	
Ethernet Connector	The Ethernet Connector Option, which supports TCP/IP protocols, requires an additional external Ethernet connector. See section 3.2 for more information.
Main connector	The main connector can be configured in several ways and according to customer specific specifications. See section 3.1 for more information.
<b>Software options</b>	
WiseMan SW	The WiseMan Software is flexible and adaptable Reader application software, which can run stand-alone or controlled from a host. WiseMan SW comprises a database and logic to make decisions based on identified ID-tags. WiseMan SW implements the ConfiTalk protocol on the RS232 and RS485 interfaces.
WatchMan SW	The WatchMan Software operates under a host system that controls the Reader and makes decisions based on ID-tag readings from the Reader. WatchMan SW implements the ConfiTalk protocol on the RS232 and RS485 interfaces.
Auto-Transmit SW	Auto Transmit Software enables communication over the serial interfaces, where the tag data is sent immediately when a tag is read. It also supports setting reader variables via the serial interfaces.
Custom SW	Custom reader software applications are also available. (Subject to separate specification and quotation).
Movement detection	Movement detection is a software option which utilises the Doppler radar function in the HD Track reader. Contact TagMaster for more information.

## 1.6. Internal Controller Board Connections

For understanding of the capabilities of the HD Track Reader, the following table lists the internal controller board connections. The information for the different interfaces are described in relationship to the layout of the controller board (see Figure 4).

Table 3 Internal Controller Board connections

No.	Function	Description
J1	Relay outputs	The controller board has one relay output.
J51	Isolated Inputs	The Reader has three separate and isolated inputs which are activated by a current flow.
J52	Isolated Outputs	The Reader has two open collector outputs which can be used for switching an external current on and off. The OUTSPL pin is a common external power supply needed for the Isolated output function. If there is no need for isolation, the power can be fed from J31 Power Supply pin 3 and 4.
J31	Power Supply	Pin 1 is internally connected to pin 3. Pin 2 is internally connected to pin 4. The purpose is to make it possible to feed power to any peripheral equipment. Use pins 1 and 2 for the external power supply connection.
J32	External Tamper Switch	To protect the Reader from tampering, there are two mechanical tampering switches. The internal one is not used on the HD Track reader. The external tamper switch interface can be connected to an external alarm loop.
J2	Wiegand/ Mag-stripe	The controller board has an access control interface that supports both Wiegand and Mag-stripe protocols. The connector pins have two different functions depending on if Wiegand or Mag-stripe is used.
J41	RS485 Serial Communication Interface	The controller board has one RS485 serial interface for both 2-wire and 4-wire communication. The communication can be in half duplex or full duplex. The RS485 supports also multi-drop serial networks for half duplex.
J42	RS232 Serial Communication Interface	The controller board has one RS232 serial interface for application software use.
J43	RS232 Service port Interface	The service interface can be used for maintenance and configuration of the Reader. Do not use the service interface as a regular system interface.
P1	Ethernet	Fast Ethernet 10/100 Mbps interface that supports auto-negotiation for automatic media speed and protocol selection. Indicators on the Ethernet connector indicate link/activity and link speed 10/100. <b>Note:</b> If the internal Ethernet interface is required, then the Ethernet Connector Option should be ordered with the HD Track Reader.
P2	USB	Two USB host interfaces that comply with the USB 2.0 Full Speed standard. They can be used as expansion interfaces for adding new functionality to the Reader meeting specific customer requirements. For instance Flash memory, GSM modem or WLAN interface. Readers are pre-installed with Linux drivers that can be used to access USB memory devices. The interfaces also supply power to the connected devices.
P3	Expansion Board Interface	It is possible to add other customer specific hardware via the expansion board interface.
P4	Micro SD Memory Card interface	The interface (specification version 1.0) can be used to add more memory and new functionality to a Reader. Readers are pre-installed with Linux drivers for accessing the memory cards.

