Product Datasheet

Advancing RFID Reader Technology

ID240 Long Range FDX/HDX Industrial Readers for 128bit ISO 11784/5 Tags

ID 240MK5/6/7/8 DATASHEET Rev 22 April, 2008

The ID240 is a new breed of smart reader with superb performance. No matter what type of tag, FDX/HDX, glass or normal tags, the ID240 works to get the best possible performance from all tags at all times. It features very long read range and is intended for logistics and cattle tagging. Read ranges in the order of 110 thru 140 cm are possible with our 600mmx800mm Antenna using Innovations ear tags.

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ID-240 MK6

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Antenna for ID-240

Features

- Very Long Read Range with FDX Tags
- Very Long Read Range with HDX Tags
- Multiple Readers Allowed
- ZIGBEE RF Interface (ID240Z only)
- DSP - Digital Signal Processing
- Continuous or single Read
- Antenna Safety Lockout
- Decimal or Hexadecimal Output
- Readers Encapsulated in Rugged Die-Cast Enclosures
- Low Power
- Auto Tuning
- Vendor Antenna tune Facility
- 12volt Supply
- Water and UV Resistant Enclosure

Note that there are some minor changes in series 5 and above reader modules

New Warning Messages for Antenna High Voltage and RF Output Socket Connection.

Modified Output data format. The ' LA ' has been dropped

Modified Switch-On Report. An internal hexadecimal number representing the Antenna Voltage now appears in the switch on report.

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General Description

The ID240 series readers are dual readers that read HDX B (AMPSK, ISO11784) and FDX (BI-Phase ISO11785) tags simultaneously. The ID240 series readers employ DSP techniques that dramatically reduce interference, noise and vibration effects making the reader suitable for hostile noisy environments. Excellent read range can be achieved with both glass and conventional open coil format tags partly because the reader can instantly changes its internal algorithms to adjust to differences in individual tag parameters. The ID240 has a synchronization feature that allows multiple readers to be used in close proximity.

The ID240 series readers are equipped with a sophisticated auto-tune facility that compensates for Antenna drift due temperature changes. The readers perform an auto-tune shortly after power up. (The ID240 allows the host computer to command an auto tune at any time down the RS232. See the command schedule)

Reader Specifications

Power requirements	11.4volt to 13.7volt Regulated DC @ 0.5 – 1.5 Amp.
Interface	RS232 @ 9600-19200-38400 baud : N,8,1
Read Range with 600x800mm antenna	Up to 110-140 cm (depends on ear tag)
Frequency	134.2KHz
Transponder	ISO Transponder
Auto-tune	Internal upon switch on and remote via RS232.
Tags	FDX/HDX 128bit ISO11784/5 Tags
Output Format	Decimal or Hexadecimal
Antenna Safety Interlock	Stops RF Power if Antenna Socket Unplugged
Antenna Impedance	8-15uH
Synchronization	Up to 6 readers
Tenth Cycle Synchronization	20mS, 50mS
Case	Painted Die-cast Aluminum.
Sockets	Water Resistant
Weight	1.7kg (nominal)
Size	40mmx220mmx125mm
Minimum HDX Period	2.5mS with no HDX tag in Range
Minimum Read Time FDX	50mS. (Range 88cm)
Maximum allowed FDX search	100mS

Absolute Maximum/Minimum Ratings

Max Input DC Voltage 18volts
Minimum Input DC Voltage -18volts

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Max Input current 1.2 amperes
Max Antenna Voltage 400Volt PKP across both terminals.
Max Case Temperature 80deg C
Min Case Temperature -30deg C
Max Sync Voltage 6V
Min Sync Voltage -0.5V
Max Beeper Voltage 15V
Max Current on beeper wire 30mA

These are absolute values. Operation at or near these values will stress the readers and may result in damage or reduce life.

Switch-on Report

Format [Software Version] [Day Month Year] [Innovations Use] [Innovations Use] [Tuning Variable]
Example V8.01 220406 EC 5F 5F 68 04

'V8.01'	=	Software Version
'220406'	=	Version Date
'EC'	=	For Innovations use only.
'5F'	=	For Innovations use only.
'5F'	=	For Innovations use only.
'68'	=	Antenna Voltage indication - For Innovations use only.
'04'	=	Tuning Variable.

