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LCIC-WIM-WIM-MODE

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(The details regarding the **'Auto Total'** feature are typed in **violet**.)

1. Introduction

The WIM-mode weighs vehicles in motion calculating the *weight* and the *speed* of each axle, as well as the *space* between consecutive axles. The results may be transmitted to a PC (or another remote computer) – please refer to the section "Communication with a PC" at the end of this document. Card's LED display shows the serial no. (only 2 rightmost digits) and the weight of each axle (axle's serial no. is limited to 4000000000 (4*10^9)). Alternately, the LED display shows also the current weight, preceded by 'A' for 'Actual'. The user may define how his process will look like, using the Settings utility, as described below. The LCIC-WIM/WIM-mode board is an expansion of the basic version of LCIC-WIM (except that there is no Fill mode in the WIM-mode version). Therefore, the User's Manual of the basic version (LCIC-WIM.PDF) – except the Fill mode topics – is relevant also for the WIM-mode board. The special features of the WIM-mode board are described by this document (LCIC-WIM-WIM-MODE.PDF).

Notation
<c/r> signifies a carriage return (ASCII 13).

2. The Settings Utility

The Settings utility lets the user define some parameters in order to optimize the system to his application. The utility is described in details in section 3.3 of **LCIC-WIM.PDF**, including the common parameters (that is, those which are not specific to the WiM-mode) as follows:

* **Communication** parameters in section 3.3.2.1:
  Communication type, Baud Rate, RS485 address, Get results immediately.
* **Filtering** parameters in section 3.3.2.4:
  Filter1, Filter2, Decimator.
* **Auto Zero** parameters in section 3.3.2.2:
  Activate, Max. Zero, Min. Zero, Time limit.
  However, in V3.128 and up there are more options described below in section 2.1.4 (Auto Zero – Advanced).

The **Menu Bar / Tools** is described in section 3.3.1.

The additional parameters which are specific to the WiM-mode are described below.

2.1 Modes Control

2.1.1 'WiM-mode starts upon card reset'

(supported by board version V3.115 and up, and LCIC-WIM-SETTINGS application version V2.25 and up.)

* When the option is **unchecked** (the default), upon 'card reset', the card stays in the general mode.
* When the option is **checked** , upon 'card reset', the card goes automatically to the WiM-Mode.

This option is available also through parameter #1074:
0 = unchecked, 1 = checked (see section 3.2).

2.1.2 'Start / End WiM-mode' or 'Start/End a Vehicle'

There are three options how to *start* (enter) the WIM-mode or *end* (exit) it:

- 1. Starts / Ends by PC
- 2. Starts / Ends by card's input1 (on) / (off)
- 3. Starts / Ends by card's input1 (on) / input2 (on)

Note that the Start/End through the PC is available in all three options.

Note about options 2 & 3

Turning input1 off (in option 2) or input 2 on (in option 3) will terminate the WiM-Mode only in case it was started by turning input 1 on, but **not** in case the WiM-Mode was initiated by board restart (when the 'WiM-mode starts upon card reset' option was checked) or by the 'w' command.

'Auto Total' feature note
With board version 3.120 and above, when parameter #2.1.1 ('WiM-mode starts upon card reset') is checked, parameter #2.1.2 gets another meaning: 'Start/End a Vehicle (for 'Auto Total' feature)'. For more details, refer to 'The 'Auto Total' Feature.pdf', section 2.

2.1.3 Hardware Indication when the Board is in WIM-mode

(V3.09 and up.)

There is a feature to get an indication when the board is in WIM-mode also by a hardware output. The output will be turned **on** once upon entering the WIM-mode, and **off** once upon exiting the WIM-mode. That is, the user may later change the output status using the write commands to the digital outputs (a, A, b, B, c, C, d & D).

How to specify which output will give the indication

* In Settings V2.35 and up:
  * Click **Tools → General Setpoints**.
  * In the **'WiM-mode Indication'** parameter:
    Specify the number of the desired output (1, 2, 3 or 4) to indicate the WIM-mode, or 0 in order to disable this feature (the default).
* In Settings V2.34 and down:
  In the general mode, write to board's parameter #116 the number of the desired output (1, 2, 3 or 4) to indicate the WIM-mode, or 0 in order to disable this feature (the default). (Refer to the 'W' command in the general documentation (LCIC-WIM.PDF), section 4.1 / a.)

'Auto Total' feature note

With board version 3.120 and above, when the 'Auto Total' feature is enabled (checked), this hardware indication has another meaning (the board is 'active', that is, it considers the coming vehicle as 'relevant'). For more details, refer to 'The 'Auto Total' Feature.pdf', section 3.3.

2.1.4 Auto Zero – Advanced

(V3.128 and up.)

In the 'Auto Zero' frame there is a 'More' button. Click it and you get the **'Auto Zero – Advanced'** frame below the 'Auto Zero' frame (hiding the text that was there before). Close the 'Auto Zero – Advanced' frame by clicking the 'x' in the right-up corner (as usual in Windows), or by clicking the 'Less' button (in the same place where the 'More' button was).

In this frame you may adjust the character of the auto- and the manual- zero, as described below.

(The 'manual zero' is the 'z' command, as described in section 3.1.)

The 'Auto Zero – Advanced' frame has two parameters:

Parameter #1 – Option box: Min/Max Limits Position

Introduction

The traditional A/Z (Auto Zero) range was fixed. That is, it was around the calibration zero. The reason it was done like that was in order to avoid unlimited creeping of the zero.
However, for some applications a 'floating' A/Z range is still required. This feature is supplied as an option in V3.128 and up: There are two new options, as described below: 'Full Floating' and 'Semi Floating'.
Keep in mind that using these options throws the responsibility of avoiding excessive creeping of the zero on the user.

In this option box you define whether the 'Min/Max Limits' (that is, the 'auto zero' range) are 'static' (**fixed**) or 'dynamic' (**floating**).

There are three options:

* Fixed (the default)
  'Min/Max Limits' are **FIXED** around **calibration** zero.
  That is, they won't 'float' due to a (auto or manual) zero operation.

* Full Floating
  'Min/Max Limits' **FLOAT** around each **new** (***auto or manual***) zero.
  That is, each new (auto or manual) zero operation, the limits 'float' around the **new** zero.

* Semi Floating
  'Min/Max Limits' **FLOAT** around each **new manual** (***but not auto***) zero.
  That is, each new **manual** zero operation, the limits 'float' around the **new** zero.

Notes

* Threshold is relative to each 'New Zero'. That is, Threshold shifts with the zero whenever the zero changes.
* The user should avoid drifting of the scale to a value >= 90% of Threshold. In such a case the board **will not recognize** a coming axle.