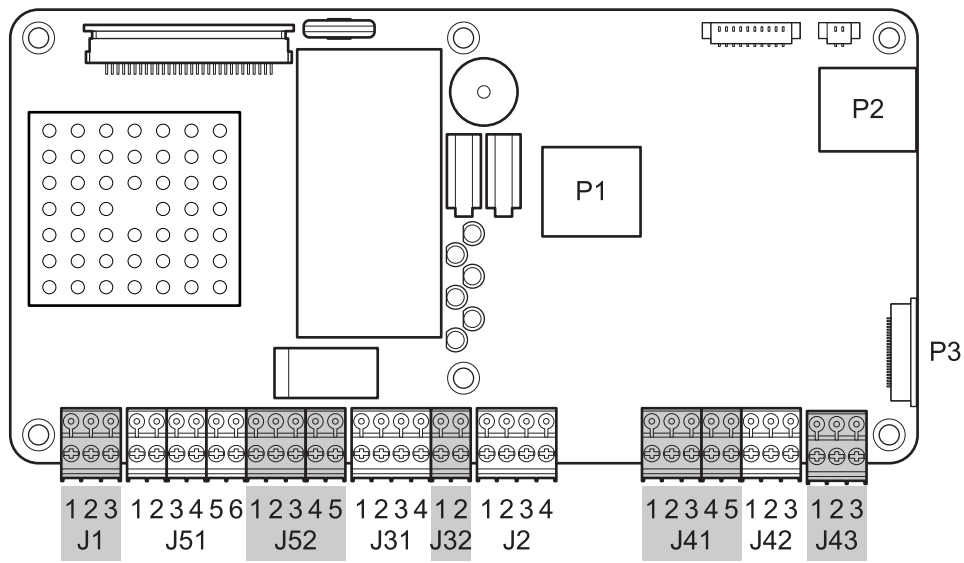


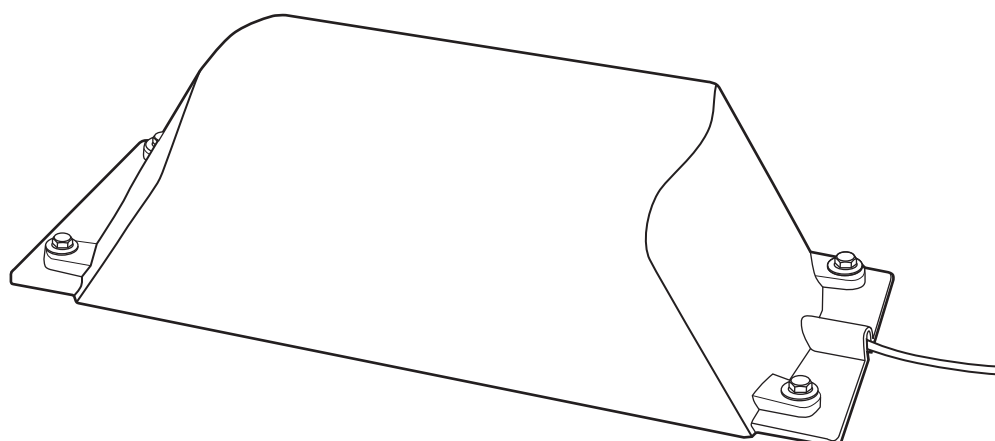
Figure 4 Internal Controller Board overview

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# 1. Introduction

The Heavy Duty (HD) Track Reader is a long range Radio Frequency Identification (RFID) device for identification of ID-tags. The HD Track Reader is specially developed for railway applications which set high requirements on electrical and mechanical endurance.

The HD Track Reader can be used as a stand-alone reading device, or can be incorporated into a comprehensive identification system by connecting the reader via one of several communication interfaces in the reader.



*Figure 1 HD Track Reader*

The HD Track Reader was previously referred to as the S1569 Heavy Duty Track Reader. With the transition to the fourth generation RFID Readers from TagMaster (GEN4), six-digit part numbers have been introduced. These part numbers specify variations in the cable connections and Reader application software for specific customer specifications.

The HD Track Reader is available in various versions, each having its own six-digit part number. The base part number is 156940 for HD Track Readers.

**Note:** Part of the associated test and certification documentation for the HD Track Reader refers to the previous S1569 part number. The HD Track Reader (156940 series Reader) is based on and contains a HD Reader (156660 series Reader).

