WIM

installation guide

2017-01-17 | v4.4 | 5279348

nedap | identification systems

CONTENT

1 INTRODUCTION

The Wiegand Interface Module (WIM) is developed to be used in combination with the License Plate Reader. The WIM will convert the license plate string into a Wiegand output message. The Wiegand interface is supported by many access control systems.
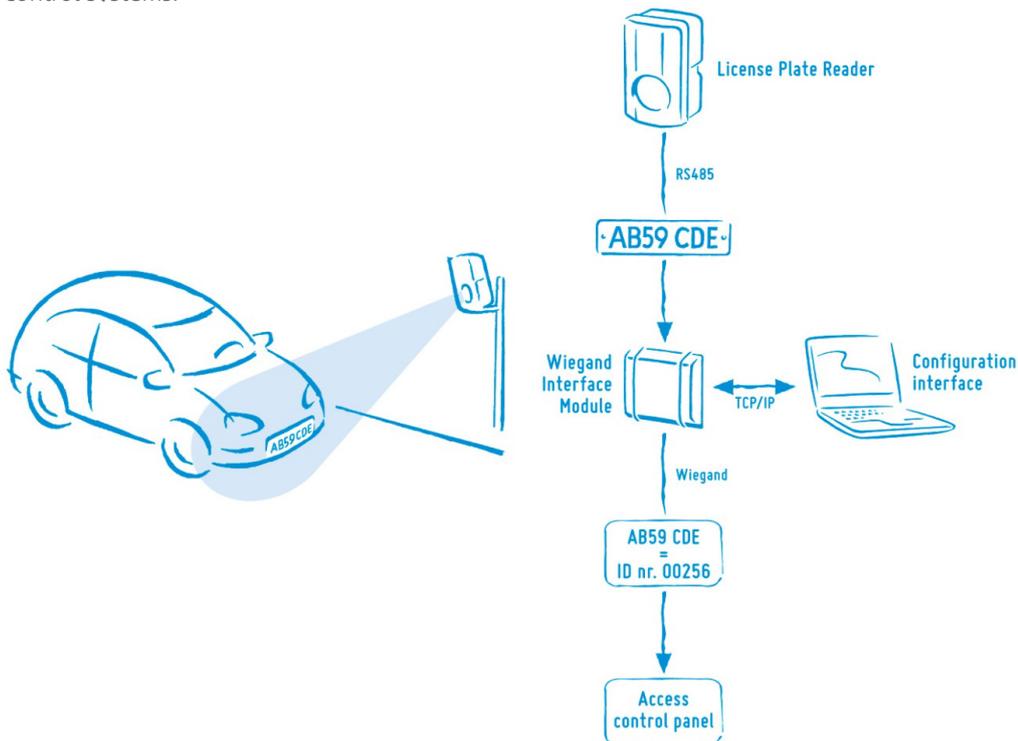
1.1 KEY FEATURES

- Converts a license plate into a Wiegand output message.
- Output in magstripe or barcode format is also possible.
- Easy integration into existing access control systems.
- Easy user configuration.
- Contains a match-list in which license plates and corresponding Wiegand output numbers are found.
- Supports a sophisticated algorithm to convert license plates into "unique" Wiegand output numbers.
- RS485 interface to connect the NEDAP ANPR license plate reader.
- LAN – TCP/IP interface to configure the device and manage the match-list.

2   INSTALLATION

2.1   SAFETY PRECAUTIONS

The following safety precautions must be observed during normal use, service and repair.

- Disconnect the power supply before opening the device.
- The WIM shall only be installed and serviced by qualified and trained personnel.
- The WIM can be powered from a low power, Class 2 power supply, in compliance with local regulations.
- To be sure of safety, do not modify or add anything other than mentioned in this manual or indicated by NEDAP N.V.