Parameter #2 – Typing box: Max-Zero-Shift

Here you define a limit to the **ACCUMULATIVE** shift (from calibration zero) allowed by (auto or manual) zero. For example, setting 'Max-Zero-Shift' to 100 kg means that the **accumulative** (total) shift may fluctuate only between -100 kg and +100 kg).
The 'Max-Zero-Shift' parameter is accessible also by parameter #330 as listed in section 3.2.

2.2 'Timeout'

If no object is detected for some time after starting the WIM-mode, the card exits the WIM-mode returning to the general mode. This 'some time' is defined by the Timeout parameter. In case you don't want the card to exit the WIM-mode even though no object passes, set Timeout to 0. **However, upon starting the WIM-mode, the initial current weight should be less than the Threshold parameter; otherwise an error message (Err302) will be displayed and the board will return to the general mode.**
The Timeout parameter is accessible also by parameter #1041 as listed in section 3.2.

2.3 Physical Parameters

- Threshold (the weight level that signifies a coming axle)
  When the weight crosses the Threshold parameter, the card assumes that a relevant object is on the scale. In other words, as long as the weight is less than Threshold, the card 'understands' that although some object is on the scale, it should not be taken into consideration; typically, it might be a human being passing on the scale.
  The Threshold parameter is accessible also by parameter #1042 as listed in section 3.2.

  Notes

  1. **Upon starting the WIM-mode, the initial current weight should be less than Threshold; otherwise an error message (Err302) will be displayed and the board will return to the general mode.**
  2. **Avoid drifting of the scale to a value >= 90% of Threshold. In such a case the board will not recognize a coming axle.**

- Scale Width
  Besides the weight, the card reports also the *speed* of each axle. In order to calculate it, the card has to know scale's width. As there is no automated way to learn it, the user has to specify it manually. It's user's responsibility to specify it correctly in order to get true speed reports.
  The Scale Width parameter is accessible also by parameter #1044 as listed in section 3.2.

- Max. Speed (expected maximal speed of a vehicle)
  The card includes a mechanism that identifies noises in order to ignore them. In order to help this mechanism be more effective, specify vehicle's maximal speed expected. The card will then know that if some 'object' seems to 'pass' the scale but its speed is higher than Max. Speed, this 'object' is only noise and should be ignored.
  The Max. Speed parameter is accessible also by parameter #1045 as listed in section 3.2.

- Speed Correction Factor (V3.114 and up)
  'Speed Correction Factor' = 1.00 gives the theoretical speed (according to the actual time & the 'Scale Width' parameter.). If real speed is different, the user may change the 'Speed Correction Factor' accordingly.
  Default: 1.00.
  Range: 0.50-2.00.
  Accessibility:
  * By LCIC-WIM-SETTINGS application V2.24 and up:
    In the 'Parameters' / 'Physical' frame (on the up-right side).
  * By a terminal or a user application: Refer to address 316.
    If you change the parameter inside the WiM mode, exit the mode and re-enter it again (by the 'x' and 'w' commands) in order to validate the new value.

- Weight Correction Factors (V3.119 and up)
  See section 6.

2.4 Arithmetical Parameters

*(Relevant for card version 3.04 or **lower**)*

- Coeff
  The card needs some criterion in order to detect that an object is passing the scale. The Coeff parameter supplies such criterion: Say that Coeff=1.15, then when the weight is rising (at least) 15%, the card assumes that an object is passing the scale.

- Speed Filter
  This is the size of the buffer used as a reference to the comparison that detects – according to the Coeff parameter – the arrival of the next object. The less your system is stable, the larger this buffer should be. Use initial value of 600. The available range is 10-700.

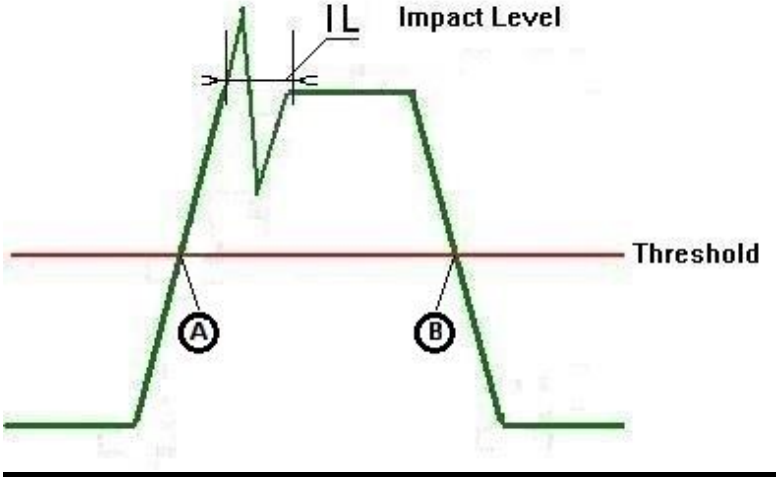
- Zero Filter
  This is the size of the readings buffer when no object is on the scale. The average of this filter will be considered as the 'empty' level in order to calculate axle's weight. The less your system is stable, the larger this buffer should be. Use initial value of 1000. The available range is 10-1500.

2.5 Internal Parameters

(Relevant for card version 3.05 or higher)

- Time Limit
  Should be **increased** for **low speed** vehicles, or if dummy axles are reported.
  Should be **decreased** for **high speed** vehicles.
  Range: 0.01-999.99 (ms).
  Default: 5 ms.
  Do not set Time Limit to more than 20% of total time that the axle is on the scale.
  The Time Limit parameter is accessible also by parameter #1201 as listed in section 3.2.

- Impact Level (specifies the time of axle's impact with the load cell)
  → Please refer to the following drawing:



  Impact Level should be proportional to the time of axle's impact with the load cell:
  Impact Level = the impact time in **percents** of the total time (100%) that object's weight is above Threshold (between points A & B in the drawing).
  Recall that Threshold is defined in the Physical Parameters frame, as described in section 2.3. You may use the Monitor utility in order to find out the behavior of your own system.
  Default: 25.
  Range: 1-40.
  The Impact Level parameter is accessible also by parameter #1209 as listed in section 3.2.

- Sensitivity
  Increase if the weight reported is too high.
  Decrease if the weight reported is too low.
  Default: 25.
  Range: 1-40.
  The Sensitivity parameter is accessible also by parameter #1208 as listed in section 3.2.

- Integration Correction (V3.06 and up) (optional manual increment to the automatically calculated integration)
  According to the parameters, the system calculates automatically the desired integration. However, sometimes the automatically calculated integration is too low and should be manually increased. Use Integration Correction=0 in order to leave the integration 'as is', or another value x in order to increase the integration by x. For example, if the automatically calculated integration is 20 and the user specifies Integration Correction=5, then the Actual Integration (as specified in the tip when the cursor is above the '5') will be 25.
  Default: 1.
  Range: 0-1000.
  The Integration Correction parameter is accessible also by parameter #1210 as listed in section 3.2.