The switch-on report gives three groups of information. These are software version, the software date and the tuning variable. The software version and the software date are for reference only. The Tuning Variable shows the current state of the antenna tuning in hexadecimal. For users who are using the Innovations Antenna both the tune value digits have meaning. All values **except** 00, 01, 02, 3D, 3E, 3F are acceptable. If the tune value is not acceptable it will indicate that the antenna is too close to a metal obstruction or other condition.

For users with their own Antenna, only the **second** digit has any meaning. If the second digit is in the range #2,#3,#4,#5,#6,#7,#8,#9,#A,#B,#C,#D then this is acceptable. For Example 02, 12, 32, 44, 0D, 3D are acceptable tune values.

Command Interface

The reader has a simple RS232 command user interface. The command interface is entered with an STX (start of transmission) which is a binary $02 and 'CMD' as an ASCII string. For test purposes, these commands can be sent

using a terminal. Once the command interface has been entered interface the commands can be sent. The commands can be easily typed in from a terminal keyboard. For further information on the command interface and Vendor commands, download "AN-ID240-3 Command Interface"

User Commands:

[1] = Initiate Auto-Tune
[2] = Return Serial Number
[3] = RF Power On [4] = RF Power Off [B][9][6][0][0] = Set Baud Rate to 9600
[B][1][9][2][0] = Set Baud Rate to 19200
[B][3][8][4][0] = Set Baud Rate to 38,400
[9][G][R][A][P][H] = Send Plot Data down RS232
[Z][O][N] = Turn on Zigbee Radio Link
[Z][O][F] = Turn off Zigbee Radio Link

The command interface is exited by sending an EOT (end of transmission) which is a binary $03. If the command interface has been entered but no command is sent for approximately 5 seconds, control will pass back to the main read routine. The exception is command '4' which can only be ended with a '3' command

TIP. *A STX (02) can be sent by USING the CONTROL/B keys: An EOT (03) can be sent by USING the CONTROL/C keys.*

Auto Tuning

The ID240 performs a self auto-tune when it is switched on, and after this it only performs an auto-tune if it is commanded to do so. The user can command an auto-tune at any time by sending (02) CMD1 (03). It is advisable to command the reader to perform an auto-tune every hour or so, so that the reader can compensate for any small changes in the antenna tuning. This has been left to the user because an auto-tune cycle takes about 100ms during which no tags will be read. In some critical high speed applications the user may determine when an auto-tune cycle 'dead time' will have the least affect. The reader will send a report in the following format: - Tune Value = 08, where 08 is the tuning variable.
Satisfactory tune values are '02,03,04,05,06,07,08,09,0B,0B,0C,OD. Any other values will mean the reader is close the maximum or minimum auto-tune range, and may require attention. Please note that ID240 Mk7 has 4x the tuning range of previous models when used with Innovations Antenna System.

See Also 'Vendor Tuning.'

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Installation of Antennas

DSP techniques provide the reader with good noise rejection but it makes sense not to use up the benefit this provides by placing the antenna in a bad position. Some simple rules should be followed when the antenna is installed. Avoid power cables as these can be a source of electrical noise, especially in industrial situations. Do not place the antenna in close proximity to metal structures particularly sheet metal. Small metal fittings are not a problem and will not affect performance. Some energy saving lights and switching power supplies can generate a lot of interference. Do not place the antenna near known sources of electronic noise. If you have any doubt, ask your supplier. See 'Antenna tune facility'.

Antenna Spacing

The normal spacing of a 600mmx800mm antenna between multiple readers is 2.5meters if the Antennas are facing each other. In general the antenna spacing can be 4x the maximum dimension of the antenna for negligible loss of performance. Spacing less than the recommended may tried. The absolute minimum limit to the distance between antennas is 1.5x the maximum antenna dimension, if the antennas are facing each other. If the Antennas are not facing each other then they may be placed closely in one of the 'Null' pick-up positions. In 'null' positions, antennas may be sited very close to each other.

Vendor Tune Facility

There is an audio/visual interactive Vendor Tune Facility on-board the ID240. For information how to use this feature download application note 'AN ID240 – 2 Vendor Tune Facility'

This facility is appropriate for vendors who need to make special antennas or for on-site adjustment where the antenna has a vendor accessible tuning adjustment

Antenna Safety Interlock

The ID240 series readers have an electronic interlock to turn off the radio frequency power when the antenna plug is removed. In this condition the read LED will flash repeatedly until the antenna socket is plugged in. Never operate the reader without an antenna connected. A 'Warning RF Socket Bad Connection' message will also be sent over the RS232 connection. These safety features alone must not be relied upon to protect the reader against abuse or Antenna malfunction. Always use a correctly specified antenna.

