

### **S1500 / S1501 Reader** *User programmable Read/Write station*



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# Functional description

**S1500** readers are a 2.45 GHz circular polarised read/write station for TagMaster RFID tags. Reading distance is typically up to 6 metres. The reader has 99 RF channels to eliminate interference of other nearby readers. Transmitted power and reception sensitivity is also adjustable with SW commands for optimising any installation.

S1500 has a movement detection function for detecting people and vehicles, or even smaller objects, even if not using a tag. It can determine their moving speed in approaching or retreating directions.

S1500 is user programmable and has a large memory for application programs and built in database functions for fast, customised and efficient stand-alone operation. User software is downloaded and saved in EEPROM through a serial communication line. If user programming is not required, there is a ready-to-use standard application SW in the reader.

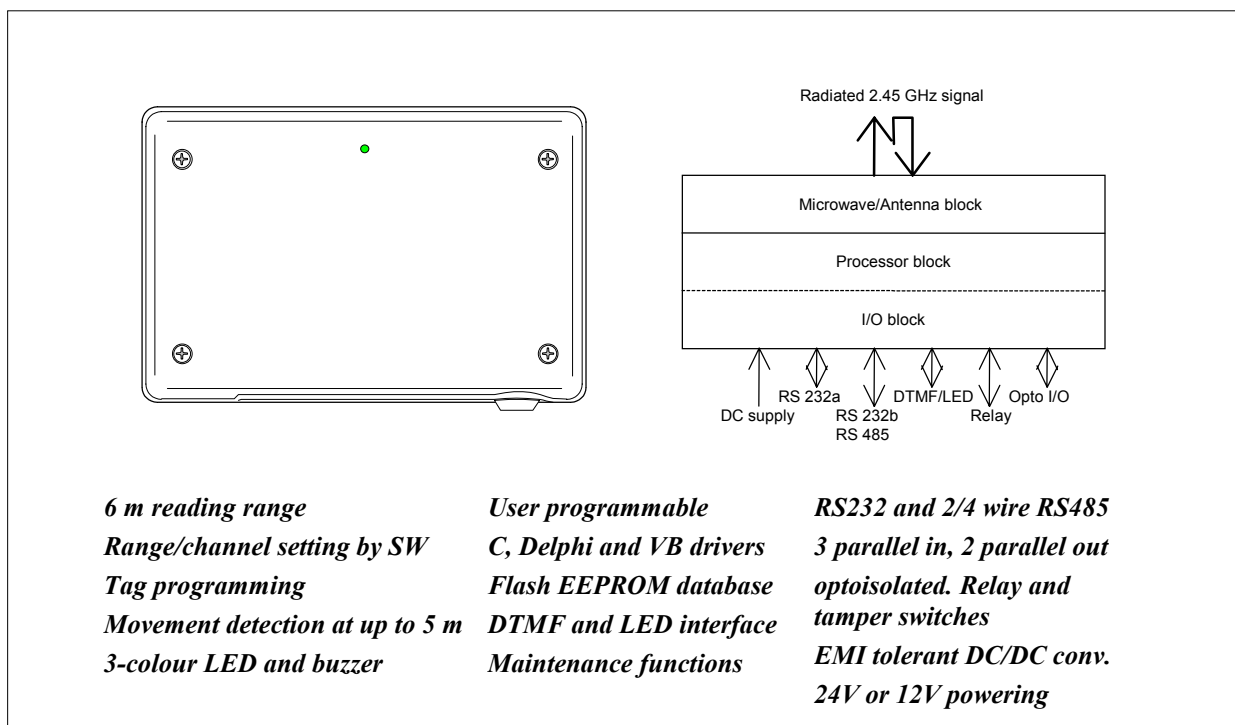
A local database in EEPROM can be loaded with over 15,000 tag entries for extremely fast read-validate-activate response times.

The ConfiTalk protocol is used for serial communication in a polled RS485 network or point-to-point in RS232 connections. There are ConfiTalk communication drivers available for 95/98/ME and NT/2000/XP with interface for C/C++, Delphi and Visual Basic.

S1500 has two serial ports, a DTMF port for keypads, LED interfaces, relay, parallel I/O (emulating magcard data as an option).

A control panel with a 7-segment LED display, two push buttons, a three colour LED, a buzzer and a reset button is available for local configuration and start up of test programs as installation aids. The unit can also be configured using a hand held computer or terminal connected locally.

S1500 is sealed from water spray and dust. Non-corrosive materials are used in external parts. Connections are made through rubber bushings, or via cable glands in a steel back plane. Jackable screw connectors connect the wires. Built in DC/DC converters tolerate noisy voltages, provide low power consumption (3W) and can be set to 24 as well as 12 V<sub>DC</sub>

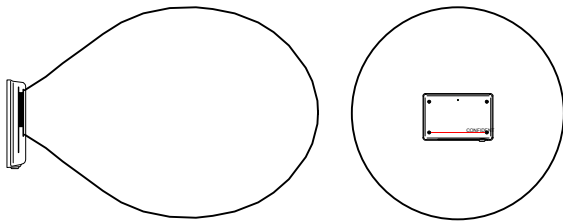


# General

S1500 comprises a plastic cover and a metal chassis for two PC boards, where the upper position carries a standard board and the lower is for an option board. A rubber gasket seals the unit.

The standard board includes a Processor and I/O block with analogue and digital circuits, and is integrated with a Microwave and Antenna block.

The antenna system is circular polarised and radiates through the front cover, with a lobe that is directed perpendicularly to the front surface of S1500. The lobe shape can be described as an ellipsoid with a circular cross section, as shown in the figure below.



The reading and writing distances depend on the tag type and on the power and sensitivity SW settings. Typically, S1500 can read TagMaster tags at up to 6 m distance. See *Reading/Writing range* for details.

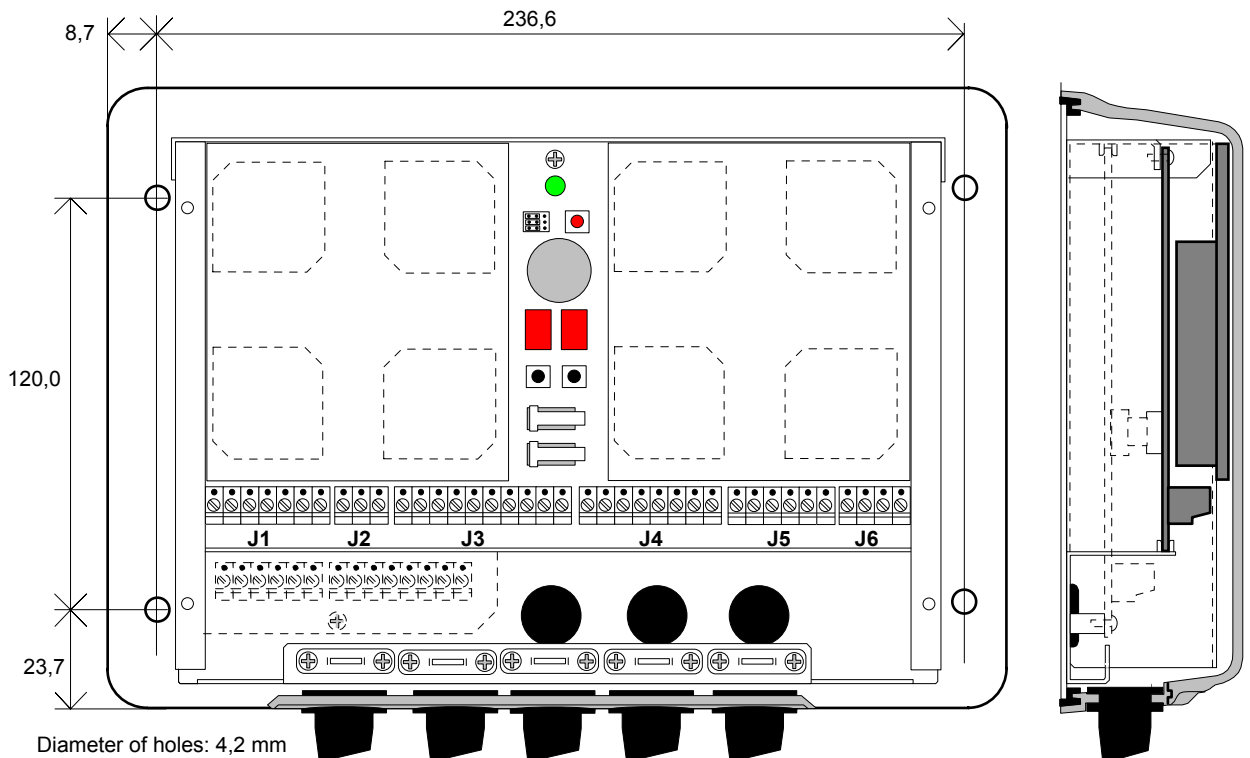
When dismantling the cover, it separates from the cable inlets to conveniently operate the unit also without cover. Screw connectors are jackable and in logical groups, i.e. it is not needed to disconnect each wire to replace the electronics.

- J1 DTMF, LED, external tamper line
- J2 RS232 for terminal
- J3 RS232 and RS 485 for host
- J4 Parallel out and relay
- J5 Parallel in
- J6 DC supply

To hide the cables, S1500 can be connected via cable glands in the back plane. Dual tamper switches monitor that the cover is closed. When removed, a software as well as hardware alarm is generated.

For service and setup purposes there is a control panel with a 7-segment LED display, 2 control buttons, a reset button, a LED and a buzzer. There are also jumpers for RS232/485 and 12/24V selection.