## 1.1. General Information

The HD Track Reader operates at the 2.45 GHz Industrial, Scientific and Medical (ISM) frequency band. This ISM band is widely used worldwide and is a license free frequency band. Using the 2.45 GHz frequency band, the HD Track Reader is not affected by electromagnetic interference, which are generated from engines or electric equipment. The HD Track Reader is designed according to existing regulations for RFID equipment as well as selected railway specific standards.

The Reader has a high performance synthesized frequency generator and a selective receiver. TX/RX parameters such as frequency, output power, and sensitivity are software controlled, and the reception circuitry uses digital processing techniques.

The HD Track Reader communicates with ID-tags through its built-in antennas. The receiver circuitry uses digital processing techniques, which enables it to be used in high-speed applications, at speeds of up to 400km/h.

The Reader is DC powered from an external source. The HD Track Reader is designed for installation in harsh environments and its construction protects it from water spray, dust and other environmental conditions.

## 1.2. Reading and Writing ID-Tags

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Readings can be performed at speeds of up to 400km/h, however, the reading speed is related to the selected ID-tag and the width of the reading lobe (which relates to the distance between the ID-tag and the Reader). Depending on the installation environment, the reading lobe might be affected by signal reflections and attenuation related to material penetration. Contact TagMaster for further information regarding reading lobe calculations and ID-tag selection.

Switch Voltage DC		60	V	1-2, 1-3
Switch Voltage AC		30	Vrms	1-2, 1-3
Switch Power		50	W	1-2, 1-3
Isolation to Shielding and Chassis	1500		V	1...3 to chassis