- Estimated Speed
  A rough estimate of vehicle's expected speed.
  This parameter helps the software to optimize; however, it should only supply some *rough* estimate around the expected speed, **not** the accurate value.
  Range: 0.1-Max. Speed.
  ('Max. Speed' is the last parameter in the 'Physical' frame.)
  The Estimated Speed parameter is accessible also by parameter #1211 as listed in section 3.2.

- Input#3 Mode
  (Board version V3.115 and up, LCIC-WIM-SETTINGS application V2.25 and up).
  Enables/disables the option to send the '**Reset Axle Counter**' request (which also clears card's Axles Store) by input #3.
  Read more on the '**Reset Axle Counter**' request in section 3 under 'The Axles Store' title.
  0 - Option off (default in V3.116 and up)
  1 - Option on, without response in communication (default in V3.115)
  2 - Option on, including response 'o'+C/R

  The 'Input#3 Mode' selection may be set also by user's application – refer to address #317 in the table of section 3.2.

  'Auto Total' feature note
  With board version 3.120 and above, when the 'Auto Total' feature is enabled (checked), Input#3 has another function (it zeroes the current weight) and the 'Input#3 Mode' option is irrelevant, hence not displayed. For more details, refer to 'The 'Auto Total' Feature.pdf', section 3.2.

3. Communication with a PC

The LCIC-WIM may communicate with a PC (or another computer) through the serial port or via the USB. You may talk with the card either by your own application or by a general RS232 terminal. One simple one called Termite is available for free at
http://www.compuphase.com/software_termite.htm
Section 4.1 of LCIC-WIM.PDF describes the commands available in the general mode. An additional command – a small 'w' – starts the WIM-mode, provided that the current weight is less than the Threshold parameter (refer also to section 4.6). Board's response on the 'w' command (in version 3.09 and up): 'w'<c/r>. *Within* the WIM-mode another set of commands is available, as described below.

The Axles Store

The system includes an '**Axles Store**' containing up to last 100 axles results. This store is useful especially when the 'Get results immediately' option is deselected, which means that you prefer the PC to poll the card from time to time drawing the results, so that the PC can handle other tasks too. The store works on FIFO (First In First Out) base. For example, after 100 axles there will be in the store 100 elements - #1-#100. Upon the next axle there will still be 100 elements - #2-#101 and element #1 is dropped. The serial number always increments each new axle. It is reset only in case you apply the 'Reset Axle Counter' request. As described below, there are three commands to draw results from the store: '**r**', '***#nnnn***' and 'L'. The store is not cleared automatically upon drawing the results by the PC. Instead, once you received them successfully, you may clear card's store by sending the 'Reset Axle Counter' request: either by the '**o**' command (section 3.1), or by digital input #3 (section 2.5). This mechanism ensures that you don't loose data in case of an unsuccessful drawing.
Note: The quantity of 100 (results) may vary in the various versions.

To start the WIM-mode, type a small 'w' in the general mode when the current weight is less than the Threshold parameter. Board's response on the 'w' command (in version 3.09 and up): 'w'<c/r>. Refer also to section 4.6.

All the one-letter commands are not followed by a <c/r>.

3.1 The commands available within the WIM-mode

r - Report (V3.02 and up).
Transmit Axles Store's contents (each on one line).
(Store's description is in section 3.)
Use the 'h' (Header) command in order to recognize the various fields (see below).
Note that the format of the 'speed' field is as specified in the description of the '**#***nnnn*<c/r>' command (below) about zzzzzzz.
Sometimes the receiving computer (PC, for example) can't support the rate of the transmission. So, V3.108 and up includes an option to add a delay after each axle data: a new parameter (address 310) sets a delay (in ms) after each axle data. Its range is between 0 (the default) to 10000 ms. The parameter takes effect **once** in the beginning of the WiM-mode. That is, if the parameter is changed inside the WiM-mode, it will take effect only after 'x' & 'w'.

o (small o) (In V3.02 → V3.08: 'c') – Reset Axle Counter.
The 'Reset Axle Counter' operation resets the **axles counter**, so the next axle serial no. will be 1. It also clears the Axles Store' (refer to section 3).
Board's response:
* In version 3.09 and up: 'o'<c/r>.
* Previously: 'OK'.

Notes
1. The 'o' command cancels the effect of the '(' and ')' commands and returns the status of 'Get results immediately' to its selection by the Settings utility (refer to LCIC-WIM.PDF, section 3.3.2.1.4).
2. Section 2.5 ('Input#3 Mode' parameter) describes an alternative for the 'o' command by a digital input.

#*nnnn*<c/r> (V3.02 and up)

- Transmit Axles Store's element no. *nnnn*, where *nnnn* is axle's serial no.:
  In V3.114 and down: *nnnn* is up to 9999.
  In V3.115 and up: *nnnn* is up to 4000000000.

  The format of the report is:

  In case element #*nnnn* is available in the store:
  #xxxxyyyyyyyyyyyyyyzzzzzzzwwwwwww<c/r>
  where x, y, z & w are left-padded by **underlines**, and their order is as specified in the response on the 'h' command (see below).
  xxxx is up to 4 rightmost digits of the axle serial no.
  Until V3.113 the format of zzzzzzz (the speed) was 2 digits after the decimal point. From V3.114 and up, the format is an integer. This format (2 digits after the decimal point, or an integer) is also the format of board's response on the 'r' and 'L' commands, and due to the 'Get results immediately' option.

  In case element #*nnnn* is not available in the store:
  #xxxx_____-1_____<c/r>
  where xxxx is *nnnn* left-padded by underlines.
  (There are 11 underlines between 'xxxx' and '-1' and 14 to the right of the '-1'.)

Note about the first character of the response
In board version 3.117 and up the response to this command is different in case the current weight is beyond range (underflow or overflow):
The first character in the response (that previously was always '#') is:
'#' if the current weight is in range;
'[' if the current weight is in underflow;
']' if the current weight is in overflow.

h - Header (V3.02 and up).
Transmit the header for the 'r' and '#*nnnn*' commands.
For example:
#Axle Weight (g) Speed(km/h) Space(mm)
(#**Axle** is axle's serial no.; the unit of **Weight** depends on user's selection upon calibration; other units are fixed.)

l (small L) (V3.108 and up)
Transmit the last axle's **serial no.** in the following format:
"L=*n*"+C/R
(*n* is up to 4 rightmost digits of last axle's serial no.)

| (shift + '\') (V3.115 and up)
Transmit the last axle's **full serial no.** in the following format:
"*n*"+C/R
(*n* may reach 4000000000)

L (V3.108 and up)
Transmit the last axle **data** in the following format:
"#__*n* __*Wgt*__*Speed*__*Space*"+C/R
(*n* is last axle's serial no.)
(This is the same format of the command "**#***nnnn*<c/r>".)