2.2   DIMENSIONS
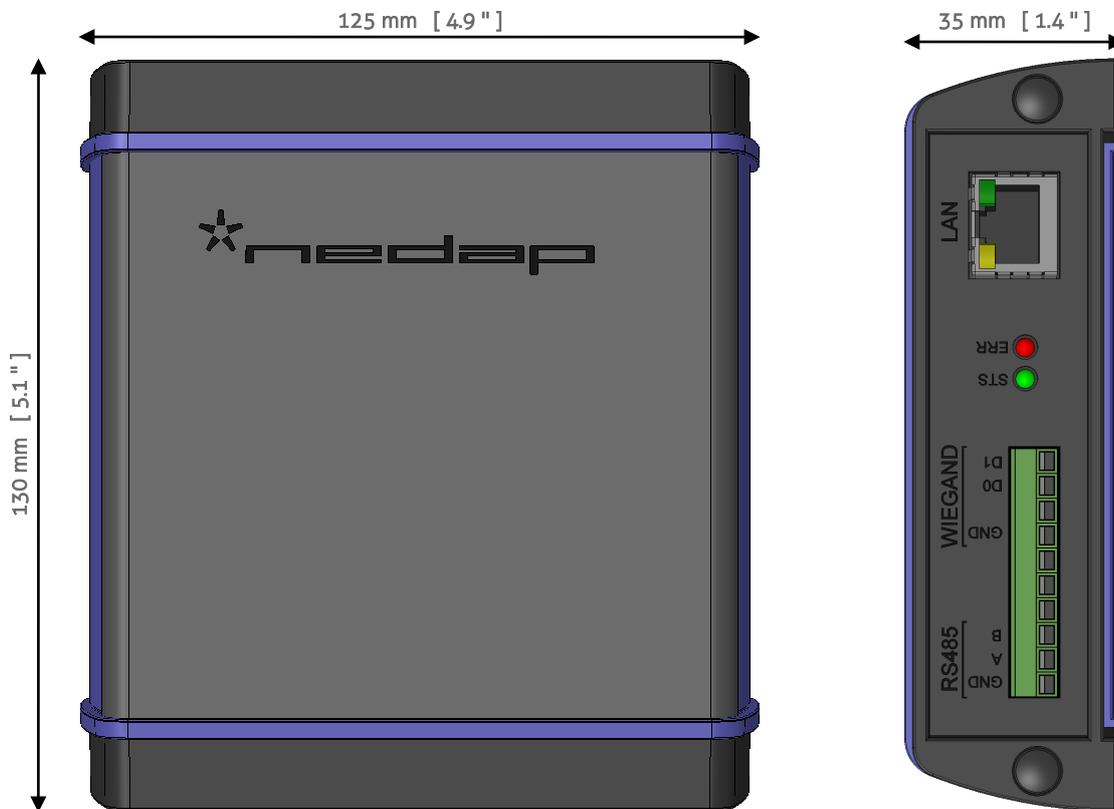
Figure 1: WIM housing dimensions

3   CONNECTIONS

Below the connections are shown which are available on front panel of the device.
Shielded cable shall be used for all connections except power supply.
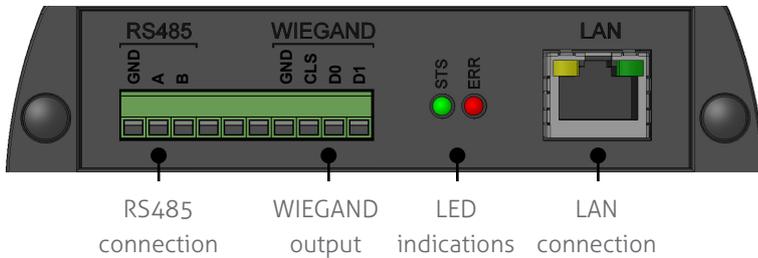
Figure 2: Front view

RS485	Connect the RS485 to the License Plate Reader (9600, 8N1). A: RS485-A (yellow) B: RS485-B (green) GND: RS485-GND (purple)
WIEGAND	Connect the Wiegand output to your access control system. D1: Wiegand data-1 (white) D0: Wiegand data-0 (green) GND: Ground (black)
MAGSTRIPE	Magstripe Clock and Data output. Select with the plate conversion mode switches. See for more details chapter 5. D1: Data D0: Clock CLS: Card Loaded GND: Ground
BARCODE	Barcode wand emulation data output in code39 format. Select with the plate conversion mode switches. See for more details chapter 5. D1: Wand emulation data output (black=high) D0: Wand emulation data output (black=low) GND: Ground
STS LED	Status LED (green) Blinks regularly to indicate standby. Blinks fast to indicate that a RS485 message (license plate) is processed.
ERR LED	Error LED (red) Normally off. On if match-list used and license plate not found.
LAN	The LAN connection (RJ45 socket) is used to configure the device and manage the match-list. Link LED (left): Off=No link, Amber=10Mbps, Green=100Mbps. Activity LED (right): Off=No activity, Amber=HDX Activity, Green=FDX Activity.