A corrosion resistant mounting bracket that gives additional sealing for rough environments is separately available. It fits the mounting holes of S1500, and has a flexible joint for easy adjustment to different mounting angles.



# Reading/writing range

The maximum reading or writing range is defined as the maximum distance along the radiation axis where the tag can be communicated when the tag and reader face each other and when there is free space in between.

The free space reading range for S1500 is up to more than 6 m (20 Ft).

In a typical installation the reading range is up to 4m (13 Ft)

Writing range is up to 0.25 m (0.8 Ft)

The reading range depends on the tag reflectivity, the data speed (high/low), power output and sensitivity settings.

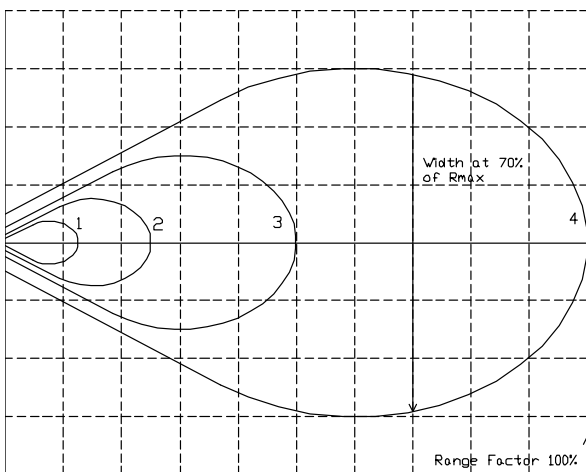
If using low power and/or low sensitivity the reading range is reduced according to the following table.

Range	Sensitivity	Power	Range factor
4	HIGH	HIGH	100%
3	HIGH	LOW	50%
2	LOW	HIGH	25%
1	LOW	LOW	12%

Writing must be done at high power. The writing range is normally not affected by speed and sensitivity settings.

## Lobe width

The lobe diagram shows, in a proportional scale, the approximate lobe shapes of the S1500 and S1501 readers.



Curves 4, 3, 2 and 1 show areas for safe reading for the four different combinations of power and sensitivity.

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Example: Your reading range has been calculated to 4.0 meters, meaning each square in the diagram is 4.0/10=0.4 meters. The lobe width at 70% range is then 5.5 squares \* 0.4 = 2.2 meters.

The diagram concerns a free space installation, and does not take into account possible influences from signal reflections or attenuating structures.

For reliability reasons, it is recommended that tags are passing at 70 % or less of specified reading and writing range.

## Reading/writing time

The time for reading and writing tags are specified in the tag data sheets. Please refer to the data sheet of the specific tag concerned.

## Passage speed

The table shows the maximum allowed passage speed in km/h for combinations of tag reading time and lobe widths.

Reading time [ms]	Lobe width [m]				
	1	1.5	2.0	2.5	3.0
20	180	270	360	450	540
50	72	108	144	180	216
70	51	77	103	129	154
100	36	54	72	90	108
130	28	42	56	69	83
150	24	36	48	60	72
200	18	27	36	45	54

## Tag orientation

Thanks to the circular polarisation, the reading and writing ranges are independent from the rotational orientation around the radiation axis. The reading time for the tag, can be found in the tag datasheets. If the ID tag is tilted in relation to the reader, a range reduction may occur. Since this effect depends mainly on the specific installation, it is recommended that a test is made. S1500 can be set to a "read beep" mode to conveniently check out the reading range.

## Movement detection

S1500 detects a moving person or car at up to 5 meters (16Ft) distance, even when moving slowly. The reader senses if the object is approaching or moving away from the reader, and at what radial

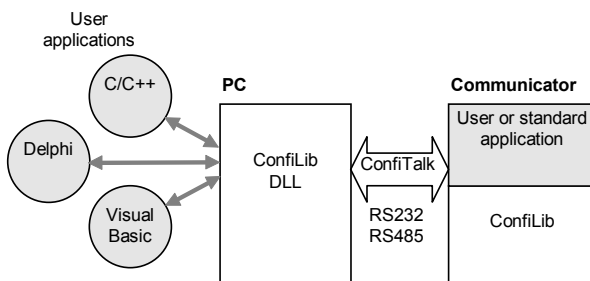
speed. The detection threshold can be set to different sensitivity levels.

## Software

The readers are delivered with the pre-installed software Pyramid for standard applications. However, you can easily develop your own application software to be executed inside the reader. This will give you the full power of controlling the reader operation for flexible solutions and fast response times.

## User application development

For user application development there are complete software development kits (SDK) including compilers, loaders, tools, drivers and libraries supporting the complete development phase for reader applications as well as PC applications.



Reader applications are developed in a PC environment with the cross compiler ConfiComp and can be executed in the PC for testing and debugging. The complete software is finally downloaded, using ConfiLoad, to the reader for permanent storage in EEPROM. PC applications are developed with any PC software development tool. For application programmers a ConfiTalk Commander is available for training and low level communications management.

## ConfiLib

ConfiLib is a function library with hundreds of functions for reader management and ConfiTalk protocol handling. ConfiLib exist in versions both for readers and PC environments including DOS, Windows 3.1, 95/98/ME and NT/2000/XP.

The reader version of ConfiLib is a function library package in C language. For PC environments, the ConfiLib API comes as dynamic link libraries (DLL) with C/C++ interface. There are also separate interface modules for Visual Basic and Delphi available. Typical functions include read/write/format tags, read/write/search database, HW/SW configuration, read/write I/O, ConfiTalk send/receive, timers, buffers, mail management, etc.

## ConfiTalk

ConfiTalk is the standard serial communications protocol used by the readers. The protocol transfers data to and from a reader and handles flow control, retransmissions, checksums and data transparency. It can be used both for point-to-point and multidrop networks, using a polling procedure.

ConfiTalk can also be replaced by a user defined protocol.

## Pyramid application

Pyramid application operates stand-alone reading tags, validating according to a downloaded database white list, activating relays for valid tags and producing logs for a PC to collect on- or off-line. Pyramid can also sense movements of people and vehicles using the movement detection.

### Events

Following events may trig actions:

- A tag is read
- A tag is read and found in the database (validated)
- A movement is detected

### Actions

For each event following actions may be specified:

- The event is logged
- The relay is pulled
- The buzzer is turned on
- The LED is set to different colours

### Alarms

Following alarms can be generated:

- Tamper switch alarm
- Reset alarm

### Database

The database in S1500 stores more than 15.000 tag identities.

### Movement detection

When enabled, this feature can sense movements 5 meters away or at reduced ranges.

### Timer

Relay activation time and tag timeout can be set.

### Logging

All events and alarms are logged to be retrieved by a PC on- or off-line. Log size is 250-1000 events.

### Terminal

For serial port configuration and local operating at installation time, an optional terminal can be connected to the terminal interface Check SW.

Pyramid may also be set to Off mode without any stand-alone operation. Instead, all ConfiLib commands are available on the serial port interface for a PC controller.

## Control panel setup

Under the cover of the S1500 there is a control panel available for local configuration and operation without the need of a terminal or PC.

The left black button is used for parameter selection and the right black button is used for value selection.

Example to change the ConfiTalk address: Push the left button repeatedly until 'Ad' is displayed. Push the right button to display the current address. Repeat pushing the right button until the wanted address is displayed. Press the left button to save the configuration. When there are unsaved changes, the LED is red.

The configuration is stored in non-volatile memory, and is retained after a power failure.

To reset the reader to default configuration and erase the database, keep the two black buttons pushed while pressing the red reset button. . Release the buttons when the LED blinks yellow. Push the red button again.

To invoke the terminal interface Check SW in S1500, keep one of the two black buttons pushed while pressing the red button.

## Hardware

### Processor block

The processor block includes a 16 bit microprocessor, 384 kByte Flash EEPROM, 100 byte EEPROM, 128 kByte SRAM and a bus interface for an external option board. Option boards are inserted in the lower position slot.

Flash EEPROM is used for program code and databases while the small EEPROM may be used for configuration data. This information is retained even after DC power interruption for any period of time. Programs and configuration can therefore be downloaded at production time and remains unchanged even after transportation.

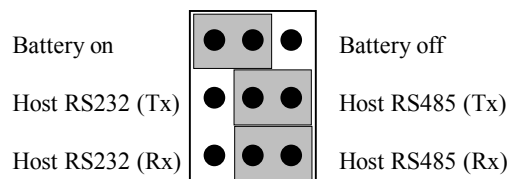
The SRAM memory is used for program data, tag reading logs, reader mail messages, etc.

The processor block includes a real time clock (RTC) and a watchdog for automatic restart in case of software failure.

A rechargeable backup battery for SRAM and RTC is automatically charged as soon as the unit is under voltage, and retains its voltage during two weeks after loss of power provided that the battery jumper is in the on position.

### Jumper settings

There are jumpers for selecting if the second serial port should be RS232 or RS485 and if the RAM backup battery shall be connected. See figure below.



Under the rightmost antenna, additional jumpers are available for setting the unit to 12 or 24 volt operation. Markings on the PC board indicate how to set these jumpers. The factory setting is 24 V.

## Hardware interface

The I/O block comprise the following interface.

### DTMF

2-wire interface to receive a dual tone signal and to power a DTMF device.

