



INID XS series readers

SmartReader (500-5000C)
SmartReader PIN (500-5040C)
MultiSmart (500-5005C)
MultiSmart PIN (500-5045C)
SmartProx (500-5200C)
SmartProx PIN (500-5240C)

Additional mounting instructions

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Document purpose

This document provides additional mounting instructions for situations where mounting on or through metal, side-by-side or back-to-back is required. The document describes the effects, the mechanisms involved and their remedies.

Related documents

List of related documents

Document name or number	Title	Version	Date
100.14.IS.01	INID XS readers Installation Manual	1.31	2016-08-26

Copyright and disclaimer

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Introduction

The INID XS-series readers are high performance RFID readers that use electromagnetic fields on certain frequencies to operate.

Interference

Other equipment in the vicinity may produce interfering fields, either by design or by accident, that can reduce the performance of the reader.

The measurements in this document were taken in an interference-free environment. Equipment like variable frequency drives, large solar power controllers, forklift battery chargers (in general all equipment that controls large currents), anti-theft gates, broadcasting or radar equipment can produce interference that results in decreased performance. Note: this list is not intended to be exhaustive.

Other RFID readers

The performance of the readers can further be negatively influenced by another RFID reader in close proximity, possibly on the other side of a wall, and metal or other conductive surfaces close by, possibly inside the mounting surface or wall.

For both situations the amount of degradation will be influenced by the actual distance and orientation of the object, as well as its physical (especially electromagnetic) properties.

There are three mechanisms involved: the detuning of the readers' antenna, the absorption of the magnetic field of the reader, and carrier / modulation interference.

The first two reduce both the amount of power reaching the card and the sensitivity of the receiver, the latter produces in-band noise confusing the decoder.

Other, non-related equipment may also produce interference that can degrade the performance of the INID XS-series readers. The FCC recommends a variety of methods to remedy this situation in part 15.

All effects decrease with increasing distance.

General mounting considerations

The installation sheet gives a recommended distance for optimal performance; in specific installations a deviation from these numbers can be necessary.

Side-by-side mounting

Mounting readers side-by-side requires that the purpose of each of the readers is clear to the user. If these two readers are set up to read the same credentials, unintentional reads on the 'wrong' reader may occur.

This is because the technical minimum of mounting readers side-by-side may be less than the 125mm (5") stated in the installation sheet and depends on reader type, credential technology and credential geometry. Generally speaking, the MultiSmart and SmartProx readers are less susceptible to side-by-side performance degradation than the SmartReader readers, given the same credentials.

A summary of the technical minimum distances is presented for some common credentials in Table 1, for three reader types.

Table 1: minimum side-by-side mounting distances (mm)

model	read range reduction	Mifare ISO		DESFire ISO (PLAIN)		DESFire ISO (AES)		PIV/PIV-I		H-PX ISO	A-PX tag	PX light ISO	EM4102 ISO	QKey ISO
		23	7/8	16	5/8	9	3/8	44	1 3/4					
5040C	none	23	7/8	16	5/8	9	3/8	44	1 3/4	N/A	N/A	N/A	N/A	N/A
	50%	0		0		0		35	1 3/8					
5045C	none	0		16	5/8	12	1/2	35	1 3/8	0	0	0	0	0
	50%	0		0		0		25	1	0	0	0	0	0
5240C	none	N/A		N/A		N/A		N/A		0	0	0	0	0
	50%									0	0	0	0	0

Notes: Identical reader types with identical configuration, magnetic axes of reader and credential aligned.

"0" signifies touching readers.

Back-to-back mounting

Mounting readers back-to-back may require additional measures, since mounting readers back-to-back causes maximum interference and susceptibility effects.

To prevent interference and accidental reads on the wrong reader, the installation sheet advises a minimum distance of 125mm (5"); for thinner walls the use of a magnetic shield may be required.

The actual minimum back-to-back mounting distance depends on reader type, credential technology and credential geometry.

A summary of the technical minimum distances for some common credentials is presented in Table 2, for three reader types.

For practical reasons, an absolute minimum wall thickness of 19mm ($\frac{3}{4}$ ") is assumed.

Table 2: minimum back-to-back mounting distances

model	read range reduction	Mifare ISO		DESFire ISO (PLAIN)		DESFire ISO (AES)		PIV/PIV-I		H-PX ISO		A-PX tag		PX light ISO		EM4102 ISO		Qkey ISO	
		mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
5040C	none	76	3	76		47	$1\frac{7}{8}$	65	$2\frac{1}{2}$	N/A		N/A		N/A		N/A		N/A	
	50%	19	$\frac{3}{4}$	19	$\frac{3}{4}$	20	$\frac{3}{4}$	59	$2\frac{1}{4}$										
5045C	none	33	$1\frac{3}{8}$	85	$3\frac{3}{8}$	60	$2\frac{3}{8}$	61	$2\frac{3}{8}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$
	50%	19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$	52	2	19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$
5240C	none	N/A		N/A		N/A		N/A		19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$
	50%	N/A		N/A		N/A		N/A		19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$	19	$\frac{3}{4}$

Notes: Identical reader types with identical configuration, magnetic axes of readers and credential aligned.