Connections

The power supply and the DIP-switches are located on the rear panel. See the picture below.

Switches   Power input

Figure 3: Rear view

Power input	Use the supplied 24VDC power adapter. Power supplies must be able to supply 12 – 24 VDC / 5 Watt (positive voltage at center pin).
Switches	The switches select the plate conversion mode. See for more details chapter 5.

4   ANPR CONFIGURATION

This chapter describes the required plate reader settings when using the WIM. These settings must be configured in the plate reader using a web browser and the plate reader's TCPIP interface. See for more details about the plate reader the ANPR installation guide.

4.1   PLATE READER SETTINGS
4.1.1   EVENTS / ACTIONS
The OCR Read event must generate an RS485 output message as specified below.
Optionally enable the OCR Not Read event to output a NOTREAD message.
Optionally enable the OCR No Plate event to output a NOPLATE message.

OCR Read – 485 Msg
> Enable: YES
> Message: %PLATE_STRING%0x0D%0x0A

OCR Not Read – 485 Msg
> Enable: YES | NO
> Message: NOTREAD%0x0D%0x0A

OCR No Plate – 485 Msg
> Enable: YES | NO
> Message: NOPLATE%0x0D%0x0A

4.2   SYSTEM SETTINGS
4.2.1   SERIAL PORTS
The RS485 serial port must be enabled as specified below.

Enable:	YES
Baud rate:	9600
Parity:	NONE
Data Bit:	8
Stop Bit:	1
Message:	RAW

5 PLATE CONVERSION MODES

The plate conversion mode is selected using the 4 switches located on the device rear panel.

Plate Conversion Mode	1	2	3	4	Mode Hex
Wiegand 26-bit SHA-1 (see chapter 5.1)	ON	ON	ON	ON	0F
Wiegand 64-bit (see chapter 5.2)	OFF	ON	ON	ON	0E
Magstripe ISO7811 track 1 (see chapter 5.4)	ON	OFF	OFF	ON	09
Magstripe ISO7811 track 2 (see chapter 5.5)	OFF	OFF	OFF	ON	08
Barcode code39 emulation (see chapter 5.6)	ON	OFF	OFF	OFF	01
Wiegand match-list mode (see chapter 5.3)	OFF	OFF	OFF	OFF	00
Wiegand match-list-XL mode (see chapter 5.3)	OFF	OFF	ON	OFF	04

5.1 WIEGAND 26-BIT (SHA-1)

In this mode, every received license plate message is converted to a Wiegand 26-bit output message using the SHA-1 security hashing algorithm.

Wiegand 26-bit SHA-1 conversion procedure:

1	Receive license plate message	hk 55 evb
2	Turn into upper case	HK 55 EVB
3	Remove spaces	HK55EVB
4	Calculate SHA-1 digest	A44F633C 8A6D1581
		50CCEB3E F83D9DE0
		BA80CF15
5	Truncate. Keep least significant 24-bits	A80CF15
6	Add parity bits according to Wiegand 26-bit format	

In Wiegand 26-bit (SHA-1) mode it is not required to use the LAN connection.