Parameter	Min	Max	Unit
Line volt. @ 10 mA	4.1	4.5	V
Tone level	-26	0	dBm

### RS 232 - host and terminal

Default: 9600 bps, 8 bits, no parity, 1 stop bit, ConfiTalk address 1

Parameter	Min	Max	Unit
Baud rate	1.2	19.2	kbits/s
Data bits	7	8	bits
Stop bits	1	2	bits
Parity	no - odd - even		

### RS 485 - host

Full (4 wire) or half duplex (2 wire). Default: 9600 bps, 8 bits, no parity, 1 stop bit, ConfiTalk address 1

Parameter	Min	Max	Unit
Baud rate	1.2	38.4	kbits/s
Data bits	7	8	bits
Stop bits	1	2	bits
Parity	no - odd - even		

### Optocoupler inputs

Parameter	Min	Max	Unit
High voltage	2,4	30	V
Low voltage	0.0	0.2	V

### Open collector outputs

Parameter	Min	Max	Unit
Allowed voltage	1	30	V
Sink current Out 1	0	500	mA
Sink current Out 2	0	100	mA

### Relay

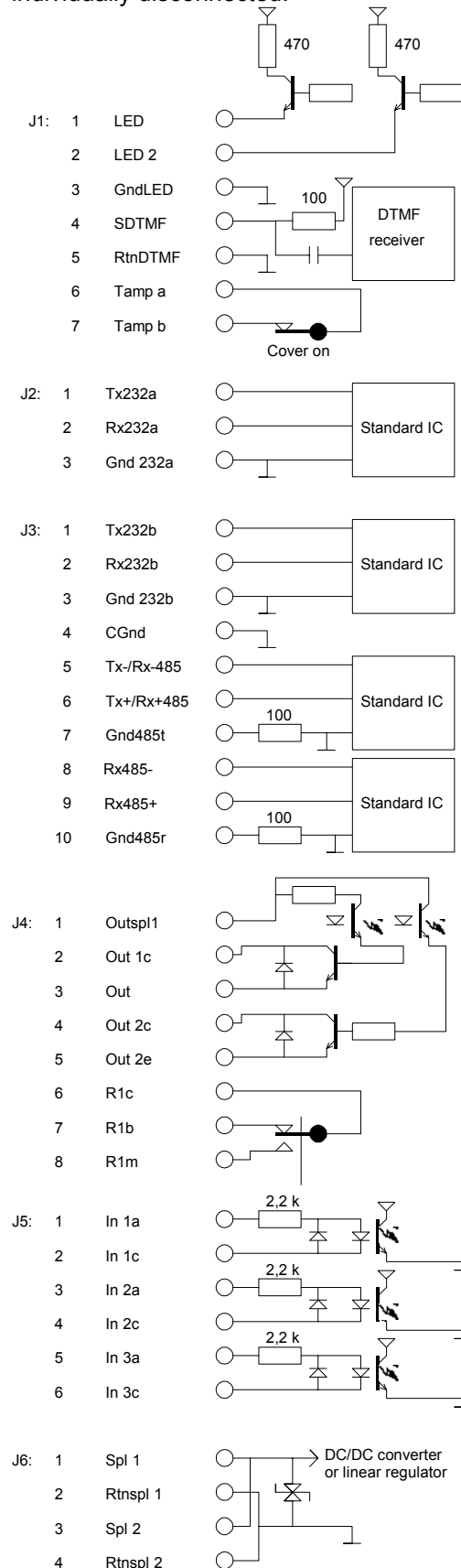
Parameter	Min	Max	Unit
Switch current	2	A	
Switch voltage DC	220	V	
Switch voltage AC	125	V	
Switch power	50	W	

### Power

The S1500 is set for 24 VDC when delivered from factory. By changing the top jumper settings, the unit can also be supplied with 12 VDC.

## Connection diagram

The electrical interface is shown in the diagram below. J1, J2 etc. represent different logical (as well as physical) connectors, which can all be individually disconnected.



## Installation aspects

Microwaves penetrate most non-metallic materials, such as gypsum, wood, plastics, glass, dirt and snow. The unit should however if possible be installed and used so that free space is available between the ID tag and the reader.

If large reflecting surfaces are present in the reading zone, the antenna diagram may be distorted. In such a case, it is recommended to shorten the distance to the ID tag to achieve a stronger signal. The system works safely at all distances down to zero.

If the reader is installed with a low grazing angle to a reflecting surface such as a road or floor, the multipath effect can increase the reading distance. Since the multipath effect may reduce the lobe width, a test is recommended to check the reader in such installations, e.g. with the "Read Beep" test function available at the control panel.

In the control panel, push the left black button until "OP" is displayed. Press the right button until "rb" is displayed. Press the left button again. In the read beep operation mode, a short beep is sounded from the buzzer every time a tag is read, thus helping to verify the actual reading zone at installation time.

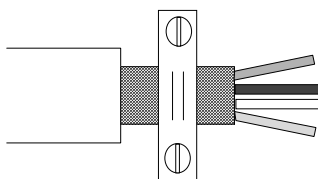
Restore the reader to normal operation mode by pressing the right button until "On" is displayed and then press the left button.

If several readers are to be operated close to each other, it is recommended to use different RF channels to avoid interference. There are 100 channels available.

If tags are passing at a close distance from the reader it might be a recommendation to reduce the reading range to avoid unwanted readings of a remote tag. The range is reduced by setting of the power and sensitivity parameters.

If the reader is to be used in wet conditions, the cable inlets should be oriented downwards. It is recommended to protect the reader from direct water spray or rain.

Screened cables shall be used with the screens clamped according to the figure below.

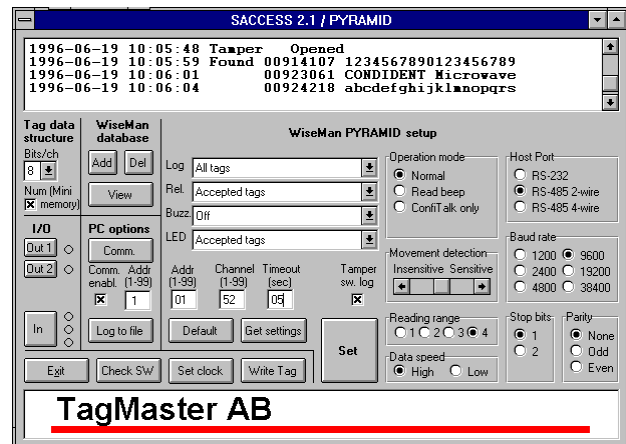


Note. The DTMF input may be disturbed if the DTMF cable is exposed to signals in the 1 - 3 MHz region and the prescribed test level (ETS 301 489) for conducted interference is exceeded.

**Warning:** To comply with the FCC RF exposure limits, it is recommended that the reader is installed so that a separation distance of at least 20 cm (8 inches) from all persons is provided.

## Success

To enable a quick start to TAGMASTER, the SACCESS Windows application is available for demonstration purposes.



The main functionality is:

- Tag reading
- Tag writing
- Stand alone capability with tag validation and relay activation
- Database update
- Event and action configuration
- Logging events on screen and file
- Reader serial port and address configuration

## S1501 stripped down version

The Reader **S1501** is a stripped down version of the S1500. It is based on the same hardware with the following differences.

- Application SW: Solid which is used for host controlled applications.
- 128 Kbyte Flash EEPROM for SW (No EEPROM database).
- No 7-segment display.
- No buzzer.
- No HW support for 4 wire RS485.
- 12V supply only. Standard voltage regulator instead of DC/DC converter.
- No real time clock. Confilib emulates a real time clock in software with less accuracy.



## Electrical data

Data regards the temperature range -20 to 60 °C.

Parameter	Value	Unit
DC Supply voltage	20 - 28	V
(selectable by jumper)	10 - 14	V
Consumption 12 V	500	mA
Consumption 24 V	150	mA
Radiation frequency	2435 – 2465	MHz
Output power	10	mW e.i.r.p
Polarisation	circular	
Tx modulation	ASK	
Number of RF channels	99	
Radiation reduction	-12	dB
Sensitivity reduction	-24	dB
Reading data speed, high	16	kbit/s
Reading data speed, low	4	kbit/s
Writing data speed	4	kbit/s
Movement det., min speed	0,3	m/s
Movement det., max speed	9,2	m/s
Movement det. max range	5	m

## Communication range data

Reading range typical inst.:	0 to 4 m (13 Ft)
Reading range up to:	6 m (20 Ft)
Writing range :	0 to 0,25 m (0.8 Ft)

## Environmental data

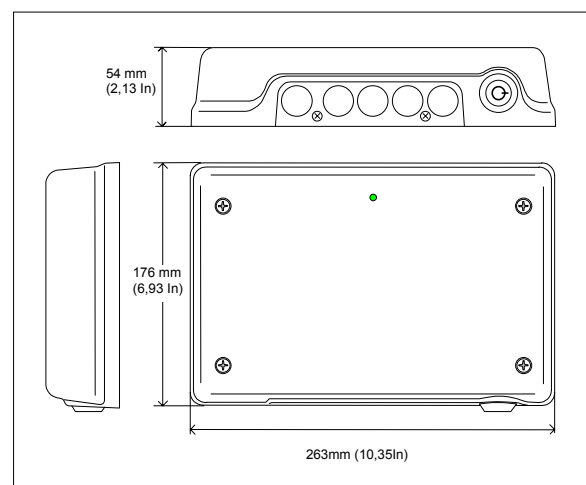
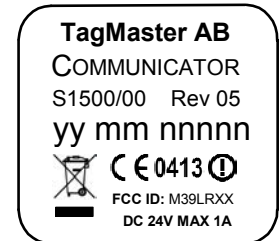
Cold	-20°C (-4°Fh)	Shock	50 G, 6 ms, IEC68-2-27 Ea 10x 3 dir	Immunity	Acc. to CE leg.
Heat	+60°C(+140°Fh)	Bump	25 G 6 ms, IEC68-2-29 Eb 1000x 3 dir	ETSI EN	301 489-3 v1.2.1(0208)
Sealing	IP 54	Sine vibration	5G/0,55mm, IEC68-2-6 Fc 500Hz, 10m, 4 worst freq	Emission	Acc. to CE leg.
IEC 529		Random Vibration	IEC 60068-2-64	ETSI EN	300 440-1 v1.3.1(0109)
				Solar radiation	1120 W/sqm IEC68-2-5 Sa C56 days

Safety Electrical and Radio  
EN 60950 and EN 60215

## Mechanical data

Product information according to the figure below is marked on the cover of S1500. A marking sticker is also placed inside the unit to avoid mixing up covers and chassis.