Antenna High Voltage

The ID240 series readers sense the RF output voltage upon switch on. This is partly to warn the user against changing to an unsuitable antenna. If the RF voltage is unexpectedly high a 'Warning High RF Voltage' message

will be sent over the RS232 connection. If an incorrect impedance antenna is being used the reader may be not able to detect an over voltage condition and could lead to component stress and failure within the ID240. If the RF voltage is above the short – term Absolute Maximum Voltage the reader will re-initialize, the read LED will issue a series of flashes and a 'RF Voltage Too High Error' message will be sent over the RS232 connection.

These safety features alone must not be relied upon to protect the reader against abuse or Antenna malfunction. Using an incorrect antenna may stress the components in the ID240 and lead to failure. Always use a correctly specified antenna.

Synchronization Line

If multiple readers are to be used in close proximity they must be synchronized or there may be loss of read range, particularly with HDX tags. FDX range can be affected to a lesser extent. The readers must adjust the radio frequency power so that the readers can work together. The ID240 incorporates a special synchronization line that allows the readers to 'talk' to each other to get the best results. No user knowledge is required and once the cables are connected the readers adjust in milliseconds and stay adjusted.

Connections ID-240 mk5 and Mk6

Antenna Cable:	6 Pin		
	Green	=	Antenna1
	Orange	=	Antenna2
Safety interlock	Short pins 3 and 6		

Warning. Do not connect MK6 or earlier readers to the ID-Innovations Antenna or damage to the Antenna could result. Only connect ID240 MK7 and above readers to ID-Innovations Antenna.

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Data Cable 8 Pin to D-type. Connects to RS232 Port on computer/controller

Power Cable	7 Pin		
	Green	=	0volts Ground
	Brown	=	+12volts (Regulated)
	Yellow	=	Beeper logic Output, '1' (high) is off, '0' (low) is on
	White	=	No Connection
	Orange	=	No Connection

Sync Cable 2 Pin : The screen should be connected to ground. Pin1 on each plug should be connected to pin1 on all other plugs and pin2 on each plug to pin2 on other readers.

Connections ID-240 mk7

Mark 7 has a special facility for use with Innovations Antennas.

ID240 Mark7 Connections for Use with Innovations Antenna

Antenna Cable:	6 Pin				
	Pin1	=	Yellow	= Innovations Antenna Unit	A1
	Pin2	=	Brown	= Innovations Antenna Unit	L1
	Pin3, 6	=	Green	= Link	
	Pin4	=	Orange	= Innovations Antenna Unit	L2
	Pin5	=	White	= Innovations Antenna Unit	A2

ID240 Mark7 Connections for Use with User Antenna

Antenna Cable:	6 Pin			
	Pin1	=	Yellow	= Antenna

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	Pin2	=	Brown	= No Connection
	Pin3, 6	=	Green	= Link
	Pin4	=	Orange	= No Connection
	Pin5	=	White	= Antenna

Data Cable — 8 Pin to D-type. Connects to RS232 Port on computer/controller

Pin3	=	Green	=GND(COM Pin5)
Pin4	=	Bule	= TX (COM Pin3)
Pin4	=	Brown	=RX (COM Pin2)
Other			= No Connection

Power Cable — 7 Pin

Pin3,4	=	Green	= 0volts Ground
Pin1	=	Brown	= +12volts (Regulated)
Pin5	=	Orange	= Beeper logic Output, '1' (high) is off, '0' (low) is on
Pin2,6,7	=	No Connection	

Sync Cable — 2 Pin : The screen should be connected to ground. Pin1 on each plug should be connected to pin1 on all other plugs and pin2 on each plug to pin2 on other readers.

Connecting Multiple Readers

In multiple reader configurations all the sync lines must connected to ensure performance. All the sync cables are connected in parallel. The beeper logic outputs (yellow wire on power cable) may also be parallel wired to give a single logic output. This may significantly ease the wiring of large systems.

Output Formats

There are two output formats available. The standard form is Decimal and the most users will know this format. This number is usually printed on the tag. The Hexadecimal output is available for special technical projects as it allows the user access to individual bits and the cyclic redundancy checksum.