Please refer to the "Note about the first character of the response" in the description of the **"#***nnnn*<c/r>" command (above), as it is relevant also for the 'L' command.

p (small p) - Parameters. Transmit the WIM-mode parameters (V3.02 and up).

((In V3.08 or less: 'I') - Turn the 'Get results immediately' option on.
Board's response:
In version 3.09 and up: '('<c/r>.
Previously: 'OK:)'.
Note: The 'o' command cancels the effect of the '(' command and returns the status of 'Get results immediately' to its selection by the Settings utility (refer to LCIC-WIM.PDF, section 3.3.2.1.4).

) (In V3.08 or less: 'i') - Turn the 'Get results immediately' option off.
Board's response:
In version 3.09 and up: ')'<c/r>.
Previously: 'OK:('.
Note: The 'o' command cancels the effect of the ')' command and returns the status of 'Get results immediately' to its selection by the Settings utility (refer to LCIC-WIM.PDF, section 3.3.2.1.4).

x (small x) - Exit the WIM-mode returning to the general mode.
Board's response (in version 3.09 and up): 'x'<c/r>.
In earlier versions the response was:
* If the 'Get results immediately' option was selected:
'Exit from WIM-mode'.
* If the 'Get results immediately' option was **not** selected:
None (no response).

t, T - See section 6.5.

z (lower case z) (V3.128 and up) – Manually zero the current weight.
This 'manual zero' operation is honored only if it would not break the 'Max-Zero-Shift' limitation, as described in section 2.1.4.
Response: 'honoredz'<c/r> if honored, 'rejectedz'<c/r> if rejected.

Notes

* The 'z' command in the WiM-mode is similar but **different** from the 'z' command in the general mode.
* The effect of this function is temporary — it expires upon card reset.
* When a 'manual zero' is applied, it averages the readings during 500 ms in order to produce the new zero. However, the '500 ms' is the default value – you may change it to any integer value between 1 and 10000 ms by writing to parameter #303.
  (Parameter #303 is accessible by the 'R' and 'W' commands – refer to LCIC-WIM.PDF, section 4.1, square 'a' in the table.)
  Restart the board after changing parameter #303.
* The 'manual zero' may be requested even if the 'auto-zero' option is not active.
* Refer also to the two following commands ('Z' and 's').

Z (upper case Z) (V3.128 and up) –
Cancel auto- or manual- (lower case 'z') zero operation.
That is, return to the original calibration zero.
Response: 'Z'<c/r>.

s (lower case s) (V3.128 and up) – Get the 'Zero Shift' value.
The 'Zero Shift' is the shift of the **current** zero point from the **original** (calibration) zero point:
'Zero Shift' = 'Current Zero' – 'Calibration Zero'
If no (auto or manual) zero operation occurred, 'Zero Shift' = 0.
The 'Zero Shift' is returned (in scientific notation) in **weighing units**, (e.g., kg) not in a/d. That way the user can easily understand how 'Zero Shift' changes.

'Auto Total' feature note
With board version 3.120 and above, when the 'Auto Total' feature is enabled (checked), there are additional commands. For more details, refer to 'The 'Auto Total' Feature.pdf', section 3.4.

Some general mode commands are available also in the WIM-mode. They are listed below; for your convenience, their description is duplicated here from section 4.1 of the general documentation (LCIC-WIM.PDF).

Please note that using the I/O commands increase the load on the board, therefore – as far as possible – should be avoided during weighing an axle.

a. Get a single reading of weight or A/D:	
?	Get weight (after Filter2, rounded to resolution).
>	Get A/D reading after Filter1.
<	Get A/D reading after Filter2.
b. Digital Outputs: Write outputs (V3.09 and up):	
a	Turn on Output1 if Manual
A	Turn off Output1 if Manual
b	Turn on Output2 if Manual
B	Turn off Output2 if Manual
c	Turn on Output3 if Manual
C	Turn off Output3 if Manual
d	Turn on Output4 if Manual
D	Turn off Output4 if Manual
c. Digital Outputs: Read outputs (V3.09 and up):	
O **(upper case o)**	Card returns a string of the form '**xxxx**<cr>', where **x** is either "1" or "0" representing the status of the 4 output opto relays OUT4,OUT3,OUT2,OUT1 respectively.
d. Digital Inputs: Read inputs & toggling counter (V3.09 and up):	
I **(upper case i)**	Card returns a string of the form '**xxxx**<cr>', where **x** is either "1" or "0" representing the digital input status of IN4,IN3,IN2,IN1 respectively.
i	Gets a 16 bit 'toggling counter'. The 'toggling counter' increments each time input #2 goes from **high** to **low**.
e. Misc.:	
* **(star)**	Resumes RS232/RS485 communication: As specified in LCIC-WIM.pdf / section D.4, after PC power on or off the serial communication (RS232/RS485) is likely to drop. One solution is card reset. Alternatively, you may utilize the fact that the collapse is only in RS232/RS485 while the USB remains unharmed: Temporarily communicate the card through a USB port and send the '*' command, either in the general mode or in the WiM-mode. The advantage of this option is that you remain inside the WiM-mode: You do not lose board's log and the continuity is kept. Response: '*' + C/R.

3.2 Parameters Addressing

The parameters on the next page are accessible by the ‘R’ and ‘W’ commands.

1. Make sure you are in general mode.
   That is, if board is WiM-mode, send the 'x' command.
   Tip: Board's response to the 'V' command indicates its mode: In WiM-mode, the response is "Wim-mode". In general mode, the response gives board's version, e.g., LCIC-WIM/V3.119.
2. Set the relevant parameter(s) to the required value.
3. Send the 'w' command in order to re-enter the WiM-mode.
4. **About the 'R' and 'W' commands, refer to LCIC-WIM.PDF, section 4.1, square ‘a’ in the table. The Address column in the table below is the 'nn' of 'parameter nn' mentioned there.**