Example of marking label:



Weight	1,8 kg
Dimensions (WxLxH):	176 x 263 x 54 mm
Front colour	Light grey
Front material	Polycarbonate
Back material	Stainless steel
Sealing method	Rubber gasket

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Website [www.tagmaster.com](http://www.tagmaster.com)

### **S1513/S1514 LR Reader User programmable Longe Range Read/Write Station**



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# Functional description

**S1513** Long Range communicator is a 2.45 GHz circular polarised read/write station for TagMaster RFID tags. Reading distance is up to 12 meters (40 Ft). The communicator has 400 RF channels to eliminate risk for interference of other nearby communicators. Transmitted power and reception sensitivity is also adjustable with SW commands for optimising the installation.

S1513 has a movement detection function for detecting people and vehicles, or even smaller objects, even if not using a tag. It can determine their moving speed in approaching or retreating directions.

S1513 is user programmable and has a large memory for application programs and built in database functions for fast, customised and efficient stand-alone operation. User software is downloaded and saved in EEPROM through a serial communication line. If user programming is not required, there is a ready-to-use standard application SW in the communicator.

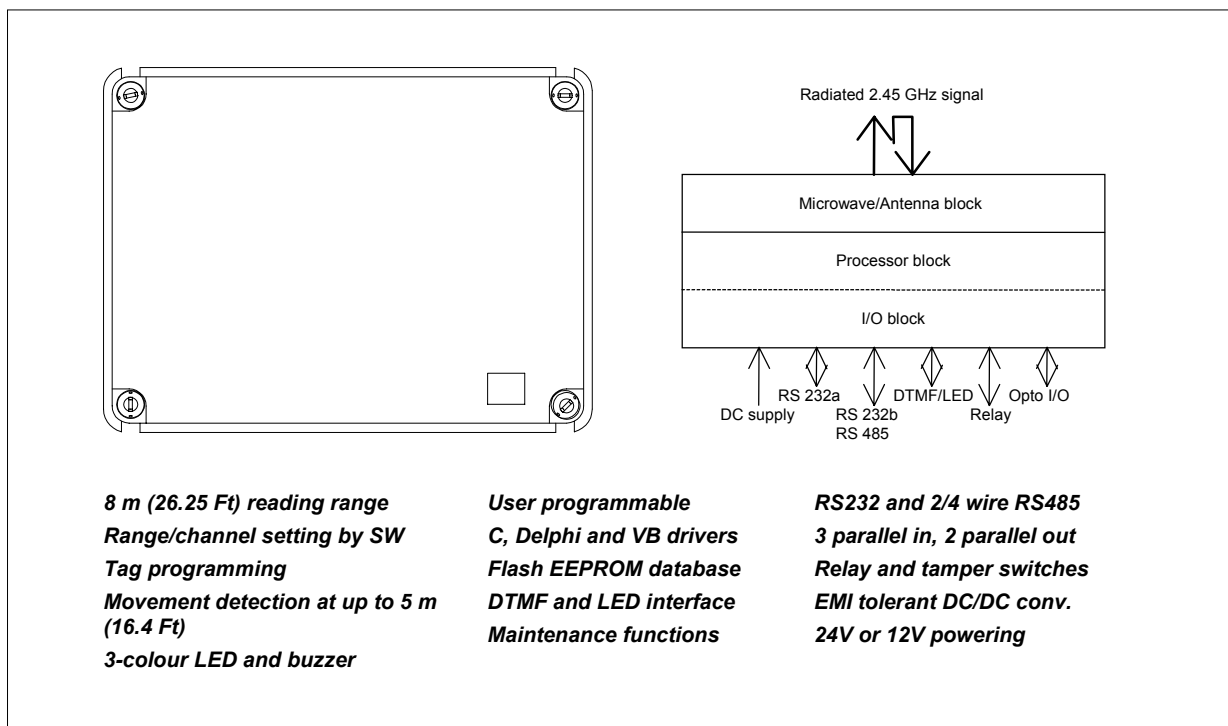
A local database in EEPROM can be loaded with over 15,000 tag entries for extremely fast read-validate-activate response times.

The ConfiTalk protocol is used for serial communication in a polled RS485 network or point-to-point in RS232 connections. There are ConfiTalk communication drivers available for Microsoft Windows for PC with interface for C/C++, Delphi and Visual Basic.

S1513 has two serial ports, a DTMF port for keypads, LED interfaces, relay, parallel I/O (emulating magcard data as an option).

In S1513 a control panel with a 7-segment LED display, two push buttons, a three colour LED, a buzzer and a reset button is available for local configuration and start up of test programs as installation aids. The unit can also be configured using a hand held computer or terminal connected locally.

S1513 is sealed from water spray and dust. Non corrosive materials are used in external parts. Connections are made through rubber bushings, or via cable glands. Jackable screw connectors connect the wires. Built in DC/DC converters tolerate noisy voltages, provide low power consumption (3W) and accept 24 as well as 12 V<sub>DC</sub>

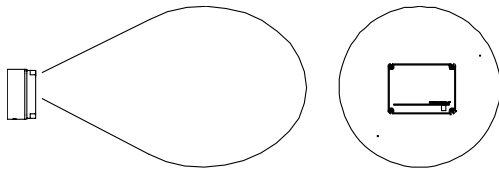


# General

S1513 comprises a plastic cover and within a metal chassis for two PC boards, where the upper position carries a standard board and the lower is for an option board. A rubber gasket seals the unit.

The standard board includes a Processor and I/O block with analog and digital circuits, and is integrated with a Microwave and Antenna block.

The antenna system is circular polarised and radiates through the front cover, with a lobe that is directed perpendicularly to the front surface of S1513. The lobe shape can be described as an ellipsoid with a circular cross section, as shown in the figure below.



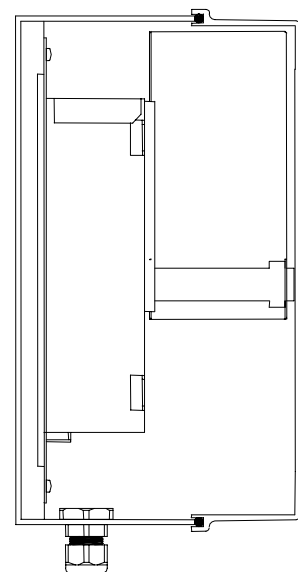
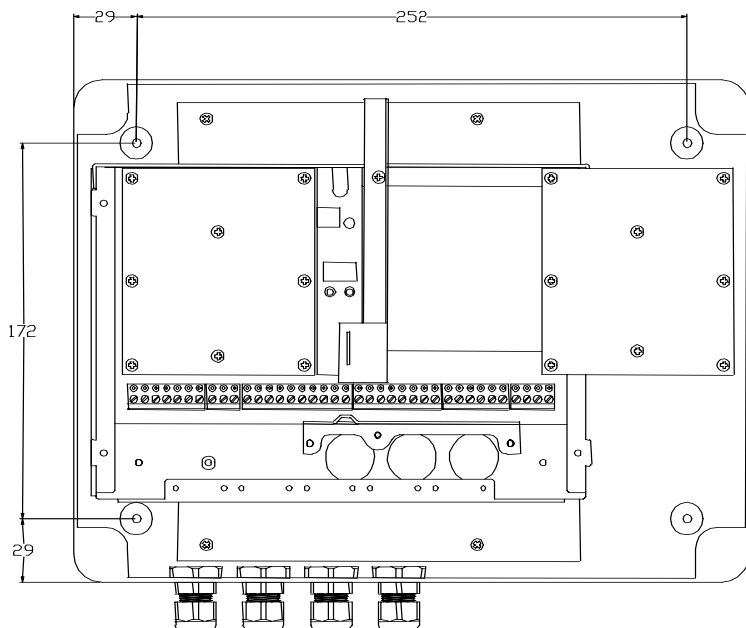
The reading and writing distances depend on the tag type and on the power and sensitivity SW settings. Typically, S1513 can read TagMaster tags at up to 12 m (39 Ft) distance. See *Reading/Writing range* for reference.

When dismantling the cover, it separates from the cable inlets to conveniently operate the unit also without cover. Screw connectors are jackable and in logical groups, i.e. it is not needed to disconnect each wire to replace the electronics.

- J1 DTMF, LED, external tamper line
- J2 RS232 for terminal
- J3 RS232 and RS 485 for host
- J4 Parallel out and relay
- J5 Parallel in
- J6 DC supply

Dual tamper switches monitor that the cover is closed. When removed, a software as well as hardware alarm is generated.

For service and setup purposes there is a control panel with a 7-segment LED display, 2 control buttons, a reset button, a LED and a buzzer. There are also jumpers for RS232/485 and 12/24V selection.