The WIM_Calc software is available to calculate Wiegand output numbers for specific license plates.
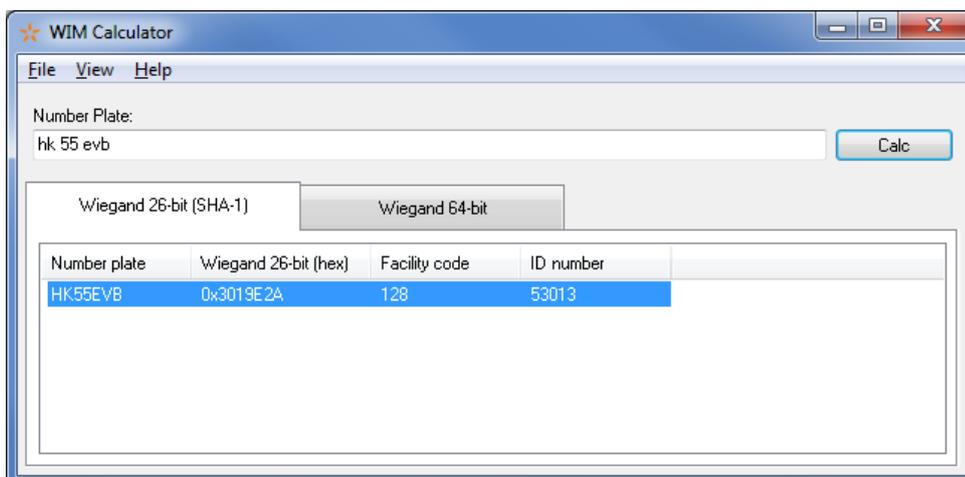
Figure 4: WIM_Calc software screenshot

5.2 WIEGAND 64-BIT

In this mode, every received license plate message is converted to a Wiegand 64-bit

output message.

The first four bits are always 0110.
Next 10 groups of 6 bits. Each 6-bit group contains a license plate character. See character conversion table below.

If the license plate string contains less than 10 characters, the first groups are « empty » (= 000000).
If a character is not found in the conversion table, then the conversion uses « other » (=111111).

CHAR	6-BIT		CHAR	6-BIT		CHAR	6-BIT		CHAR	6-BIT
'0'	010000		'A'	011010		'K'	100100		'U'	101110
'1'	010001		'B'	011011		'L'	100101		'V'	101111
'2'	010010		'C'	011100		'M'	100110		'W'	110000
'3'	010011		'D'	011101		'N'	100111		'X'	110001
'4'	010100		'E'	011110		'O'	101000		'Y'	110010
'5'	010101		'F'	011111		'P'	101001		'Z'	110011
'6'	010110		'G'	100000		'Q'	101010			
'7'	010111		'H'	100001		'R'	101011			
'8'	011000		'I'	100010		'S'	101100		« empty »	000000
'9'	011001		'J'	100011		'T'	101101		« other »	111111

Table 1: character conversion table

The WIM_Calc software is able to calculate the Wiegand 64-bit output numbers for specific license plates.

Examples:

License plate 'HK55EVB':

0110	000000	000000	000000	100001	100100	010101	010101	011110	101111	011011
	«empty»	«empty»	«empty»	H	K	5	5	E	V	B

License plate 'VR46#T':

0110	000000	000000	000000	000000	101111	101011	010100	010110	111111	101101
	«empty»	«empty»	«empty»	«empty»	V	R	4	6	#	T

5.3   WIEGAND MATCH-LIST MODE

In the Wiegand match-list mode, every received license plate message is searched in the match-list. If the plate string is found, then the corresponding Wiegand output message will be transmitted. If the plate string is not found, then no Wiegand output is generated. Optionally a defined Wiegand output message can be transmitted when no match is found.

The match-list or match-list XL mode is selected with the dip-switches.

	Match-list (mode 00)	Match-list xl (mode 04)
Memory	EEPROM	FLASH
Capacity	1008 plates	20480 plates
Write endurance	1M times	100K times
Read/search speed	133µsec / plate max = 130µsec x 1008 = 135msec	8µsec / plate max = 8µsec x 20480 = 160msec

The match-list is managed through the LAN interface. This can be done using the WIM_List software.