Parameter Described in Section ...	Parameter Name	Min.	Max.	Default	Address	Notes
2.1.1	WiM-mode starts upon card reset	0	1	0	**1074**	0 = no 1 = yes
2.1.3	Hardware Indication when the Board is in WIM-mode	0	4	0	**116**	V3.09 and up. # of the desired output, 0 to disable.
2.1.4	Max-Zero-Shift		'Maximum Applied Capacity'	('Maximum Applied Capacity') / 2	**330**	V3.128 and up. Units: Weight unit (e.g., kg)
2.2	Timeout	0	100000	0	**1041**	Units: Sec.
2.3	Threshold	0	60% of Maximum Applied Capacity	10*Max. Auto Zero	**1042**	Units: Weight unit (e.g., kg)
2.3	Scale Width	0.01	1000	0.85	**1044**	Units: m
2.3	Max. Speed	0.1	999.9	45	**1045**	Units: km/h
2.5	Time Limit	0.01	999.99	5	**1201**	Units: ms. If you change this parameter, duplicate its value also to the following addresses: 1202, 1204, 1205, 1206, 1207
2.5	Impact Level	1	40	25	**1209**	
2.5	Sensitivity	1	40	25	**1208**	
2.5	Integration Correction	0	1000	1	**1210**	
2.5	Estimated Speed	0.1	Max. Speed	30	**1211**	Units: km/h
2.5, 3	Input#3 Mode	0	2	0	**317**	In board V3.115 the default is 1.
3.1	Delay between axles transmission by the 'r' command	0	10000	0	**310**	Units: ms
3.1	Averaging time upon 'manual zero' operation (the 'z' command)	1	10000	500	**303**	Units: ms
4.4	General Setpoints	0		0	**121**	0 = disabled >0 = enabled (See section 4.4 for details)
4.5	Darken LED display	0	1	1	**297**	0 = LED off 1 = LED on

4. Notes

4.1 Errors

The following error messages appear on the LED display in case of malfunction:

Err301 - Board's hardware is improper for WIM-mode.
Err302 - There was a request to start the WIM-mode, but the current weight is more than the Threshold parameter, therefore the request is rejected and the board returns to the general mode.

4.2 Compatibility

In principle, our rule is to make the new versions back-compatible. However, there were cases where we had to break this rule. For example, in V3.09 we enabled the I/O commands within the WiM-mode (previously they were accessible only in the general mode). These I/O commands use the a, b, c, d, A, B, C, D, i and I letters, so, we had to rename the veteran commands c, i and I.

If you upgraded your board firmware, inspect the 'Type / C' column in section 7 (What's New?) in order to know whether there are any incompatibility points that you might meet.

4.3 New Truck

To start a new truck send '**x**' and '**w**', or just '**o**' (small letters).

4.4 General Setpoints

In V3.111 and up

The General Setpoints feature is **disabled** within the WiM-mode. That is, the WiM-mode ignores user's definition of the outputs (Manual or Setpoint) and makes all outputs Manual.

In V3.122 and up

The General Setpoints feature is available **as an option** within the WiM-mode.

1. How to enable the option (=activate the general setpoints also within the WiM-mode)

* If your Settings version is V2.35 and up:

* In Settings, click **Tools → General Setpoints**.
* Check the **'Enable General Setpoints in WiM-mode'** parameter.
* Click **'Save to Board'**.

Note that Settings adjusts the refresh rate to 10 ms. That is, the digital output(s) are refreshed each 10 ms (both in WiM-mode and in the general mode). In case you like to change it, use parameter #121 as described below when Settings version is V2.34 and down.

* If your Settings version is V2.34 and down:

In parameter #121:

Write **0** to **disable** the General Setpoints option during the WiM-mode.

Write **x** (x>0) to **enable** the General Setpoints option during the WiM-mode. **x** adjusts the **refresh rate** (in ms) of the digital output(s) defined as setpoint(s). For example, if x=10, the refresh rate will be each 10 ms. Note that x adjusts the refresh rate both in WiM-mode and in the general mode.

* Change the above parameters by the 'R' and 'W' commands as described in 'LCIC-WIM.pdf' section 4.1, part 'a' in the table.
* After changing parameter(s), restart the board!

2. Avoid conflict with the option of "*Hardware Indication when the Board is in WIM-mode*"

Refer to section 2.1.3. The same output (1, 2, 3 or 4) cannot be at the same time both a setpoint and a "Hardware Indication when the Board is in WIM-mode". Therefore:

* If you need all 4 outputs as setpoints, you **can't** use the "Hardware Indication when the Board is in WIM-mode" option. In this case you have to disable the "Hardware Indication when the Board is in WIM-mode" option as described in section 2.1.3.
* If you need only 3 or less setpoints, you **may** use also the "Hardware Indication when the Board is in WIM-mode" feature. However, you should make sure to define in LCIC-WIM-SETTINGS / Tools → "General Setpoints..." the 'Mode' of the output dedicated for the "Hardware Indication when the Board is in WIM-mode" as **Manual** (and not Setpoint). For example, if you defined output #2 as the "Hardware Indication when the Board is in WIM-mode", then the 'Mode' of output **#2** should be **Manual**.

4.5 Darken the LED Display

(V3.112 and up.)
There is an option to keep the LED display dark within the WiM-mode.
For details how to activate / deactivate this option refer to parameter #297 in section 3.2.

4.6 Overflow & Underflow

(Board version 3.115 and up.)

If the load cell is in **overflow/underflow** condition, the board **rejects** a request to enter the WiM-mode.
That is, when the load cell is in overflow/underflow condition:
* Upon board reset, the board **won't enter the WiM-mode** even though the 'WiM-mode starts upon card reset' option is selected.
* If (in general mode) the user sends in communication the 'w' command, the board responds 'w' and 'x', and **stays in general mode**.

On the other hand, if the overflow/underflow condition occurs when the board is already **within** the WiM-mode, the board **does not leave** the WiM-mode. However, false axles might be reported upon the start and/or the end of an overflow/underflow condition.

After the overflow/underflow condition ended, repeat the operation, that is, restart the board, or send the 'w' command.

Refer also to appendix J (Overflow & Underflow) in LCIC-WIM.PDF.

5. Digital I/O

5.1 Digital Input

Input #1
May be used in the mechanism of 'Start/End WiM-mode'
or 'Start/End a Vehicle'.
Refer to section 2.1.2.

Input #2
May be used in the mechanism of 'Start/End WiM-mode'
or 'Start/End a Vehicle'.
Refer to section 2.1.2.

Input #3
May be used as an alternative to the 'o' command. Refer to section 2.5, 'Input#3 Mode' parameter.

Input #4
Optionally resets (restarts) the board.
Refer to LCIC-WIM.pdf, appendix I.

5.2 Digital Output

In V3.09 and up: One of board's 4 digital outputs may be set to give indication when the board is in WiM-mode. Refer to section 2.1.3.
In V3.122 and up: Part of or all board's 4 digital outputs may be set as setpoint indicators also when the board is in WiM-mode. Refer to section 4.4.

6. Weight Correction Factors (V3.119 and up)

6.1 Background

As you may know, the accuracy of WIM depends also on the **speed** of the trucks. So, usually our customers use to have some Correction Factors (CF) in their **applications** in order to improve the accuracy. For example, if the truck static weight is 20 ton and at 5 km/h you read 19.85 ton, the CF will be 1.0076 (20/19.85). Now, the same truck at 10 km/h shows 19.35 ton, so the CF will be 1.0336. Supplying the program with these Speed/CF pairs (such as 5/1.0076 in the example) will enable the program to improve the accuracy. Obviously, the more Speed/CF pairs are supplied, the accuracy will be better.