# Reading/writing range

The maximum reading or writing range is defined as the maximum distance along the radiation axis where the tag can be communicated when the tag and communicator face each other and when there is free space in between.

The free space reading range for S1513 is up to more than 12 m (39 Ft).  
 In a typical installation the reading range is up to 8 m (26 Ft)  
 Writing range is up to 1.2 m (4 Ft)

The reading range depends on the tag reflectivity, the data speed (high/low), power output and sensitivity settings.

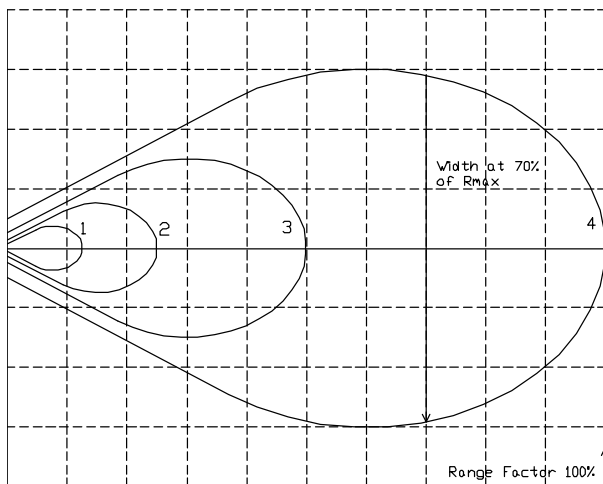
If using low power and/or low sensitivity the reading range is reduced according to the following table.

Range	Sensitivity	Power	Range factor
4	HIGH	HIGH	100%
3	HIGH	LOW	50%
2	LOW	HIGH	25%
1	LOW	LOW	12%

Writing must be done at high power. The writing range is normally not affected by speed and sensitivity settings.

## Lobe width

The lobe diagram shows, in a proportional scale, the approximate lobe shapes of the S1513 and S1514 readers.



Curves 4, 3, 2 and 1 show areas for safe reading for the four different combinations of power and sensitivity.

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Example: Your reading range has been calculated to 8.0 meters, meaning each square in the diagram is 8.0/10=0.8 meters. The lobe width at 70% range is then 5.5 squares \* 0.8 = 4.4 meters.

The diagram concerns a free space installation, and does not take into account possible influences from signal reflections or attenuating structures.

For reliability reasons, it is recommended that tags are passing at 70 % or less of maximum reading and writing range.

## Reading/writing time

The time for reading and writing tags are specified in the tag data sheets. Please refer to the data sheet of the specific tag concerned.

## Passage speed

The table shows the maximum allowed passage speed in km/h for combinations of tag reading time and lobe widths.

Reading time [ms]	Lobe width [m]				
	1	1.5	2.0	2.5	3.0
20	180	270	360	450	540
50	72	108	144	180	216
70	51	77	103	129	154
100	36	54	72	90	108
130	28	42	56	69	83
150	24	36	48	60	72
200	18	27	36	45	54

## Tag orientation

Thanks to the circular polarisation, the reading and writing ranges are independent from the rotational orientation around the radiation axis. However, if the ID tag is very tilted in relation to the communicator, a range reduction may occur. Since this effect depends mainly on the specific installation, it is recommended that a test is made. S1513 can be set to a "read beep" mode to conveniently check out the reading range.

## Movement detection

S1513 detects a moving person or car at up to 10 m (33 Ft) distance, even when moving slowly. The communicator senses if the object is approaching or moving away from the communicator, and at

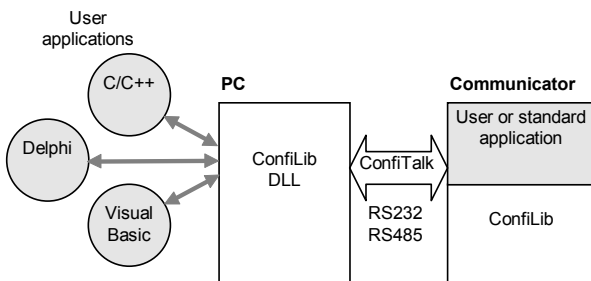
what radial speed. The detection threshold can be set to different sensitivity levels.

# Software

The communicators are delivered with the pre-installed software Pyramid for standard applications. However, you can easily develop your own application software to be executed inside the communicator. This will give you the full power of controlling the communicator operation for flexible solutions and fast response times.

## User application development

For user application development there are complete software development kits (SDK) including compilers, loaders, tools, drivers and libraries supporting the complete development phase for communicator applications as well as PC applications.



Communicator applications are developed in a PC environment with the cross compiler ConfiComp and can be executed in the PC for testing and debugging. The complete software is finally downloaded, using ConfiLoad, to the communicator for permanent storage in EEPROM. PC applications are developed with any PC software development tool. For application programmers a ConfiTalk Commander is available for training and low level communications management.

## ConfiLib

ConfiLib is a function library with hundreds of functions for communicator management and ConfiTalk protocol handling. ConfiLib exist in versions both for communicators and Microsoft Windows for PC.

The communicator version of ConfiLib is a function library package in C language. For PC environments, the ConfiLib API comes as dynamic link libraries (DLL) with C/C++ interface. There are also separate interface modules for Visual Basic and Delphi available. Typical functions include read/write/format tags, read/write/search database, HW/SW configuration, read/write I/O, ConfiTalk send/receive, timers, buffers, mail management, etc.

## ConfiTalk

ConfiTalk is the standard serial communications protocol used by the communicators. The protocol transfers data to and from a communicator and handles flow control, retransmissions, checksums and data transparency. It can be used both for point-to-point and multidrop networks, using a polling procedure.

ConfiTalk can also be replaced by a user defined protocol.

## Pyramid application

Pyramid application operates stand-alone reading tags, validating according to a downloaded database white list, activating relays for valid tags and producing logs for a PC to collect on- or off-line. Pyramid can also sense movements of people and vehicles using the movement detection.

### Events

Following events may trig actions:

- A tag is read
- A tag is read and found in the database (validated)
- A movement is detected

### Actions

For each event following actions may be specified:

- The event is logged
- The relay is pulled
- The buzzer is turned on
- The LED is set to different colours

### Alarms

Following alarms can be generated:

- Tamper switch alarm
- Reset alarm

### Database

The database in S1513 stores more than 15.000 tag identities.

### Movement detection

When enabled, this feature can sense movements 5 meters (16.39 Ft) away or at reduced ranges.

### Timer

Relay activation time and tag timeout can be set.

### Logging

All events and alarms are logged to be retrieved by a PC on- or off-line. Log size is 250-1000 events.

### Terminal

For serial port configuration and local operating at installation time, an optional terminal can be connected to the terminal interface Check SW.

Pyramid may also be set to Off mode without any stand-alone operation. Instead, all ConfiLib commands are available on the serial port interface for a PC controller.



## Control panel setup

Under the cover of the S1513 there is a control panel available for local configuration and operation without the need of a terminal or PC.

The left black button is used for parameter selection and the right black button is used for value selection.

Example to change the ConfiTalk address: Push the left button repeatedly until 'Ad' is displayed. Push the right button to display the current address. Repeat pushing the right button until the wanted address is displayed. Press the left button to save the configuration. When there are unsaved changes, the LED is red.

The configuration is stored in non-volatile memory, and is retained after a power failure.

To reset the communicator to default configuration and erase the database, keep the two black buttons pushed while pressing the red reset button. Release the buttons when the LED blinks yellow. Push the red button again.

To invoke the terminal interface Check SW in S1513, keep one of the two black buttons pushed while pressing the red button.

## Hardware

### Processor block

The processor block includes a 16 bit microprocessor, 384 kByte Flash EEPROM, 100 byte EEPROM, 128 kByte SRAM and a bus interface for an external option board. Option boards are inserted in the lower position slot.

Flash EEPROM is used for program code and databases while the small EEPROM may be used for configuration data. This information is retained even after DC power interruption for any period of time. Programs and configuration can therefore be downloaded at production time and remains unchanged even after transportation.

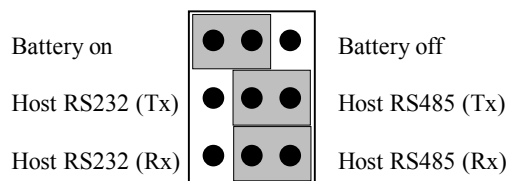
The SRAM memory is used for program data, tag reading logs, communication mail messages, etc.

The processor block includes a real time clock (RTC) and a watchdog for automatic restart in case of software failure.

A rechargeable backup battery for SRAM and RTC is automatically charged as soon as the unit is under voltage, and retains its voltage during two weeks after loss of power provided that the battery jumper is in the on position.

### Jumper settings

There are jumpers for selecting if the second serial port should be RS232 or RS485 and if the RAM backup battery shall be connected. See figure below.



Under the rightmost antenna, additional jumpers are available for setting the unit to 12 or 24 volt operation. Markings on the PC board indicate how to set these jumpers. The factory setting is 24 V.

## Hardware interface

The I/O block comprise the following interface.

### DTMF

2-wire interface to receive a dual tone signal and to power a DTMF device.