See below a screenshot of the WIM_List software.
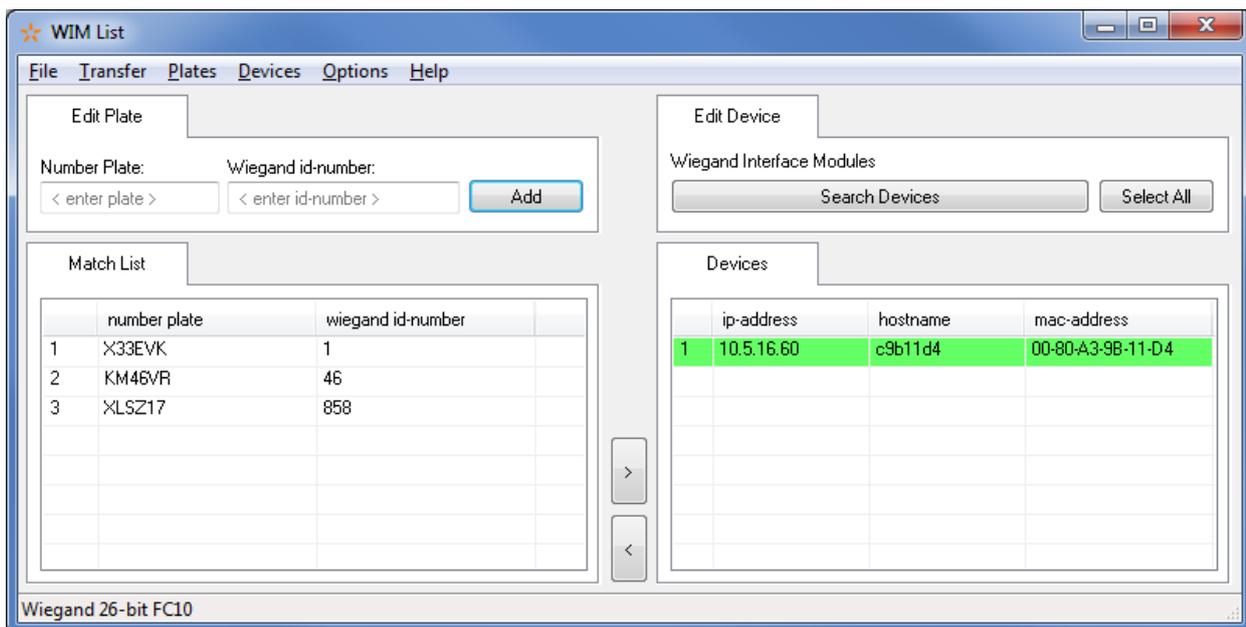
Figure 5: WIM_List software screenshot

The WIM_List software shows on the left side the match-list. New plates and numbers can be added to the list. Remove plates by using the popup menu or pressing the delete key. To view or edit the special plates or the Wiegand output format, it is required to select the Expert user mode.

On the right side the devices (Wiegand Interface Modules) are shown. Click the Search button to scan for devices. System administrators and installers require user mode Expert to configure the devices (e.g. assign an IP address).

Click the transit ('>') or receive ('<') button to synchronize the match-list with the

selected device.
Do not transmit the match-list more than 50 times per day, to avoid memory endurance stress.
Do not transmit the match-list XL more than 500 times per day, to avoid memory endurance stress.

5.4   MAGSTRIPE ISO7811 TRACK 1

In this mode the license plate is converted to a magstripe ISO7811 track 1 compatible output message.

Syntax:	<SS> <plate> <ES> <LRC>	
Where:	<SS>	Start sentinel (hex 05 = bin 000101)
	<plate>	License plate string (variable number of characters)
	<ES>	End sentinel (hex 1F = bin 011111)
	<LRC>	Checksum. Xor all message characters including <SS> and <ES>.

ISO7811 track 1 data consists of 6 data bits + 1 odd parity bit for each character. See character set below.

Char	Bin	Char	Bin	Char	Bin	Char	Bin
Space	000000	0	010000	@	100000	P	110000
!	000001	1	010001	A	100001	Q	110001
"	000010	2	010010	B	100010	R	110010
#	000011	3	010011	C	100011	S	110011
$	000100	4	010100	D	100100	T	110100
% <SS>	000101	5	010101	E	100101	U	110101
&	000110	6	010110	F	100110	V	110110
'	000111	7	010111	G	100111	W	110111
(	001000	8	011000	H	101000	X	111000
)	001001	9	011001	I	101001	Y	111001
*	001010	:	011010	J	101010	Z	111010
+	001011	;	011011	K	101011	[	111011
,	001100	<	011100	L	101100	\	111100
−	001101	=	011101	M	101101	]	111101
.	001110	>	011110	N	101110	^ <FS>	111110
/	001111	? <ES>	011111	O	101111	_	111111

Table 2: ISO7811 track 1 character set

Example:
License plate 'HK55EVB' = %HK55EVB?H
License plate 'VR46IT' = %VR46IT?!