In order to save our customers to put those correction factors in their applications, we have decided to add this feature to the embedded software on the LCIC-WIM board as new parameters that allow you to enter up to 10 CF's. (Of course you can enter any other number smaller than 10, or not use this feature at all, which is equivalent to CF = 1.0000).

The new feature allows storing a table of up to 10 correction factors. For example:

Correction Factor (CF)	Speed (km/h)
1.0000	5
1.0120	8
1.0190	12
1.0210	17
1.0280	20

Now, when an axle passes over the scale, the board will look for the speed of this axle and the closest CF for this speed, and correct the reported weight accordingly. In other words, the weight takes into consideration the truck speed – no need to do it in your application any more. For example, if the speed is 7 km/h and the raw weight is 10 ton, the reported weight would be 10*1.0120 = 10.12 ton. Note that the CF used is according to the closest speed in the table (8 km/h) – no interpolation is carried out.

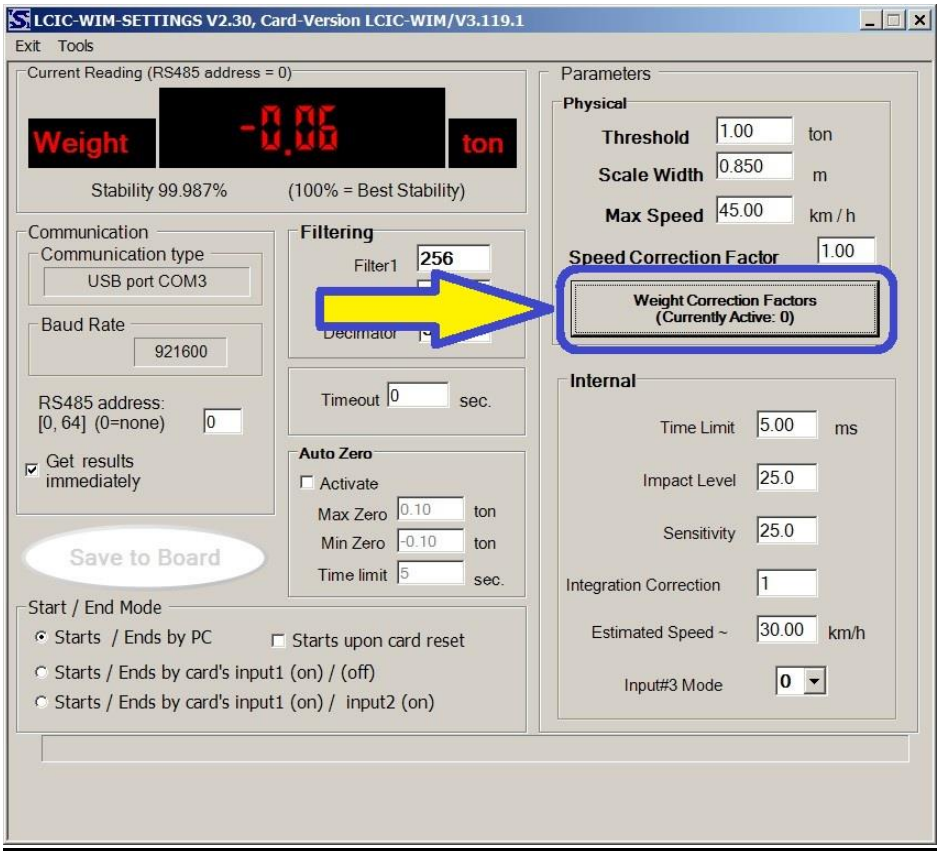
6.2 Introduction

The new "Weight Correction Factors" feature is supported by **board** version 3.119 and up, and by the **Settings** application version 2.28 and up.

The "Weight Correction Factors" option enables the user define correction factor(s) for the weight based on his experience with dynamic vs. static weighing.

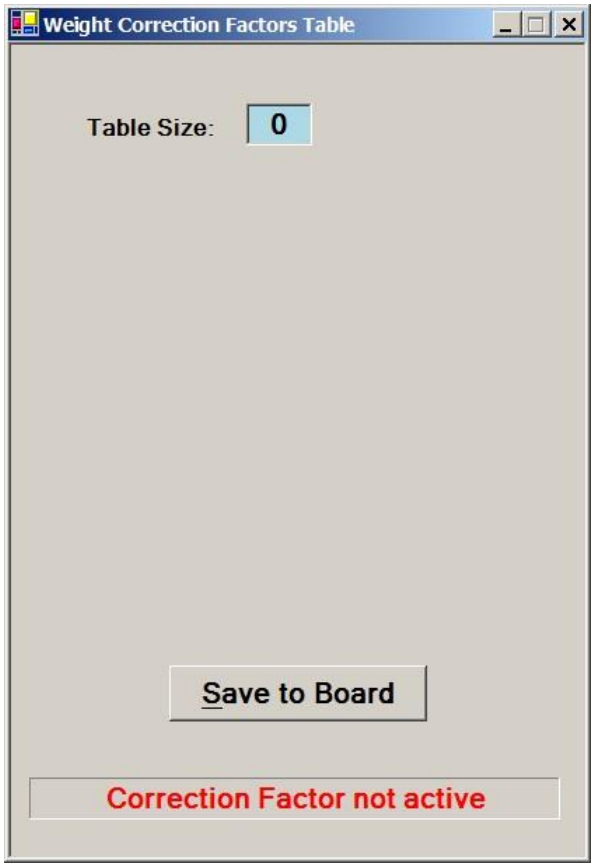
The user has 3 main options:
1. Using the dynamic weighing "**as is**" without correction factor (the default).
2. Use **one** correction factor, common for all speeds.
3. Use **some** correction factors (up to 10) for various speeds.