In case the wall thickness is less than the minimum back-to-back mounting distance, a magnetic shield in the form of a metal plate (aluminum recommended) of sufficient size (175x225mm, 7x9" recommended) and thickness (minimum 0.5mm, 24 gauge) is required between the two readers.

This magnetic shield *will* influence the read performance (depending on its proximity to the readers); a reduction of up to 50% may be observed depending on proximity, credential technology and credential geometry.

Mounting on metal

Mounting a reader directly on or close to a metal surface or aluminum honeycomb panels will reduce reading performance. Depending on credential technology and geometry, the reduction will be 10-30%, with individual cases running up to 50%. This reduction decreases with increasing distance, to be virtually nonexistent at 38mm (1½").

The composition of the wall may also lead to a decrease in performance: e.g. rebar close to the surface inside a concrete wall, or the metal film found on some wall insulations both act as a metal surface.

The reductions listed in the Typical read range table in the installation sheet are an average over all models and were determined on a solid aluminum plate of 1.45mm (15 gauge) thickness, measuring 196 x 220mm (7¾ x 8⅝").

To aid in determining the requirement of a spacer in a given situation, Table 3 presents the results refined for three reader types.

Table 3: typical read ranges and reduction when mounted directly on metal

model	typical read range	Mifare ISO		DESFire ISO (PLAIN)		DESFire ISO (AES)		PIV/PIV-I		H-PX ISO		A-PX tag		PX light ISO		EM4102 ISO		Qkey ISO	
		mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
5040C	up to	45	1¾	36	1⅜	19	¾	38	1½	N/A		N/A		N/A		N/A		N/A	
	reduction	10%		10%		5%		15%											
5045C	up to	45	1¾	36	1⅜	19	¾	37	1½	75	3	45	1¾	74	2⅞	81	3¼	53	2⅞
	reduction	10%		10%		5%		10%		20%		25%		15%		10%		30%	
5240C	up to	N/A		N/A		N/A		N/A		78	3¾	49	1⅞	78	3¾	90	3½	58	2¼
	reduction									20%		20%		15%		10%		25%	

When mounting on or close to metal can not be avoided the use of a non-conductive spacer is recommended (minimum thickness 6mm, ¼"). With aluminum honeycomb panels, the outer surface of the panel may be non-conductive and thus help with its thickness to remedy the reduction.

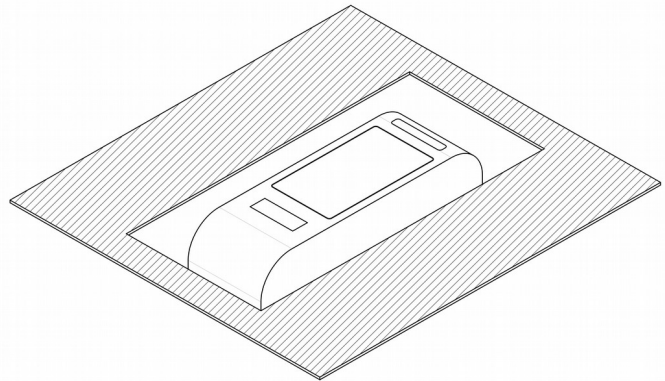
Table 4 lists the possible improvements in reading distance when a spacer is used. Other models will experience identical or greater improvement when mounted on a spacer.

Table 4: typical read range improvements when mounted on metal with a spacer

model	spacer	Mifare ISO		DESFire ISO (PLAIN)		DESFire ISO (AES)		PIV/PIV-I		H-PX ISO		A-PX tag		PX light ISO		EM4102 ISO		Qkey ISO	
		mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
5045C	9mm (⅜")	+5%		+0%		+5%		+5%		+10%		+15%		+5%		+5%		+20%	
	25mm (1")	+15%		+10%		+10%		+15%		+15%		+25%		+15%		+10%		+30%	

Mounting *through* metal

Mounting a reader protruding a metal surface will reduce its performance. Depending on gap size, protrusion, credential technology and credential geometry, the reduction will be 5-15%. This reduction decreases with distance, to be virtually nonexistent at 38mm (1½").



When mounting through metal is desired, the reader should protrude at least 5mm (¼"); the gap between the reader and the metal should be uniform and made as large as possible (20mm, ¾" minimum recommended), decreasing protrusion requires a larger gap to maintain performance. With the same gap geometry, increasing protrusion will increase performance.