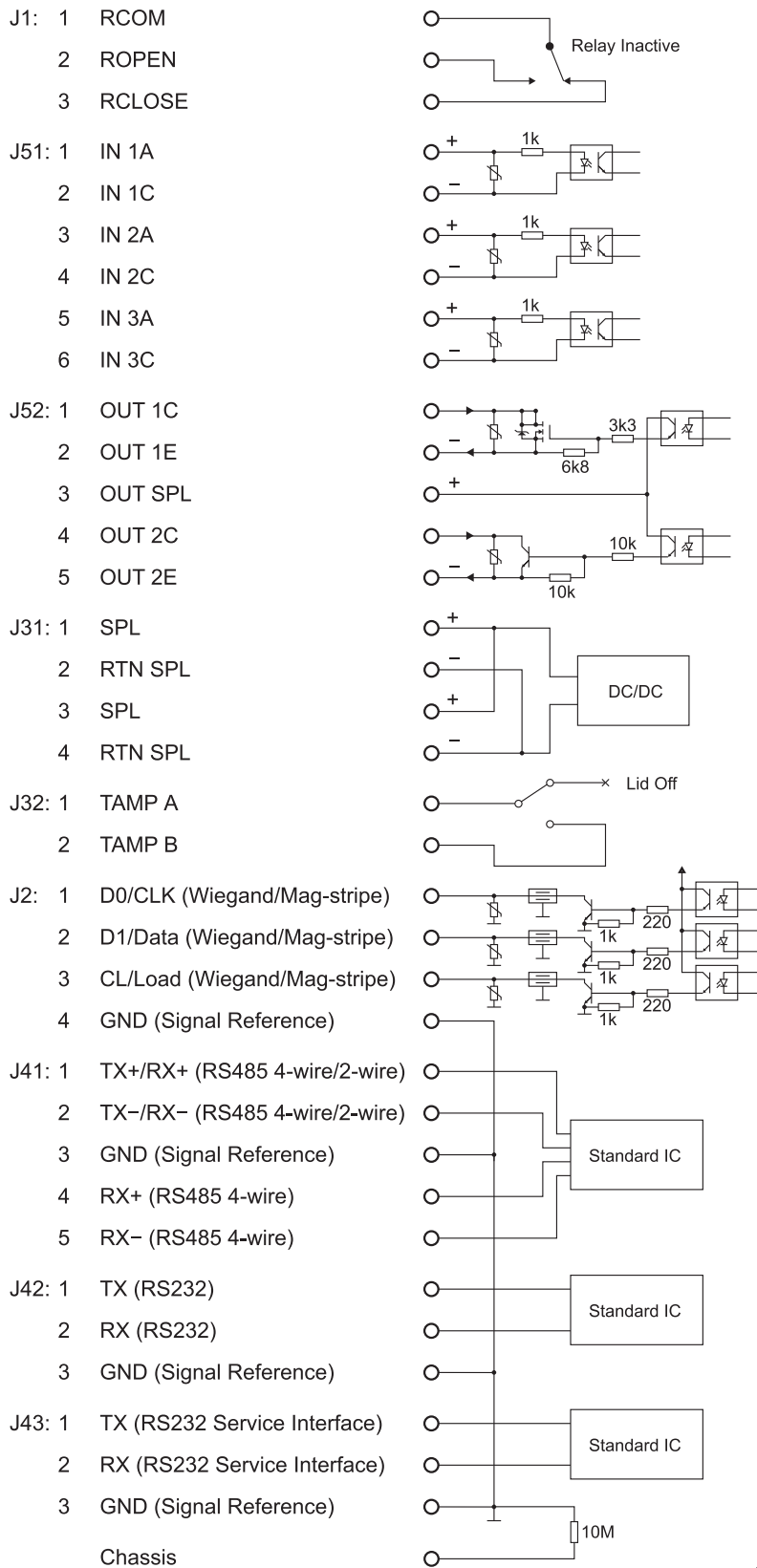
### 2.2.6. Wiegand/Mag-stripe, J2

Parameter	Min	Max	Unit	Measured between pins
Voltage		30	V	1-4, 2-4, 3-4
Sink Current		50	mA	1-4, 2-4, 3-4
Isolation to Shielding and Chassis	1500		V	1...4 to chassis

### 2.2.7. USB, P2

Parameter	Min	Max	Unit
Total Current Supply		500	mA

## 2.3. Internal Interface Circuitry



06-234 01

Figure 5 Internal Interface Circuitry

### 3. Cable Connection

The standard HD Track Reader is supplied with one main connector and an earth grounding point. The circular Ethernet connector is a hardware option and must be ordered with the HD Track Reader.

NOTE! The mating connector cables for both the main connector and the Ethernet connector must use connectors with 90° back shells, as space is very limited behind the Reader.

#### 3.1. Main Connector

The main connector is used for both incoming and outgoing signals, which protects the connections from dust, moist and vibrations.

The main connector is a 19-socket MIL-C-26482 Series I receptacle with shell size 14.

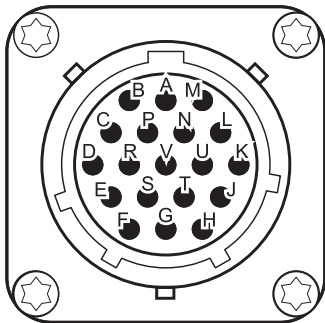


Figure 6 Main connector with letter labelling

The sockets in the main connector are connected in different ways in different Reader versions. See APPENDIX A for detailed information.

#### 3.2. Ethernet Connector

The Ethernet connector is an option on the HD Track Reader. The Ethernet connector is a 10-socket MIL-C-26482 Series I receptacle with shell size 12.

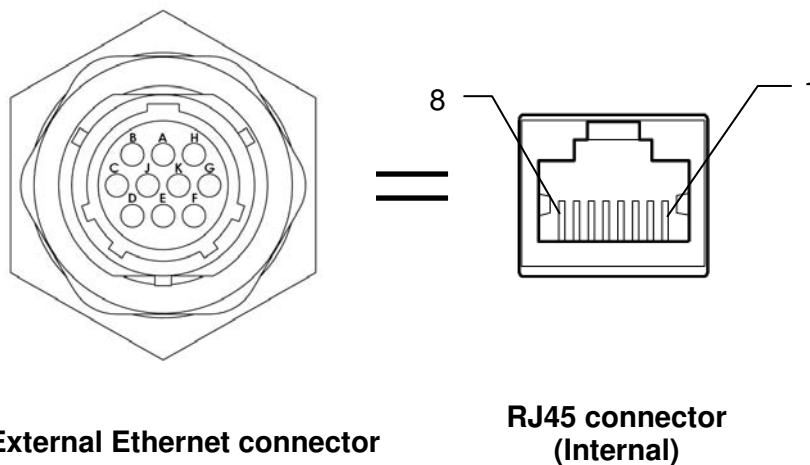


Figure 7 The Ethernet connector compared to a RJ45 connector

Table 4 below shows how the sockets in the Ethernet connector are connected to the internal RJ45 connector.