In order to select one of these options, use the Settings program and click the "Weight Correction Factors" button in the 'Parameters' / 'Physical' frame:



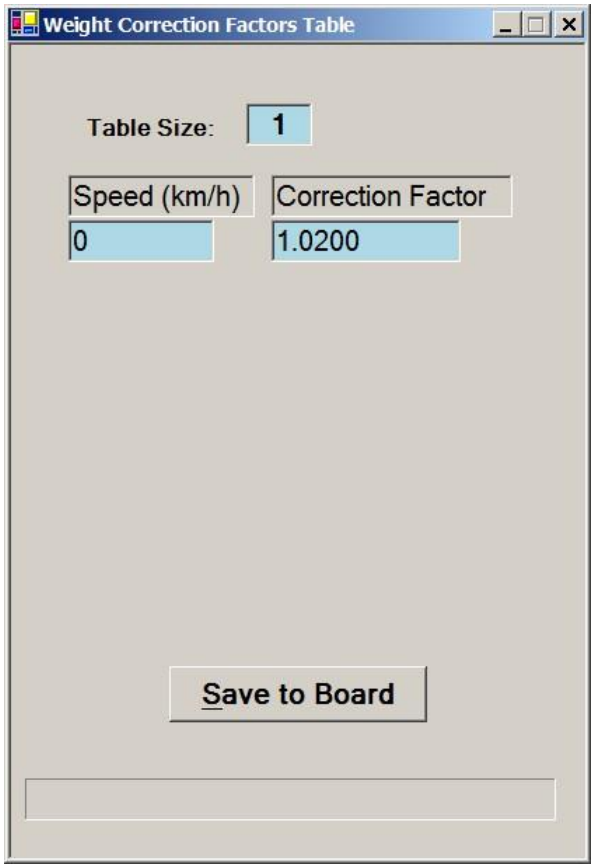
For option #1 (no correction factor, the default):

Make sure that "Table Size" is 0. If it is not 0, specify 0 in "Table Size", then click "Save to Board":



For option #2 (**one** correction factor, common for all speeds):

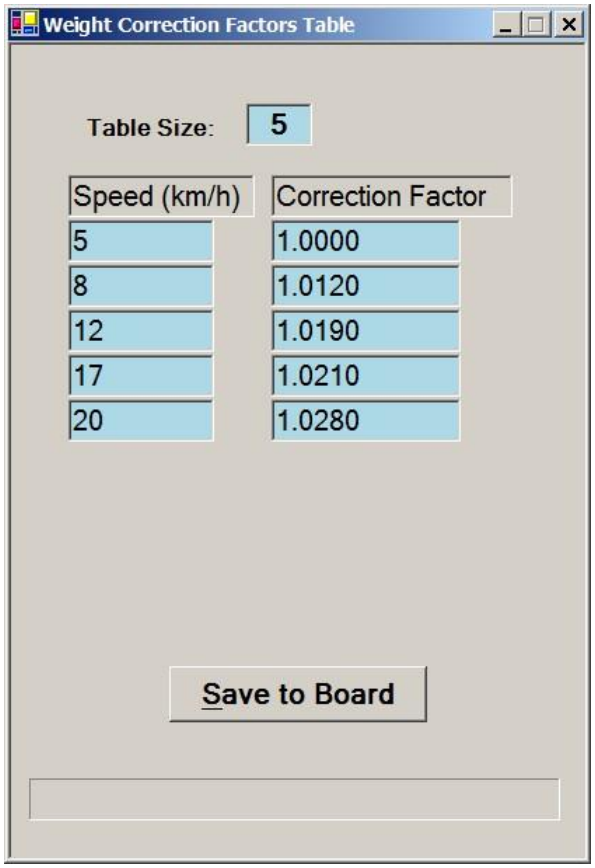
* Specify 1 in "Table Size".
* Specify 0 in the "Speed" square.
* Specify the desired weight correction factor in the "Correction Factor" square.
  In the example below the correction factor is 1.0200 which means "plus 2%". That is, if the raw dynamic weight gave 1000 kg, the result will be set to 1000*1.0200 = 1020 kg.
* Click "Save to Board".



For option #3 (**some** correction factors for various speeds):

* In the "Table Size" square specify for how many speeds (max. 10) you have a corresponding correction factor. In the example below there are 5 such speeds.
* In the "Speed" column specify the speeds. Make sure that the minimum difference between speeds is 1 km/h.
* In the "Correction Factor" column specify the corresponding correction factor for each speed.
* Click "Save to Board".

For a specific speed, the actual correction factor will be that one whose speed is **closest** to the actual speed.
There is **no interpolation!** In the example below, for speed = 6 km/h the actual correction factor would be 1.0000, as 5 km/h is the closest speed to the actual 6 km/h. It would **not** be 1.0040 as interpolation for the correction factors of 5 km/h and 8 km/h would give.



The Two Aspects of the Actual Speed

The (theoretical) calculated Actual Speed participates in two places:
a. When selecting the Actual CF, the program looks in the table for the speed which is closest to the Actual Speed, making its corresponding CF the Actual CF.
b. The Actual Speed is reported to the communication port –
* each axle (if Get Results Immediately is on);
* when responding to the '**r**', '***#nnnn***' or 'L' command.

However, there is a slight difference between the Actual Speed of 'a' and that of 'b':

The Actual Speed used in 'a' is the exact value that was calculated, for example, 6.784 km/h. But the Actual Speed in 'b' is rounded to the closest integer, so 6.784 would be represented as '7'.

The difference between 'a' and 'b' becomes meaningful in the borderline cases. For example, with the table on the previous page both 9.9 km/h and 10.1 km/h will be represented in 'b' as 10 km/h. But note that the closest speed in the table is:
* For 9.9 km/h: 8 km/h.
* For 10.1 km/h: 12 km/h.
So, the mechanism of 'a' will give Actual CF=1.0120 for 9.9 km/h and 1.0190 for 10.1 km/h.
That means that **identical reported speeds do not have necessarily the same Actual CF**. Actually this is not a problem, but in case you need to take the report for analysis and you wish to reproduce the Actual CF for each axle according to the speed, it will be ambiguous if the speed falls on a borderline case. If such analysis is really essential for you, there are two option for a solution:
1. You may program your application to send the 't' command after each axle in order to get the last Actual CF (refer to section 6.5).
2. You may evade these borderline cases: Make sure that the difference between two adjacent speeds in the table will always be an **odd** value (1, 3, 5 etc.). That way, the borderline will never fall on an integer speed and the matching between speed and its Actual CF will always be unambiguous. For example, watch the two last lines in the table on the previous page: The speeds are 17 and 20 km/h. The borderline is 18.5 km/h, so there is no ambiguity:

* If the reported speed is 18 km/h:
  The exact speed is more than 17.5 km/h and less than 18.5 km/h.
  So, the corresponding CF is 1.0210.
* If the reported speed is 19 km/h:
  The exact speed is more than 18.5 km/h and less than 19.5 km/h.
  So, the corresponding CF is 1.0280.

6.3 Adjusting the "Weight Correction Factors" table

As the correction factor depends on the mechanics of the scale, scale alignment, type of load cells etc., the technician has to do the required tests and calculate the correction factor for each particular speed. The speed in the table should be the speed that the **board** reports, which will be the **average** speed of all axles.