ISO7811 track 1 details:

Card loaded, Clock and Data signals are active-low.

Timing per character is 1575 µsec, per bit 225 µsec (= ±4450 Hz).

The characters are transmitted "backwards". Least significant bit first and ending with the odd parity bit.

Number of leading and trailing clock zeros is 62.
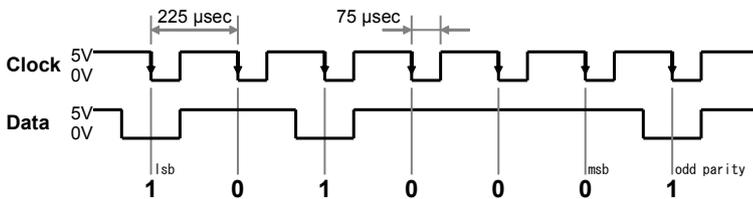
5.5   MAGSTRIPE ISO7811 TRACK 2

In this mode the license plate is converted to a magstripe ISO7811 track 2 compatible output message.

Syntax:	<SS> <plate> <ES> <LRC>	
Where:	<SS>	Start sentinel (hex B = bin 1011)
	<plate>	License plate string (variable number of characters)
	<ES>	End sentinel (hex F = bin 1111)
	<LRC>	Checksum. Xor all message characters including <SS> and <ES>.

ISO7811 track 2 data consists of 4 data bits + 1 odd parity bit for each character. All characters must be decimal numbers in the range from 0 to 9. Except for the start-sentinel (hex B), end-sentinel (hex F) and LRC.

Because the character set only contains decimal numbers, the license plate string must be converted from text to numbers. This conversion is done as shown in the conversion table below.

Plate Conversion Modes

CHAR	TK2 CHARS		CHAR	TK2 CHARS		CHAR	TK2 CHARS		CHAR	TK2 CHARS
Space	0 0		0	2 0		@	4 0		P	6 0
!	0 1		1	2 1		A	4 1		Q	6 1
"	0 2		2	2 2		B	4 2		R	6 2
#	0 3		3	2 3		C	4 3		S	6 3
$	0 4		4	2 4		D	4 4		T	6 4
%	0 5		5	2 5		E	4 5		U	6 5
&	0 6		6	2 6		F	4 6		V	6 6
'	0 7		7	2 7		G	4 7		W	6 7
(	1 0		8	3 0		H	5 0		X	7 0
)	1 1		9	3 1		I	5 1		Y	7 1
*	1 2		:	3 2		J	5 2		Z	7 2
+	1 3		;	3 3		K	5 3		[	7 3
,	1 4		<	3 4		L	5 4		\	7 4
−	1 5		=	3 5		M	5 5		]	7 5
.	1 6		>	3 6		N	5 6		^	7 6
/	1 7		?	3 7		O	5 7		_	7 7

Table 3: ISO7811 track 2 character conversion table

Example

License plate 'HK55EVB' = B50532525456642F0
License plate 'VR46IT' = B666224265164F4

ISO7811 track 2 details

Card loaded, Clock and Data signals are active-low.
Timing per bit is 630 µsec (= ±1600 Hz).
The characters are transmitted "backwards". Least significant bit first and ending with the odd parity bit.
Number of leading and trailing clock zeros is 16.

5.6 BARCODE WAND EMULATION CODE39

In this mode the license plate is transmitted in the barcode wand emulation code39 data format.
The code39 format is a widely used barcode format. The specification defines that the character set includes uppercase letters (A to Z), decimal digits (0 to 9) and a few special characters. The asterisk (*) is used for start and stop character.
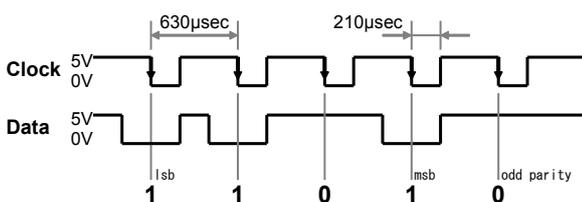
Note
The barcode code39 mode does not require to use the LAN connection.
The barcode code39 mode is introduced in firmware version 1.06.