*Table 4 Ethernet connector description*

<b>Ethernet Connector</b>	<b>Internal RJ45</b>	<b>Description</b>
A	1	Transmit+
B	2	Transmit-
C	3	Receive+
D	4	-
E	5	-
F	6	Receive-
G	7	-
H	8	-
J	-	-
K	-	-

**Note:** The optional Ethernet connector must be ordered separately when ordering the HD Track Reader.

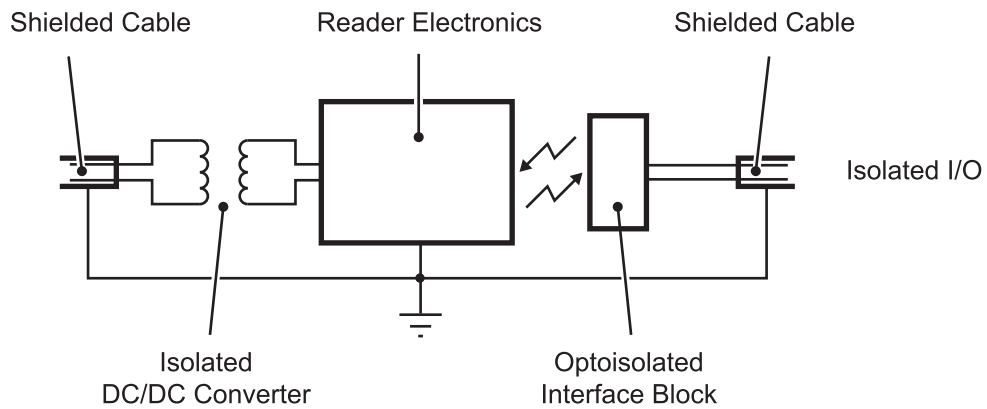
### 3.3. Interface Isolation and Protection

The hardware design is protected against radiated and wired interference by extensive use of filters, transformers and shielding. The power input is galvanically separated from the main electronic part of the Reader by use of an on-board DC-DC converter.

The Interface Block with Ethernet, Serial Interfaces and I/O signals is also galvanically isolated from the rest of the Reader. This makes sure that no ground currents will occur between shielding, power lines and other interfaces.

The common ground connection for signals “RS485 GND”, “RS232 GND”, and “RS232 (service interface) GND” is a floating reference ground for the interface block signals. This makes it possible to operate the interface with the voltage potential set from the other party.

The reference ground is internally connected to the chassis via a discharge resistor to avoid static voltage potential. It has no other reference to connections outside the interface block.



06-237 01

Figure 8 Principal galvanic isolation

### 3.4. External Ground-Connection Point

An additional ground-connection point is found on the Reader enclosure. The connection point is an M8 helicoil fitted hole.

**Note:** The hole is sealed at the base, so the screw must not extend more than 10mm into the Reader.

Connect the ground-connection point to a suitable earth point using a separate earth cable. For further information about connecting the Reader to earth, refer to the HD Track Reader Installation Manual.