Parameter	Min	Max	Unit
Line volt. @ 10 mA	4.1	4.5	V
Tone level	-26	0	dBm

### RS 232 - host and terminal

Default: 9600 bps, 8 bits, no parity, 1 stop bit, ConfiTalk address 1

Parameter	Min	Max	Unit
Baud rate	1.2	19.2	kbits/s
Data bits	7	8	bits
Stop bits	1	2	bits
Parity	no - odd - even		

### RS 485 - host

Full (4 wire) or half duplex (2 wire). Default: 9600 bps, 8 bits, no parity, 1 stop bit, ConfiTalk address 1

Parameter	Min	Max	Unit
Baud rate	1.2	38.4	kbits/s
Data bits	7	8	bits
Stop bits	1	2	bits
Parity	no - odd - even		

### Optocoupler inputs

Parameter	Min	Max	Unit
High voltage	2,4	30	V
Low voltage	0.0	0.2	V

### Open collector outputs

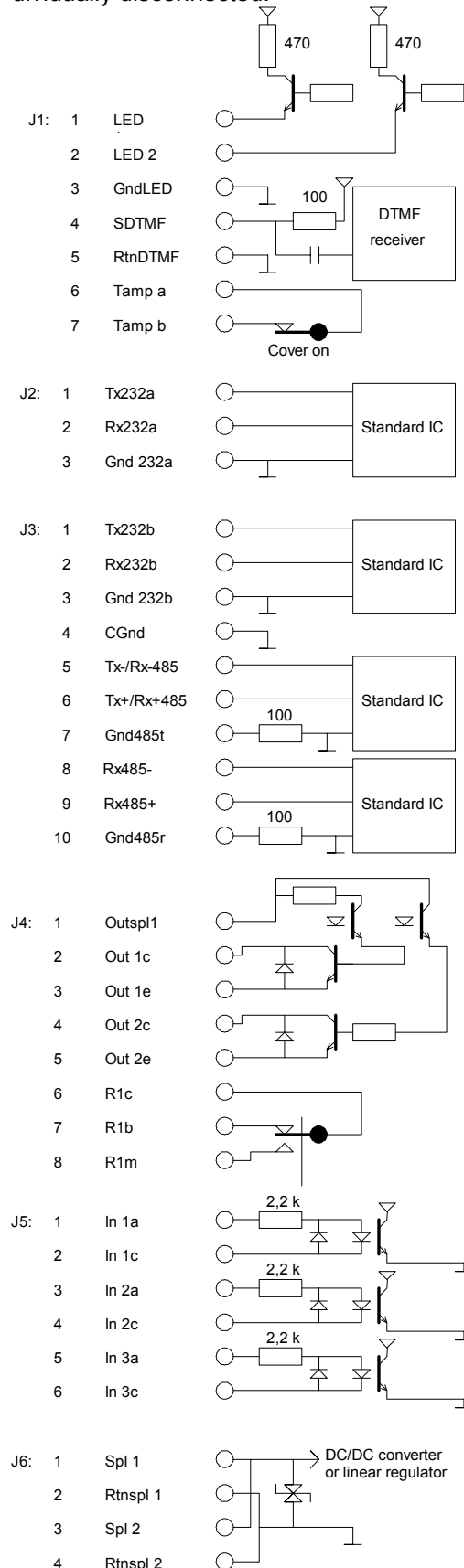
Parameter	Min	Max	Unit
Allowed voltage	1	30	V
Sink current Out 1	0	500	mA
Sink current Out 2	0	100	mA

### Relay

Parameter	Min	Max	Unit
Switch current		2	A
Switch voltage DC		220	V
Switch voltage AC		125	V
Switch power		50	W

## Connection diagram

The electrical interface is shown in the diagram below. J1, J2 etc. represent different logical (as well as physical) connectors, which can all be individually disconnected.



## Installation aspects

Microwaves penetrate most non metallic materials, such as gypsum, wood, plastics, glass, dirt and snow. The unit should however if possible be installed and used so that free space is available between the ID tag and the communicator.

If large reflecting surfaces are present in the reading zone, the antenna diagram may be distorted. In such a case, it is recommended to shorten the distance to the ID tag to achieve a stronger signal. The system works safely at all distances down to zero.

If the communicator is installed with a low grazing angle to a reflecting surface such as a road or floor, the multipath effect can increase the reading distance. Since the multipath effect may reduce the lobe width, a test is recommended to check the communication in such installations, e.g. with the "Read Beep" test function available at the control panel.

In the control panel, push the left black button until "OP" is displayed. Press the right button until "rb" is displayed. Press the left button again. In the read beep operation mode, a short beep is sounded from the buzzer every time a tag is read, thus helping to verify the actual reading zone at installation time.

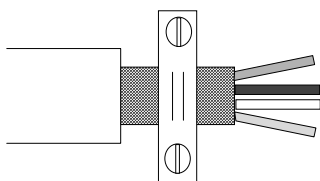
Restore the communicator to normal operation mode by pressing the right button until "On" is displayed and then press the left button.

If several communicators are to be operated close to each other, it is recommended to use different RF channels to avoid interference. There are 100 channels available.

If tags are passing at a close distance from the communicator it might be a recommendation to reduce the reading range to avoid unwanted readings of a remote tag. The range is reduced by setting of the power and sensitivity parameters.

If the communicator is to be used in wet conditions, the cable inlets should be oriented downwards. It is recommended to protect the communicator from direct water spray or rain.

Screened cables shall be used with the screens clamped according to the figure below.



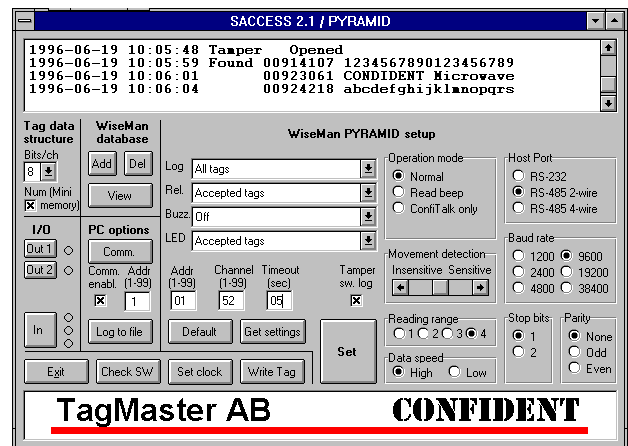
Note. The DTMF input may be disturbed if the DTMF cable is exposed to signals in the 1 - 3

MHz region and the prescribed test level (ETS 300 683) for conducted interference is exceeded.

**Warning:** To comply with the FCC RF exposure limits, it is recommended that the reader is installed so that a separation distance of at least 20 cm (8 inches) from all persons is provided.

## Success

To enable a quick start to TagMaster products, the SACCESS Windows application is available for demonstration purposes.



The main functionality is:

- Tag reading
- Tag writing
- Stand alone capability with tag validation and relay activation
- Database update
- Event and action configuration
- Logging events on screen and file
- Communicator serial port and address configuration

## S1514 stripped down version

The Reader **S1514** is a stripped down version of the S1513. It is based on the same hardware with the following differences.

- Application SW: Solid which is used for host controlled applications.
- 128 Kbyte Flash EEPROM for SW (No EEPROM database).
- No 7-segment display.
- No buzzer.
- No HW support for 4 wire RS485.
- 12V supply only. Standard voltage regulator instead of DC/DC converter.
- No real time clock. Confilib emulates a real time clock in software with less accuracy.

## Electrical data

Data regards the temperature range -20 to 60 °C.

Parameter	Value	Unit
DC Supply voltage	20 - 28	V
(selectable by jumper)	10 - 14	V
Consumption 12 V	500	mA
Consumption 24 V	150	mA
Radiation frequency	2435 – 2465	MHz
Output power	10	mW e.i.r.p
Polarisation	circular	
Tx modulation	ASK	
Number of RF channels	99	
Radiation reduction	-12	dB
Sensitivity reduction	-24	dB
Reading data speed, high	16	kbit/s
Reading data speed, low	4	kbit/s
Writing data speed	4	kbit/s
Movement det., min speed	0,3	m/s
Movement det., max speed	9,2	m/s
Movement det. max range	5	m

## Communication range data

Reading range typical inst.:	0 to 4 m (13 Ft)
Reading range up to:	6 m (20 Ft)
Writing range :	0 to 0,25 m (0.8 Ft)

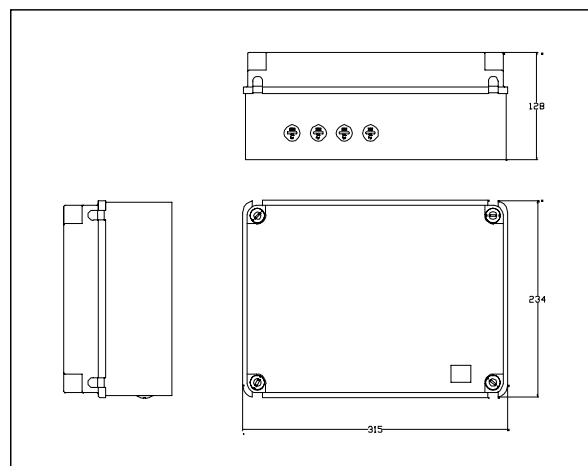
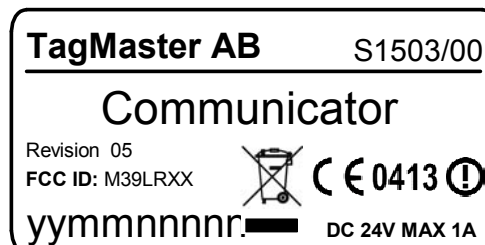
## Environmental data

Cold	-20°C (-4°Fh)	Shock	50 G, 6 ms, IEC68-2-27 Ea 10x 3 dir	Immunity	Acc. to CE leg.
Heat	+60°C(+140°Fh)	Bump	25 G 6 ms, IEC68-2-29 Eb 1000x 3 dir	ETSI EN	301 489-3 v1.2.1(0208)
Sealing	IP 54	Sine vibration	5G/0,55mm, IEC68-2-6 Fc 500Hz, 10m, 4 worst freq	Emission	Acc. to CE leg.
IEC 529		Random Vibration	IEC 60068-2-64	ETSI EN	300 440-1 v1.3.1(0109)
				Solar radiation	1120 W/sqm
				IEC68-2-5 Sa	C56 days
				Safety Electrical and Radio	EN 60950 and EN 60215

## Mechanical data

Product information according to the figure below is marked on the cover of S1500. A marking sticker is also placed inside the unit to avoid mixing up covers and chassis.