Example
License plate HK55EVB:

* H K 5 5 E V B *

Barcode code39 details:

The code39 format contains for each characters 5 bars (black stripes) and 4 spaces (white). Three elements are wide and six elements are small. The ratio between wide and small is 3:1. The characters are separated by an inter-character gap, which is a small space.
Output connection D1 transmits code39 data black = high.
Output connection D0 transmits code39 data black = low.
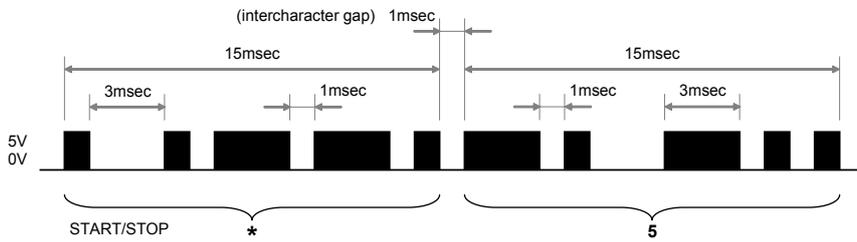
Timing constants

Small element	1msec
Wide element	3msec
Inter-character gap	1msec

6 PROGRAMMER'S GUIDE

The LAN interface allows to configure the device and manage the match-list. The easiest way is to do this using the NEDAP WIM_List software. Customized software can be developed using the command messages described in this chapter.

By default DHCP is enabled on the WIM. This means that the WIM will ask upon powerup the DHCP server on the network for an ip-address. You can use the WIM_List software or the Lantronix Device Installer software to assign a fixed ip-address.

The TCP port number for communication with the WIM is 10001.

6.1 MESSAGE FORMAT

Once the connection is established with the WIM on TCP port number 10001, command messages can be transmitted to the WIM and response message may be received.

Messages are sent in ASCII format. Every message is terminated with a carriage-return (0x0D) and linefeed (0x0A) character sequence.
message<cr><lf>

Usually the WIM will reply messages with a echo-message to indicate that the message was successful. If a command message is not supported or not recognized, the WIM will return an error message (?<cr><lf>).

6.2 COMMAND MESSAGES

QVE   **Request Firmware Version**

Description:	Request firmware version.	
Syntax:	QVE	
Reply:	QVEpppvvv	
Where:	ppp	Firmware name (LPX)
	vvv	Firmware version (100 = version 1.00)

QTM   **Request Plate Conversion Mode**

Description:	Request plate conversion mode as selected using the plate conversion switches. See also chapter 5.	
Syntax:	QTM	
Reply:	QTMmm	
Where:	mm	Plate conversion mode in the range from hex 00 to 0F (00=all switches off, 01=only switch 1 on, 0F: all switches on).

QLS   **Request Match-List Status**

Description:	Request match-list status. Returns the match-list size and number of used entries. The reply depends upon the match-list mode selected by the dip-switches.	
Syntax:	QLS	
Reply:	QLSuuuussss	
Where:	uuuu	Number of used entries in the match-

		list. Range from hex 0000 to FFFF.
	ssss	Match-list size. Range from hex 0000 to FFFF.
Example 1:	QLS006403F0	Match-list size is 1008 entries. Used 100 entries (908 free).
Example 2:	QLS03E85000	Match-list-XL size is 20480 entries. Used 1000 entries (19480 free).

CLS   Clear Match-List

Description:	Clear match-list completely. Clears both the match-list in eeprom aswell as the match-list-xl in flash.
Syntax:	CLS
Reply:	CLS
Notes:	This command also clears the no-match found entry.

SLS   Set Match-List Entry

Description:	Append an entry to the match-list. The entry contains a license plate string and it's corresponding Wiegand output specification. If the license plate is already in the match-list, then the entry is updated. It is not possible to update a license plate in the match-list-XL mode. It is recommended to use the WIM_List software to transmit many license plate entries.	
Syntax:	SLSppp=wwwwwwwwwwww	
Reply:	SLSppp=wwwwwwwwwwww	
	MEMFULL	← Memory full: plate not appended.
	PLEXIST	← Plate already exists: plate not updated (only match-list XL mode).
Where:	ppp	License plate string. String length can be 1 to 10 characters. Use uppercase characters and do NOT use separators or spaces.
	ww..ww	Wiegand output specification. Must be exactly 12 hex characters, including a start-bit and the complete Wiegand output format. E.g. parity bits, facility code, id-number.
Notes:	Don't forget to add the start-bit, when building the Wiegand output specification.	
Example:	Assign license plate 'HK55EVB' to Wiegand 26-bit facility code 1, ID-number 12345. SLSHK55EVB=000006026073	