## 4. Mechanical Specification

Description	Specification
Size	617 × 242 × 166 mm or 24.29 × 9.52 × 6.54 in
Weight	8.0 kg or 17.6 lbs
Material	Protective cover is made of fibre glass. Reader enclosure is made of aluminium. Antenna cover is made of halogen-free polycarbonate (fire class UL 94 V-2).
Colour	Protective cover is Yellow

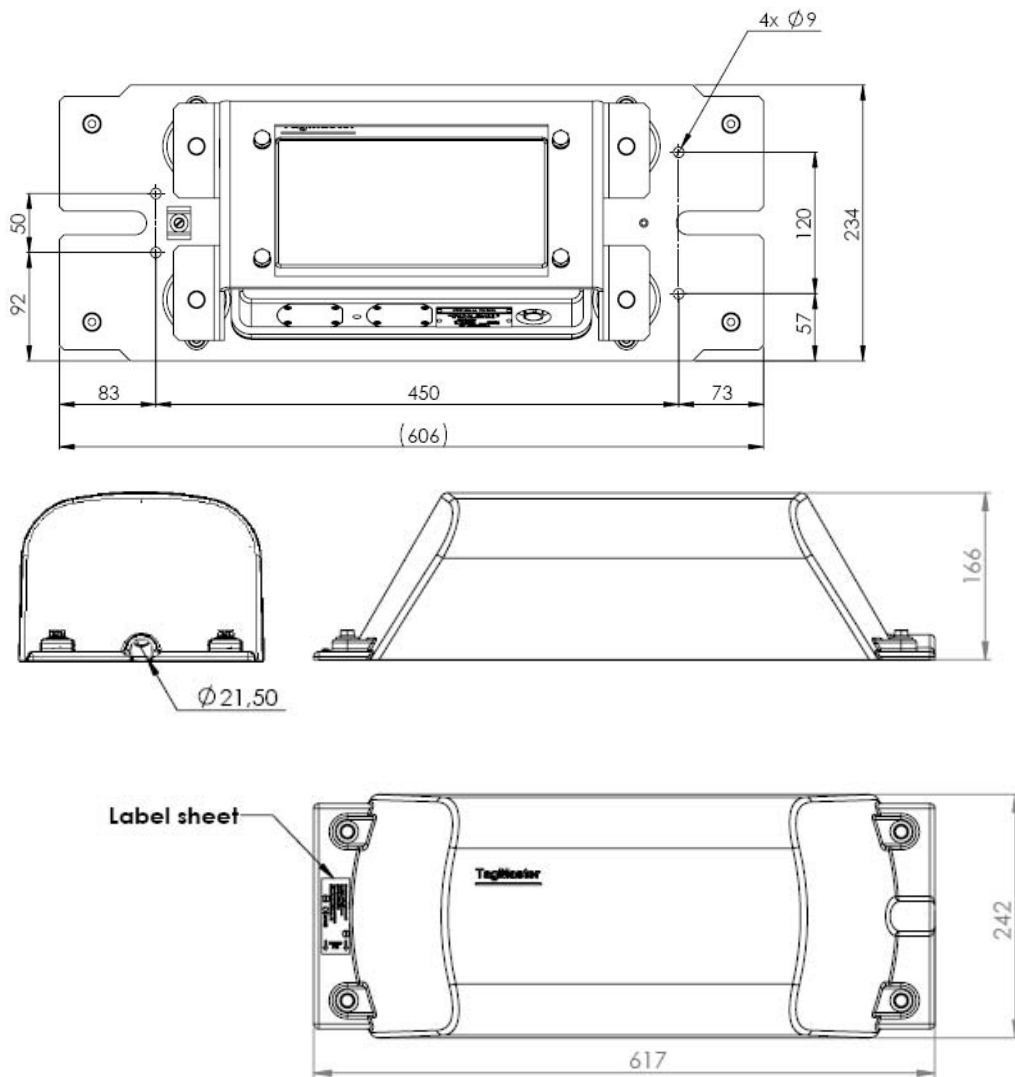


Figure 9 HD Track Reader dimensions

## 4.1. Mounting

Mount the Reader on the railroad sleeper, as close as possible to the centre line of the ID-tag positioned underneath the train.

For further information about mounting the Reader, see the HD Track Reader Installation Manual.

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### Warning!

To comply with Council Recommendation 1999/519/EC, it is recommended that the reader is installed so that a separation distance of at least 20cm (8in) from all persons is provided.

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## 5. Environmental Specification

Description	Specification
Operating temperature range	-40 °C to +70 °C (-40 °F to +158 °F)
Chemical resistance	Resists oil, grease, petrol, trichlorethylene
Sealing	IP 67*

\*When connected with an IP67 certified connector.