Example of marking label:



Weight	1,8 kg
Dimensions (WxLxH):	315 x 234 x 128 mm
Front colour	Light grey
Front material	Polycarbonate
Back material	Stainless steel
Sealing method	Rubber gasket

SE-164 87 KISTA, Sweden

## S1566 Heavy Duty Reader



### Special features

- Long read-range, up to 6m (20ft)
- Extremely tolerant to high electromagnetic fields
- Complying with railway standards
- Specially designed for tough demanding environments
- 2.45 GHz licence free band
- Easy integration with controlling system
- User-programmable for adaptation or standalone-operation
- High passage speed, up to 400 km/h

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#### Disclaimer

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## General

The Heavy Duty Reader S1566 is a read/write unit intended for RFID applications with very high requirements on electrical and mechanical endurance.

The unit is designed to withstand railway requirements, being vehicle mounted in high power electromagnetic field.

Mounting on underground train close to the power pick-up rail is an example where the S1566 is the ultimate choice.

S1566 is a microwave based read/write heavy-duty station for RFID operating in the 2.45 GHz band which is possible to use all over the world.

It communicates with ID-tags through antennas and communicates with host via standard interfaces.

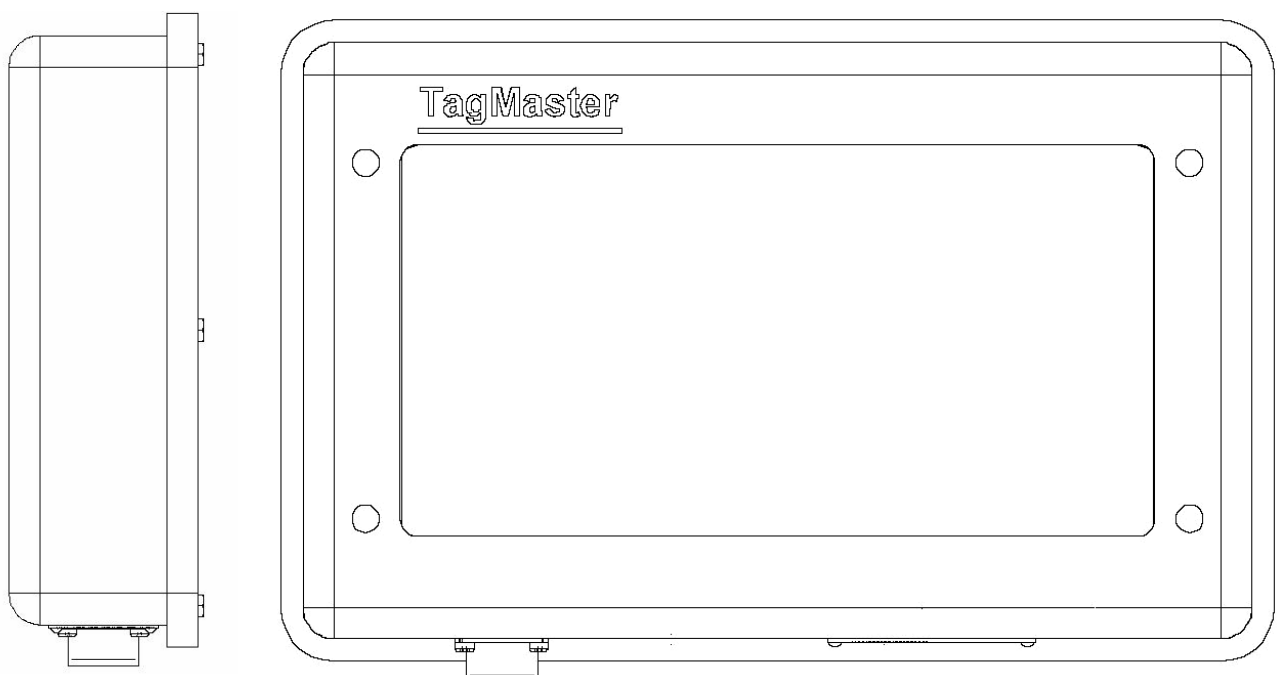
It is designed according to existing regulations for RFID equipment and railway standards.

The reader is capable of reading TagMaster ID-tags at a distance up to 6 m. The receiver circuitry uses digital processing techniques, which enables use in high-speed applications, such as for train or other vehicle identification, up to 400 km/h.

The unit is DC powered from an external source. The design is made for installation in harsh environments and its construction protects it from water spray, dust and other environmental conditions.

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 Heavy Duty Reader S1566 operates at the 2.45 GHz ISM frequency band (Industrial, Scientific and Medical). This is widely used over the world without license requirement. On this high frequency (2.45 GHz) the communication is not affected by ignition and other electromagnetic disturbances that are generated from engines or electric equipment.



# Reading/writing range

The maximum reading or writing range is defined as the maximum distance along the radiation axis where the tag can be communicated when the tag and reader face each other and when there is free space in between.

The free space reading range for S1566 is up to more than 6 m (20 Ft).

In a typical installation the reading range is up to 4m (13 Ft)

Writing range is up to 0.25 m (0.8 Ft)

The reading range depends on the tag reflectivity, the data speed (high/low), power output and sensitivity settings.

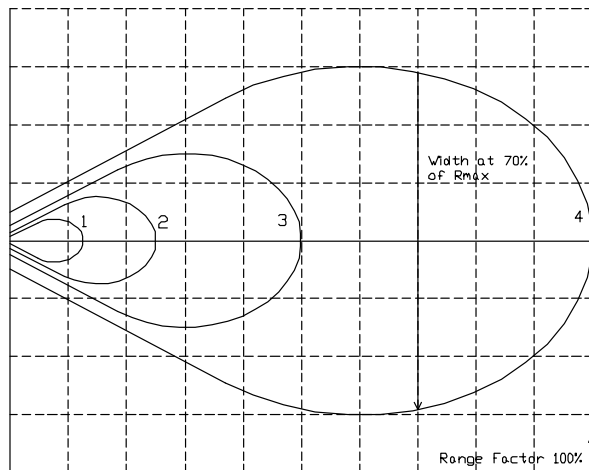
If using low power and/or low sensitivity the reading range is reduced according to the following table.

Range	Sensitivity	Power	Range factor
4	HIGH	HIGH	100%
3	HIGH	LOW	50%
2	LOW	HIGH	25%
1	LOW	LOW	12%

Writing must be done at high power. The writing range is normally not affected by speed and sensitivity settings.

## Lobe width

The lobe diagram shows, in a proportional scale, the approximate lobe shapes of the S1566 readers.



Curves 4, 3, 2 and 1 show areas for safe reading for the four different combinations of power and sensitivity.

Example: Your reading range has been calculated to 4.0 meters, meaning each square in the diagram is 4.0/10=0.4 meters. The lobe width at 70% range is then 5.5 squares \* 0.4 = 2.2 meters.

The diagram concerns a free space installation, and does not take into account possible influences from signal reflections or attenuating structures.

For reliability reasons, it is recommended that tags are passing at 70 % or less of specified reading and writing range.

## Reading/writing time

The time for reading and writing tags are specified in the tag data sheets. Please refer to the data sheet of the specific tag concerned.

## Passage speed

The table shows the maximum allowed passage speed in km/h for combinations of tag reading time and lobe widths.

Reading time [ms]	Lobe width [m]				
	1	1.5	2.0	2.5	3.0
20	180	270	360	450	540
50	72	108	144	180	216
70	51	77	103	129	154
100	36	54	72	90	108
130	28	42	56	69	83
150	24	36	48	60	72
200	18	27	36	45	54

## Tag orientation

Thanks to the circular polarisation, the reading and writing ranges are independent from the rotational orientation around the radiation axis. The reading time for the tag, can be found in the tag datasheets. If the ID tag is very tilted in relation to the reader, a range reduction may occur. Since this effect depends mainly on the specific installation, it is recommended that a test is made.

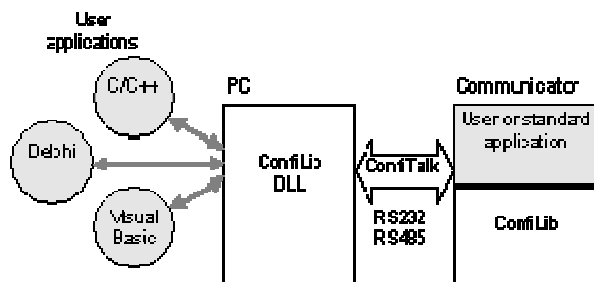


# Software

The readers are delivered with the pre-installed TagMaster software Solid software for standard applications. Should the option real-time clock, built-in database or I/O be selected, the reader can be pre-installed with TagMaster Pyramid software. The software platform in the reader allows the user to develop their own application software. However, you can develop your own application software which can be downloaded and to be executed inside the reader. This will give you will give the user the full power control over of controlling the reader's operation for flexible solutions and fast response times.