Examples:

Decimal **999000000264103** *

999	=	Country Number
000000264103	=	Unique Identity Number

*Note that for software versions V8.03 and above the gap is removed between Country code and National ID

Hexadecimal **E5E02000039F0001CA99**

E5E02000039F0001	=	Tag number
CA99	=	Check Sum (CRC)

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For a complete explanation of the Hexadecimal tag number see tag manufacturers data.
Data is followed by **CR LF** - Carriage Return and Line Feed (ID240MK5 and above)

Read Mode

There are two read modes. The tag data can either be sent once or the data can repeated endlessly while a tag is in reading range. Please make sure that you order the correct type.

FDX Only Readers

If the user does not need HDX capabilities then an FDX only reader model is available. There are a few small technical advantages to using FDX only. The main advantage is the number of readers that can be used together is increased to 10. Antennas spacing rules still apply.

User Antennas

The Innovations Antenna has a nominal inductance of 8-15uH and has a search coil 820mmx620mm. If the user wishes to use their own antenna the inductance should be in this range. If the user requires a higher value of inductance or different size of antenna then please contact Innovations for advice.

Tuning Sequence for Multiple readers

When two or more ID240 readers are used in a system and the antennas are within meters of each other it is best to command a tuning sequence that will not be affected by the other readers. A suggested tuning start up sequence is detailed in application note "**AN - ID240-1 Software Command Sequence for Multiple Readers"**. The whole sequence will take about a second. Where user-made antennas are employed it is recommended that COG capacitors are used as these are for most purpose drift free.

RS232 Communication Interface

The RS232 communication Interface has a software selectable baud rate of either 9600, 19200 or 38400 baud with no parity, 8data bits and 1 stop bit (xxxxx:N,8,1). The cable provided is 3m long. The interface itself will work reliably up to 100meters using a good quality cable. See command interface for commands. For long distance communication the 9600 baud is generally best.

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Plotting Environmental Noise

Sometimes loss of read range can be explained by electrical interference or noise. It is always desirable to see if the electrical environment has sources of interference. If possible the ID240 antenna should be placed away from noise. The noise waveform can be plotted using the 'Graph' Command which sends plot data down the RS232. By placing the antenna at various places it may be possible to identify noise sources and take precautions. The 'Graph' command is [$02][C][M][D][9][G][R][A][P][H]. This will place the user in graph mode. After this graph data can be obtained by typing a "S'. To exit the facility type 'E'

Cables

The following cables are provided:

1) Antenna cable. Length 3m
2) Power cable. Length 2m
3) RS232 communication cable. Length 3m

Distance from Reader to Antenna

There may be occasions where the Antenna is required to be placed remote from the reader. The antenna cable supplied is 3m long. The cable can be extended with varying degrees of power loss to the Antenna. However, power loss of power to the Antenna does not directly mean a corresponding loss in range, for example a 50% power loss in the cable will cause a loss of range of about 15%. In general use a high quality screened cable for lengthy extensions. The cable should be chosen to have a series inductance <15uH.

Zigbee Interface

The ID240Z reader has an integral Zigbee 2way radio interface with a maximum direct range of 1km. It is important to note that this is line-of-site range and walls and buildings can reduce the range significantly. The interface does not need any setup procedure. Once enable the network will link the reader to the remote host automatically. Up to 10 readers can be controlled in a single network. For further information see data sheet AN - 240 - 5 Zigbee Radio Network

Environmental Issues

The case is a sturdy water resistant aluminum die-cast enclosure that is painted with UV resistant white paint. The sockets are water resistant and most of the internal electronics are covered in resin. The paint has good adhesion

properties and will withstand light knocking and scraping. These the customer will readily see. Please note that while we take efforts to make the reader environmentally secure and trouble free**, we *neither claim that the enclosure or sockets or cables are waterproof, acid rain proof, vandal proof or UV proof or make any guarantees in these respects***. This policy serves to give the customer reasonable protection at a low price.

Care should be taken to avoid impact damage, particularly to the cables and sockets. Do not allow moisture to contact the reader case. For outdoor installations we recommend placing the reader in a weather-proof outdoor polycarbonate enclosure with metal conduits for the cables routing. When considering the location and an exterior enclosure please note that the reader temperature must not go above 80deg C or below -30deg C. In hot sunny geographic locations we advise against placing the reader installation in direct sunlight. Always ensure adequate ventilation. For anti-corrosion reasons always use stainless steel fixing screws.