## 6. Environmental Tests

The following test specifications apply to the HD Track Reader. The Mean Time Before Failure (MTBF) is 1 000 000 hours for stationary applications and 150 000 hours for mobile applications.

### 6.1. Climatic tests

Test	Reference
Damp heat cyclic	IEC 68-2-30:1983
Change of temperature	IEC 60068-2-14

### 6.2. Mechanical tests

Test	Reference
Bump	IEC 68-2-29 Eb
Shock	IEC 68-2-27 Ea
Random vibration	IEC 68-2-64 Fh
Random vibration simulated long life	IEC 68-2-64 Fh

### 6.3. Electrical tests

Tests	Reference
EMC	ETSI EN 301 489-3 and ETSI EN 301 489-1
Railway applications EMC	EN 50121-4 and EN 50121-3-2
Electrical safety	EN/IEC 60950-1
Radio	ETSI EN 300 440-2
Supply related surge	BRB/RIA12
Variation of voltage supply	EN 50121-3-2 and EN 50155
Indirect Transient	BRB/RIA 12
Radio RFI susceptibility	EN 50 121-3-2, EN 301 489-3, and EN 50 204
Radio frequency emission	EN 50121-3-2 and EN 300 440V
Conducted emission	EN 50121-3-2 and EN 301 489-3
Transient immunity	EN 50121-3-2
Surges	EN 50121-3-2
Conducted radio frequency	EN 50121-3-2 and EN 301 489-3
EIRP	EN 300 440
Frequency range	EN 300 440
Surges and burst	EN 301 489-1
Electromagnetic Fields	EN 50 364 and EN 50 357

## 7. Contact

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

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# APPENDICES

## A Main Connector Specifications

### A.1 Reader Part No. 156940 (Standard Version)

Internal Connection	Signal	Description	Socket in Receptacle
J1:1	RCOM	Common terminal of relay	L
J1:2	ROPEN	Connected to RCOM when relay is open	M
J1:3	RCLOSE	Connected to RCOM when relay is closed	G
J2:1	D0/CLK	Wiegand/Mag-stripe: D0/clock	
J2:2	D1/DATA	Wiegand/Mag-stripe: D1/data	
J2:3	CL/LOAD	Wiegand/Mag-stripe: Card Load/Load	
J2:4	GND	Wiegand/Mag-stripe: Ground	
J31:1	SPL	Positive DC supply input	P
J31:2	RTN SPL	Negative DC supply input	R
J41:1	RS485 TX+	RS485 full duplex (4-wire): Transmitted data from Reader. RS485 half duplex (2-wire): Transmitted and received data.	J
J41:2	RS485 TX-	RS485 full duplex (4-wire): Transmitted data from Reader. RS485 half duplex (2-wire): Transmitted and received data.	H
J41:3	RS485 GND	RS485 Ground	K
J41:4	RS485 RX+	RS485 full duplex (4-wire): Received data to Reader. Not used for RS485 half duplex (2-wire)	U
J41:5	RS485 RX-	RS485 full duplex (4-wire): Received data to Reader. Not used for RS485 half duplex (2-wire)	V
J42:1	RS232 TX	RS232: Transmitted data from Reader	
J42:2	RS232 RX	RS232: Received data to Reader	
J42:3	RS232 GND	RS232: Ground	
J43:1	RS232 TX (service interface)	RS232 Service Interface: Transmitted data from Reader	A
J43:2	RS232 RX (service interface)	RS232 Service Interface: Received data to Reader	B
J43:3	RS232 GND (service interface)	RS232 Service Interface: Ground	C
J51:1	IN 1A	Input 1 signal	N
J51:2	IN 1C	Input 1 reference	S
J52:1	OUT 1C	Output 1 collector	E
J52:2	OUT 1E	Output 1 emitter	F
J52:3	OUT SPL	External supply voltage for the outputs	D
J52:4	OUT 2C	Output 2 collector	T
J52:5	OUT 2E	Output 2 emitter	