## User application development

For user application development there is a complete software development kits (SDK) including compilers, loaders, tools, drivers and libraries supporting the complete development phase for reader applications as well as PC applications.



Reader applications are developed in a PC and the complete software is downloaded, using ConfiLoad, to the reader for permanent storage in EEPROM. PC applications are developed with any PC software development tool. For application programmers a ConfiTalk Commander is available for training and low level communications management.

## ConfiLoad

ConfiLoad is Windows software that "downloads" a reader application to the reader over standard RS232. This provides the possibility to easily upgrade readers without replacing the EEPROM.

## ConfiLib

ConfiLib is a function library with hundreds of functions for reader management and ConfiTalk protocol handling. ConfiLib exists in versions both for readers and PC environments including DOS, Windows 3.1, 95/98/ME and NT/2000/XP. The reader version of ConfiLib is a function library package in C language. For PC environments, the ConfiLib API comes as dynamic link libraries (DLL) with C/C++ interface. There are also separate interface modules for Visual Basic and Delphi available.

## ConfiTalk

ConfiTalk is the standard serial communications protocol used by the readers. The protocol transfers data to and from a reader and handles flow control, retransmissions, checksums and data transparency. It can be used both for point-to-point and multidrop networks, using a polling procedure.

# Communication interface

## RS 485 Interface

The RS 485 interface is compatible with the RS 485 standard. This interface is normally connected to a host computer.

Configuration parameters for the RS 485 interface are controlled by software. The following settings are possible (bold settings are default):

Baud rate 150 - **9600** - 38400 \*  
 Data bits 7 or **8**  
 Parity Odd, even or **No parity**  
 Stop bits 1 or 2

The communication is in half (2-wire) duplex. A shielded data cable shall be used with twisted pairs with the following characteristics:

Impedance 120 ohm  
 Capacitance (max) 66 pF/m  
 Resistivity (max) 80 ohm/m

## RS 232 Interface

The RS 232 interface is compatible with the RS 232 standard. This interface is normally used as a service interface.

Configuration parameters for the RS 232 interface are controlled by software. The following settings are possible (bold settings are default):

Baud rate 150 - **9600** - 38400 \*  
 Data bits 7 or **8**  
 Parity Odd, even or **No parity**  
 Stop bits 1 or 2

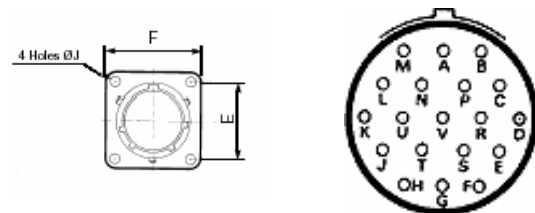
# Connector

The readers means of connection to the host system is via a 19-pole jackable size 14 military type connector (FCI / Souriau part no: FCI-851 02R 14-19 S50) selected to make a connection unexposed to dust, wet and insensitive to vibrations.

PIN P DC power. (12 V or 24 V)  
 PIN R DC power. (0 V)  
 DC Ground (via a "Y" capacitor and a resistor to casing)

shell size	L Max		A	B Max	C Max	D Max	E	F Max	J
	solder	crimp							

14	32.70 1.287	32.00 1.260	22.25 .876	11.70 .461	1.32 .052	23.40 .921	23.00 .906	28.89 1.137	3.13 .123
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## Pin configuration

## Power Supply Connector

**Pin configuration****Power Supply**

Connector  
PIN P DC power. (12 V)  
PIN R DC power. (0 V)  
DC Ground (via a "Y" capacitor and a resistor to casing)

**RS232 communication port A**

Connector  
PIN A Tx/232A.  
PIN B Rx/232A.  
PIN C GND/232A

**RS485 communication port B**

Connector

PIN H	Tx+/Rx-485: Transmit (and receive when 2-wire is used), low wire.
PIN J	Tx-/Rx+485: Transmit (and receive when 2-wire is used), high wire.
PIN K	Gnd485: Shield ground for transmits wires. Note: Signal ground, Interface ground are separated from chassis.

**Alternative RS232 communication port B**

Connector  
PIN H Tx/232B  
PIN J Rx/232B  
PIN K GND/232B

# Electrical data

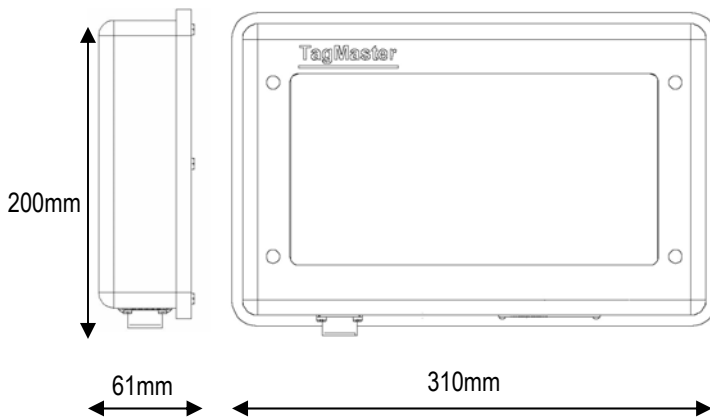
Data regards the temperature range -20 to 60 °C.

Parameter	Value	Unit
DC Supply voltage	10-14	V
(available as option)	20 - 28	V
Consumption 12 V	500	mA
Consumption 24 V	150	mA

Radiation frequency 2435 – 2465 MHz  
 Output power 10 mW e.i.r.p

Polarisation	circular
Tx modulation	ASK
Number of RF channels	99
Radiation reduction	-12 dB
Sensitivity reduction	-24 dB
Reading data speed, high	16 kbit/s
Reading data speed, low	4 kbit/s
Writing data speed	4 kbit/s

# Mechanical Data

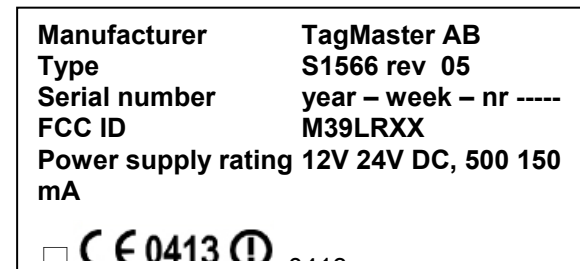


Weight: 3600 grams  
 Casing: Aluminium  
 Antenna cover: Polycarbonate Fire class V-2 (UL 94); Halogen free.  
 Colour: Black with grey cover over antennas

### Dimensions:

L x W x H: 310 x 200 x 61 mm.

**Marking:** The Reader is marked with a label. Example of label specifying:




### Mounting

The unit is intended for front mounting using a mounting bracket. There is a special mounting fixture for mounting on each train type. Suitable screw dimensions: M8x16. The reader has 4 mounting holes on the front face.

# Environmental data

<b>Climatic</b>			<b>Electrical</b>	
Temperature	-25°C..+ 60°C		EMC	301 489-3:2000
Protection class	IP 65		Railway applications EMC	DD ENV 50121-4 1996
Damp heat cyclic	IEC68-2-30 : 1983		El. Safety	EN 60 950
Change of temperature	IEC 60068-2-14		Health	1999/519/EC
<b>Mechanical</b>			Radio	EN 300 440:2001
Bump	IEC 68-2-29 Eb		Supply related surge	BRB/RIA12
15g 6ms, 2x1000 bumpbs per 3 axis			Variation of voltage supply	DD ENV 50121-3-2 (1996)
Shock IEC 68-2-27 EA			Indirect Transient	EN 50155
Orientation	Peak acceleration	Nominal duration	Radio RFI susceptibility	BRB/RIA 12 EN50155
	A m/s <sup>2</sup>	D ms		RIA 18DD ENV 50 121-3-2 1996,
Vertical	30	30		EN 50155:1995,
Transverse	30	30		EN 301 489-3, EN 50
Longitudinal	50	30		204
3+ 3 shocks per 3 axis			Radio frequency emission	RIA 18, EN 50155:1995
Random Vibration	IEC 68-2-34 Fd			DD ENV 50121-3-2
RIA20 Freq span	5-150 Hz (table 2)			ETS 300 827,EN 300
Orientation	RMS m/s <sup>2</sup>	Frequency range		440V 1.2.1
Vertical	1,00	2	Conducted emission	DD ENV 50121-3-2:
Transverse	0,45	2		1996
Longitudinal	0,70	2		ETS 300 827, EN 301
Simulated Long Life	BRB/LUL/RIA		Transient immunity	489-3
	Specification no.20			DD ENV 50121-3-2:
Random vibration	5 hours each direction axis x 3		Surges	1996
Orientation	RMS 5 hrs			DD ENV 50121-3-2:
	test period m/s <sup>2</sup>	Frequency range	Conducted radio frequency	1996
Vertical	7,90	2	ESD	DD ENV 50121-3-2:1996
Transverse	3,50	2		DD ENV 50121-3-2
Longitudinal	5,50	2		(1996),
			E.I.R.P	EN 301 489-3
			Frequency range	EN 300 440V 1.2.1
			Surges and burst	EN 300 440V 1.2.1
				EN 301 489-1 V1.4.1
			S1566 complies with EC directives for EMC;	
			89/336/EEC (with additional directive 92/31/EEC)	
			R&TTE directive 1999/5/EC	
			<b>Reliability</b>	
			The expected MTBF is 1 000 000 hours for stationary applications and 150 000 hours for mobile applications.	

 **Warning:** To comply with the FCC RF exposure limits, it is recommended that the reader is installed so that a separation distance of at least 20 cm (8 inches) from all persons is provided.