* Make some experiments with a truck whose static weight is known.
* Within each experiment, as far as possible, keep truck's speed steady. That is, avoid accelerating/decelerating.
* When you have the result:
  As 'speed' specify the **average** of all axles, rounded to the closest integer. For example, if there are 4 axles with speeds 8, 9, 8 and 8 km/h, specify 8 km/h.
  As 'correction factor' specify truck static weight divided by the sum of all axles' weights. For example, if the static weight is 1000 kg and the sum of all axles' weights is only 980 kg, specify 1000/980 = 1.0204.
* Note that the actual speed considers the **speed** correction factor as specified above the "Weight Correction Factors" button in the Setting application.

Example

Following is an example how to do the required tests and calculate the correction factor for **one** particular speed.
Suppose that static weighing of the truck gave 32.5 ton.

During the tests we need that the reported weights will be the raw weights (without any correction). Therefore, we set the "Weight Correction Factors" to "Table Size = 0", that is, "Correction Factor not active".

In this example we pass the truck only twice, in order to explain the principle. In reality, it is recommended to pass the truck more times in order to improve the accuracy.

First Pass

Axle	Weight	Speed
1	10.15	10
2	5.83	11
3	8.77	11
4	7.54	10

Second Pass

Axle	Weight	Speed
1	10.05	11
2	5.89	10
3	8.84	10
4	7.45	10

Conclusions:

Average Truck **Weight**:
(10.15 + 5.83 + 8.77 + 7.54 + 10.05 + 5.89 + 8.84 + 7.45) / 2 =
64.52 / 2 = 32.26 ton

Recall that the static weight was 32.5 ton.
Correction Factor = 32.5 / 32.26 = 1.0074
→ Specify **1.0074** in the "Correction Factor" square in the table.

Average Truck **Speed**:
(10 + 11 + 11 + 10 + 11 + 10 + 10 + 10) / 8 = 83 / 8 =
10.375 km/h
Round to closest integer, that is, 10 km/h.
→ Specify **10** in the "Speed" square in the table.

Note:
Weight sum was divided by the number of **passes** (2).
Speed sum was divided by the **total** number of **axles** (8).

6.4 How to Update the Correction Factors Table

To update the correction factors table:

1. In the Setting application:
Click the 'Weight Correction Factors' button in the 'Parameters' / 'Physical' frame (see screenshot in the beginning of section 6.2).

2. Define 'Table Size':
If no correction factor is needed: 0 (the default).
If correction factor is needed: How many 'Speed' / 'Weight Correction Factor' pairs are about to be defined (1-10).

3. If Table Size > 0: Define table entries:
Update all table's entries ('Speed' & 'Weight Correction Factor' in each line).

4. Click 'Save to Board'.

6.5 New Commands (through Communication)

There are two new commands:
't': Print the last actual 'Weight Correction Factor'.
'T': Print the 'Weight Correction Factor' Table.

Examples:

(The `blue` text is **to** the board, the `green` text is **from** the board)

With CF table as in the example of option 1 in section 2

```
T
Table size =  0
Correction Factor not active
```

With CF table as in the example of option 2 in section 2

```
T
Table size =  1
 #   Speed (km/h)     CF
 1       0           1.0200
```

With CF table as in the example of option 3 in section 2

```
T
Table size =  5
 #   Speed (km/h)     CF
 1       5           1.0000
 2       8           1.0120
 3      12           1.0190
 4      17           1.0210
 5      20           1.0280
```

Example using this table when an axle passed the scale:

```
#1        10.17     11       0
t
Last CF =    1.0190
```

Explanation:
The **raw** weight of the axle was 9.98 ton (not seen in the report). The speed was 11 km/h. The closest speed in the CF table is in line #3: 12 km/h. The corresponding CF is 1.0190, therefore the **reported** weight was 9.98*1.0190 = 10.17 ton.

7. What's New?

This section describes the development of board's firmware. This lets you know what to expect when you upgrade your version.

The **'Type'** column indicates the type of the new item:
N = New feature.
C = Change in a veteran function, might break compatibility.
(Some items are both 'N' and 'C'.)

Version	Feature	Type		See details in Section…
		N	C	
V3.02	Command (small) 'p': Transmit the WIM-mode parameters	V		3.1
	Command 'r': Transmit Axles Store's contents.	V		
	Command '#nnnn': Transmit Axles Store's element no. nnnn.	V		
	Command 'h': Transmit the header for the 'r' and '#nnnn' commands.	V		
V3.06	Integration Correction.	V		2.5

V3.09	Hardware Indication when the board is in WIM-mode.	V		2.1.3
	Command 'w' in general mode (to start the WiM-mode) is now responded by 'w' and c/r. (Previously there was no response.)		V	3
	The response on the 'x' command (to exit the WiM-mode) is now: * 'x' and c/r. (Before, it was responded by 'Exit from WIM-mode'). * Independent of the 'Get results immediately' selection. (Before, the response was supplied only if the 'Get results immediately' option was on.)		V	3.1
	Commands renamed: * The command 'Reset Axle Counter' is now: * Renamed from 'c' to 'o'. * Responded by 'o' and c/r (before: 'OK'). * The commands 'Turn the Get results immediately option on/off' renamed: * from 'I' to '(' (for on) * from 'i' to ')' (for off) The commands are responded now by: * '(' instead of 'OK:)' before (for on) * ')' instead of 'OK:(' before (for off).		V	
	Digital Outputs commands.	V		3.1 sections b-c in the table
	Digital Inputs commands.	V		3.1 section d in the table

V3.108	Command 'r': Option to add a delay after each axle data.	V	V	3.1
	Command 'l' (small L): Transmit the last axle's serial no.	V		
	Command 'L': Transmit the last axle's data.	V		
V3.111	The General Setpoints feature is now disabled within the WiM-mode. (In V3.122 it is available again, as an option.)		V	4.4
V3.112	Darken the LED Display.	V		4.5
V3.114	Speed Correction Factor.	V		2.3
	Commands '#nnnn', 'r' & 'L': Change in speed format.	V	V	3.1
V3.115	'WiM-mode starts upon card reset' option.	V		2.1.1
	Input#3 Mode. ('Reset Axle Counter' by input #3.)	V		2.5 & 3
	Command '#nnnn': Max. nnnn = 4000000000 (previously 9999).	V	V	3.1
	Command '|' (shift + '\'): Transmit the FULL last axle's serial no. (As opposed to the 'l' (small L) command that transmits only up to 4 rightmost digits.)	V		3.1
V3.119	Weight Correction Factors.	V		6
V3.122	The General Setpoints feature is available as an option within the WiM-mode. (In V3.111 it was disabled.)	V	V	4.4
V3.128	Control the 'Min/Max Limits Position' of Auto Zero.	V	V	2.1.4
	Limit the shift (from calibration zero) allowed by (auto or manual) zero.	V	V	
	Manual zero by command 'z'.	V		End of 3.1 (before the table)
	Command 's': Get the value of 'Zero Shift'.	V		