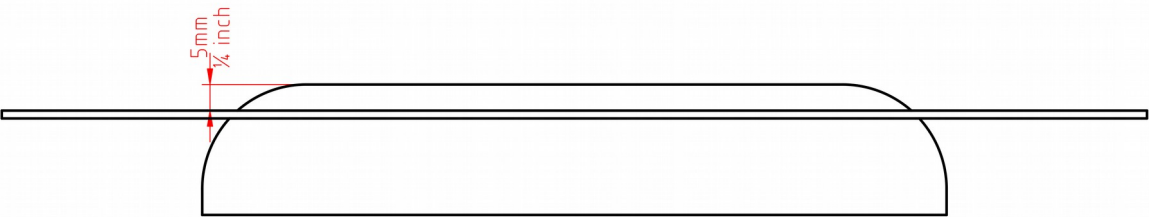
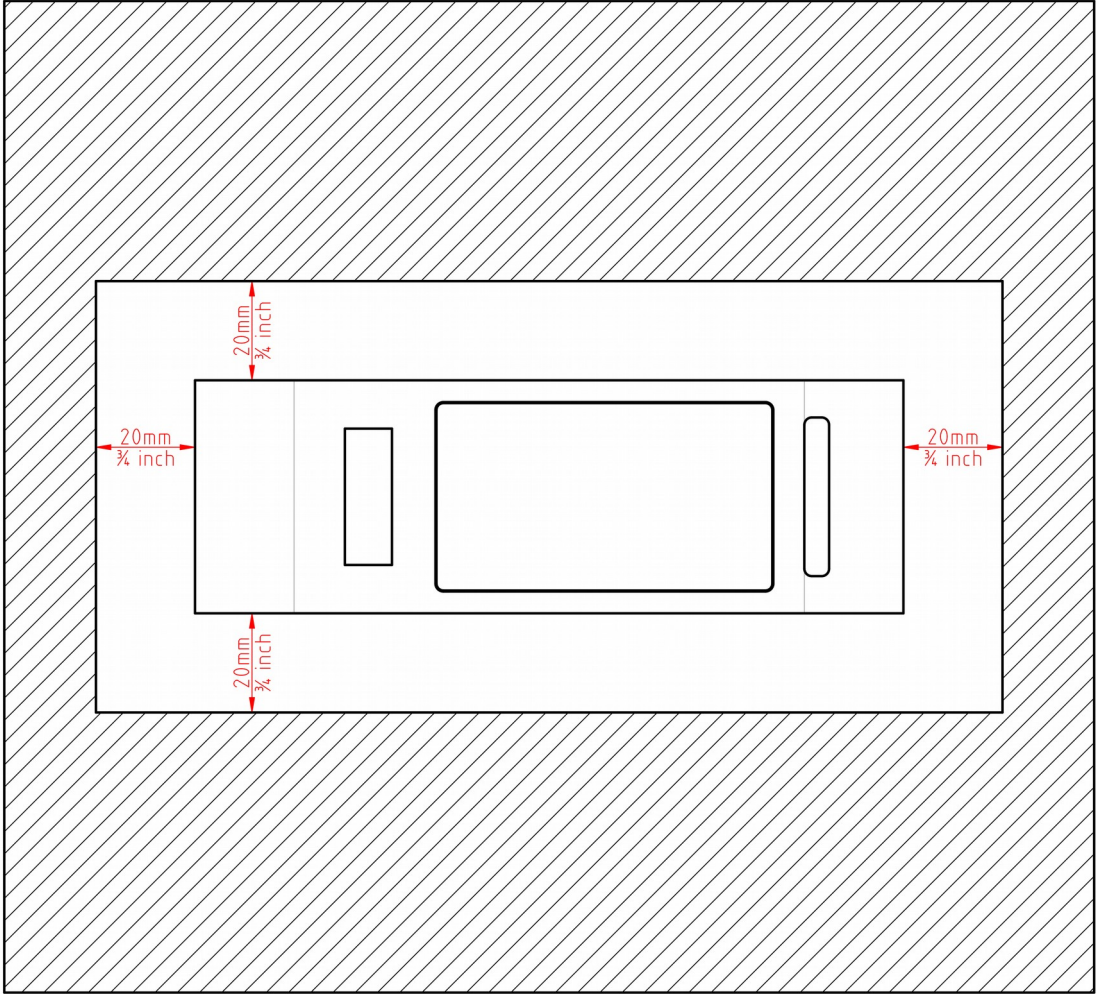
The reductions listed in the Typical read range table in the installation sheet are an average over all models and were determined with a solid aluminum plate of 1.45mm (15 gauge) thickness, measuring 196 x 220mm (7¾ x 8⅝") and a cutout of 92 x 184mm (3⅝ x 7¼") with the reader protruding 5mm (¼").

To aid in determining the gap requirement in a given situation, Table 5 summarizes the results using the recommended gap, refined for three reader types.

Table 5: typical read ranges and reduction when mounted through metal (mm)

model	typical read range	Mifare ISO		DESFire ISO (PLAIN)		DESFire ISO (AES)		PIV/PIV-I		H-PX ISO		A-PX tag		PX light ISO		EM4102 ISO		Qkey ISO	
		mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
5040C	up to	45	1¾	36	1⅝	19	¾	39	1½	N/A		N/A		N/A		N/A		N/A	
	reduction	10%		10%		5%		10%											
5045C	up to	46	1⅞	37	1½	20	¾	37	1½	80	3⅛	52	2	76	3	81	3¼	62	2½
	reduction	10%		10%		0%		10%		15%		10%		15%		10%		15%	
5240C	up to	N/A		N/A		N/A		N/A		79	3⅛	53	2⅛	80	3⅛	91	3⅝	67	2⅝
	reduction									15%		10%		15%		10%		15%	

Reference drawings



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