QLI   Request Match-List Entry

Description:	Request an indexed entry from the match-list. If the requested entry is empty, then an empty message is returned. Use the QLS command to check how many entries are used in the match-list.	
Syntax:	QLIiiii	
Reply:	QLIiiiippp=wwwwwwwwwwww	
Where:	iiii	Match-list index in range from hex 0000 to FFFF. First entry at index 0.
	ppp	License plate string. String length can be

	1 to 10 characters.
ww..ww	Wiegand output specification. Is exactly 12 hex characters and includes a start-bit and the complete Wiegand output format. E.g. parity bits, facility code, id-number.
Example 1:	Request the 1st match-list entry. Response contains license plate 'HK55EVB'. QLI0000 QLI0000HK55EVB=000006026073
Example 2:	Request the 10th match-list entry. Empty response. QLI000A QLI000A

SNF   Set No-Match-Found Entry

Description:	Set the no-match-found entry. This entry contains the Wiegand output specification assigned to every received license plate that is not found in the match-list.
Syntax:	SNFwwwwwwwwwwww
Reply:	SNFwwwwwwwwwwww
Where:	ww..ww	Wiegand output specification used when license plate not found. Must be exactly 12 hex characters, including a start-bit and the complete Wiegand output format. E.g. parity bits, facility code, id-number.
Example:	Set the no-match-found entry to Wiegand 26-bit facility code 255, id-number 65553. SNF00005FFFFFFF

QNF   Request No-Match-Found Entry

Description:	Request the no-match-found entry.
Syntax:	QNF
Reply:	QNFwwwwwwwwwwww
Where:	ww..ww	Wiegand output specification. 12 hex characters including a start-bit and the complete Wiegand output format. E.g. parity bits, facility code, id-number.

CNF   Clear No-Match-Found Entry

Description:	Clear the no-match-found entry. If the license plate is not found in the match-list, then no Wiegand output is generated.
Syntax:	CNF
Reply:	CNF

A   TECHINAL SPECIFICATIONS

Item	Specification	Remark
Article number	9958789	incl. power adapter
Dimensions	130 x 125 x 35 mm [5.1 x 4.9 x 1.4 "]	
Weight	600 gram	
Housing	Aluminium die-cast zinc alloy	
Color	Graphite gray (RAL 7024)	
Protection class	IP40 (approx. NEMA1)	
Operating temperature	0 °C ... 55 °C [32 °F ... 130 °F]	
Relative humidity	<90 % non condensing	
Power supply	12 ... 24 VDC ±10% power supply	
Current consumption	5 Watt	
Interfaces	RS485 – License Plate Reader Wiegand – Access Controller LAN – Config and management	max. 1200 mtr [4000 ft] max. 150 mtr [500 ft] max. 100 mtr [330 ft]
Power supply	12 ... 24 VDC ±10% power supply	
Match-list	Memory: EEPROM Capacity: 1008 plates Write endurance: 1M times Search speed: ±130μsec / plate	
Match-list XL	Memory: FLASH Capacity: 20480 plates Write endurance: 100K times Search speed: ±8μsec / plate	

B   DISCLAIMER

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C   DOCUMENT REVISION

Version	Date	Comment
4.4	2017-01-17	Shielded cable requirement added
4.3	2015-04-28	Document number on front page
4.2	2015-04-28	Connections front view image improved
4.1	2015-03-23	HR update
4.0	2014-02-26	Layout adjusted to new corporate style
1.3	2013-11-21	Added match list XL
1.2	2012-06-07	Added barcode plate conversion mode
1.1	2012-02-15	Added magstripe plate conversion modes
1.0	2012-01-19	Added chapter with required ANPR settings
0.3	2011-12-06	RS485 A/B naming corrected
0.2	2011-10-25	Updated with Wiegand 64-bit mode and command messages
0.1	2011-10-11	Initial document version