Problem Solving

For help with problem solving download information sheet 'AN-ID240-4 Problem Solving' from our website.

User Serviceable Parts

The ID240 Reader Module has **no user-serviceable parts**. **Under no circumstances attempt to open the aluminum case**. This will invalidate the warranty. The Electronic parts used may contain toxic material and should not be opened.

Storage

The ID240 Reader Module and cables should be stored at a temperature between 0 to +35deg C. We recommend a plastic sealed bag with a silicon desiccant to keep the moisture low. Storage at high temperatures may reduce the life of the product.

Disposal

Do not burn or incinerate the ID240 Reader. Do not attempt to open the reader case. Dispose of reader safely at a designated Industrial waste site. Alternatively return the reader to ID-Innovations.

Warranty

The warranty period and the replacement period will be as stipulated in the separate warranty document provided at the time of sale. In general, Innovations give a 1 year repair only warranty for faulty components from the time

of purchase. If a failure occurs and the reader is returned to Innovations within 3months of purchase, Innovations normally replace the entire reader. Innovations warranties do not include using the equipment outside the Electrical and Environmental conditions specified or failure due to customer abuse. Innovations invite customers to report all failures that occur within 3 years for our quality control assessments.

Useful Information

1) For general testing we suggest the user downloads a terminal program free from the internet. Here is one particularly good one to consider: http://braypp.googlepages.com/terminal - Truly an excellent piece of software, the best terminal we have seen.

2) Simultaneously pressing the CONTROL/B keys can be used on most terminals to send a STX (02) and simultaneous pressing the CONTROL/C keys can be used to send an EOT (03)

1) The ISO 11785/5 standard is constantly evolving. We only claim that the ID240 reader reads ISO tags and make no claims that the ID240 reader complies with all current standards and recommendations.

Help Line

If you have any technical queries we can be contacted on **help@ID-Innovations.com**

Ordering Code

ID-[Model Number]-[**R**epeat / **S**ingle]-[**I**SO / **F**DX only]-[**S**ynchronization Line/**N**o Synchronization]

Example1	**ID-240MK5-S-I-S**
Reader model	ID-240MK5
Read Mode	Single Read
Configuration	ISO (FDX and HDX)
Synchronization Line	Yes

Example2	**ID-240MK7-R-F-N**
Reader model	ID-240MK7
Read Mode	Repeat Read
Configuration	FDX only
Synchronization Line	No

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Hardware Revision History

ID240MK3	-	Read and Power LEDs added
ID240MK4	-	Output Sockets changed : Later models have 5volt line.
		User has choice of Synchronized or not Synchronized output line to save cost
ID240MK5	-	Sync brought up to 5volts as standard.
ID240MK6	-	New Seal on Die-cast enclosure introduced.
		Case coated with UV Resistant white Paint
ID240MK7	-	Can now Drive Innovations Antenna with extra wide tuning range.
		Pin-out to Antenna Changed to accommodate control leads to antenna.
ID240MK8	-	DC Switch-on system changes.
ID240MK9	-	DC Switch-on system changes.

Please note the Zigbee enabled readers are due for production mid 2008

Firmware Revision History

V5	Decimal and Hexadecimal data now followed by CR LF, changed from LF CR
	New Turn off RF and Turn on RF commands added
V8.01	New Vendor tune Command added.
	Antenna Over-Voltage Warning added.
	Antenna voltage too high Error protection added to start up.
	LA dropped from output data format in Decimal mode output.
	Improved TIRIS signal window – (TIRIS more stable in noise)
	Vendor Software upgrade service available - most ID240MK4 and above.
	Characters added to Switch-on-Report
V8.02	TIR software change to respond quicker to RS232 Commands.
	ID240 can now detect Innovations Antenna or similar.
	Software commands added to allow choice of 9600, 19200 or 38400 SR232 baud rate.
V8.03	Spacing removed in Decimal Data Output between Country Code and National ID
V8.04	Alpha testing for client program down-load added.
V9.00	Graph Plot Data command added. User Firmware up-grade facility added. Software protection for low voltage DC supply added. Tuning range extended to include 64 positions using Innovations Antenna.
V9.01	Customer Code Update facility confirmed.
V9.10	DC Switch on changes.

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