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1. General Description

1.1 Introduction



High speed in-motion weighing controller

For weighing packages while passing over a conveyor

Seeking for weighing packages that are running on a conveyor at high speed? Looking for high accuracy? I.M.S Ltd. Is happy to announce that we have released an embedded application for our LQC-WIM board (Stands for: Load Cell Interface Card for Weighing- In-Motion) that was especially designed to handle such applications.

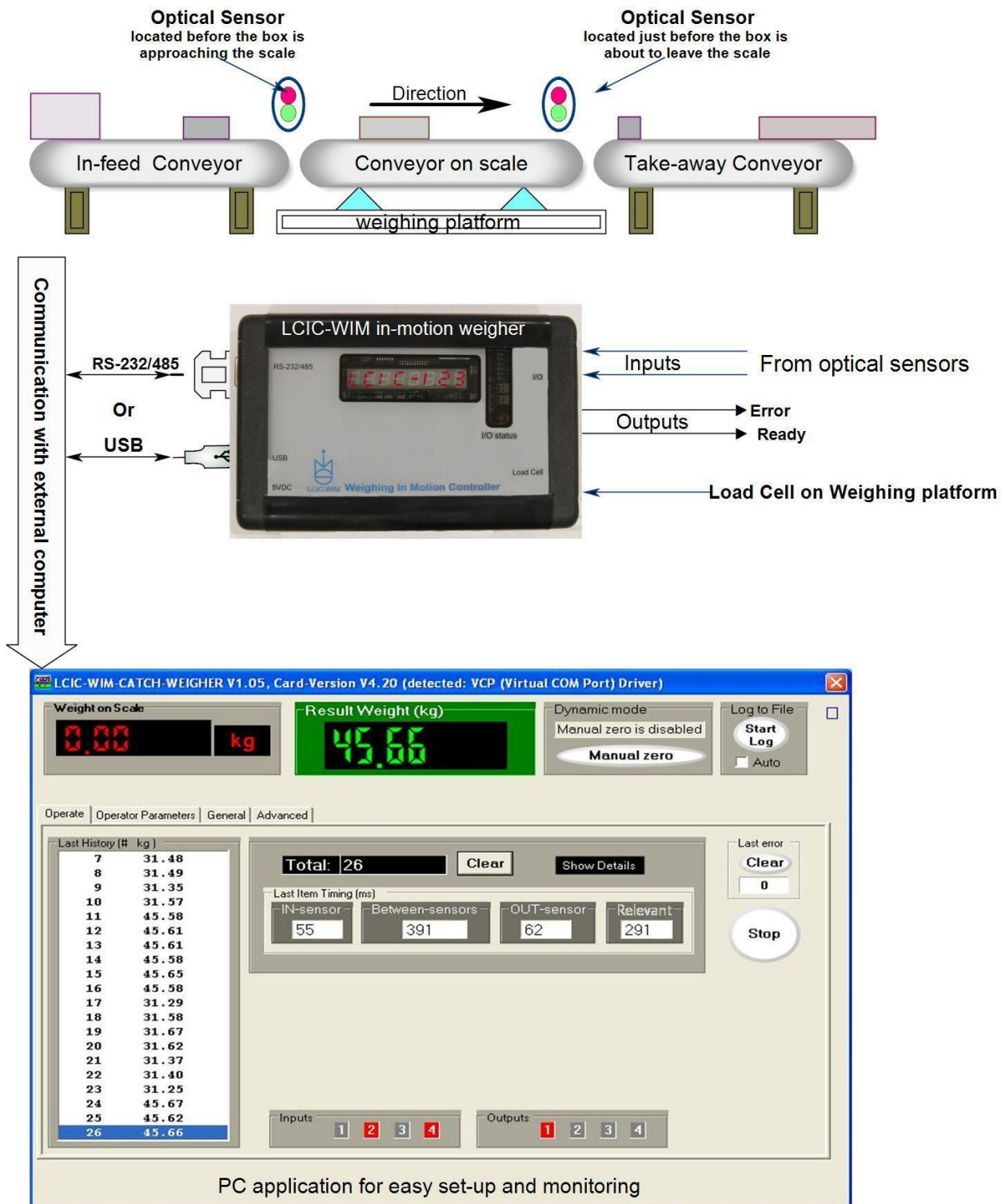
The embedded on-board sophisticated algorithm of the *LQC-WIM*, runs all necessary filters to clear the mechanical noises and finally provide the external computer with the product's net weight via the RS-232/485 or USB communication port. The controller is directly connected to the conveyor scale (utilizing standard analog load cells) and the two photo-eyes at both conveyor sides.

Taking advantage of being the most powerful and high-speed *load-cell interface board* (see: <http://ims.co.il/ims/content/view/36/66/>) *it can handle high speed conveyors @2.5-3 meter/second (500-600 f/m) with excellent accuracy. Also it will handle when 2 products are passing the scale at the same time if there is enough distance between them.*

We provide also a PC utility for easy setup and for immediate start. Needless to say that all drivers are included so, customer can make his own PC application or, just send the data to another host computer.

Being in the real-time weighing field for 25 years, with thousands of boards installed around the world and well known OEM customers, we have no doubt that this *Catch-Weigher* controller, will allow any company in this field to release the most sophisticated product with minimum time to market.

High speed in-motion weighing controller



The LCIC-WIM board – preloaded with the Catchweigher embedded software – manages a **catchweigher** process.

The system must include a **scale based on standard load cells** and two optical sensors, all connected to the LCIC-WIM board. The IN-sensor is located a **few mm before approaching the scale** and reports to the board when a box arrives. The OUT-sensor is located **at the end of the scale** and reports when the box **is about to leave the scale**. (see the drawing above).

The LCIC-WIM board may be connected to a PC (or another remote computer) via RS232, RS485 or USB in order to transmit the results

Summary

The LCIC-WIM/CATCH-WEIGHER board includes:

- * Inputs to get indication that a box arrives / leaves the scale.
- * Communication with a PC to enter the setup parameters and sending back to the PC data about the results.

In addition to transmitting the weighing results to a PC (or another remote computer), the board reports these results also on its LED DISPLAY.

The LCIC-WIM-Catch-Weigher package includes

- a. An LCIC-WIM board embedded with a CatchWeigher algorithm.
- b. General utilities for the LCIC-WIM board:
 - b1. LCIC-WIM-CALIBRATION.
 - b2. LCIC-WIM-SETTINGS.
 - b3. LCIC-WIM-MONITOR.
- c. A specific LCIC-WIM-CATCH-WEIGHER utility.

The CatchWeigher mode board is an expansion of the basic version of LCIC-WIM (except that there is no Fill mode). Therefore, the User's Manual of the basic version (LCIC-WIM.PDF) – except the Fill mode topics – is relevant also for the CatchWeigher mode board.

1.2 Requirements/Limitations

1. PC Operating System: Windows XP Pro.
2. Catchweigher is running at the same speed all the time.
3. The board should be calibrated -
see section 3.2 in LCIC-WIM.PDF.
4. All the parameters should be defined correctly:
 - 4.1 General parameters -
see section 3.3 in LCIC-WIM.PDF.
 - 4.2 CatchWeigher-Mode parameters -
see 'Operator Parameters' (section [4.2](#))
and 'General' (section [4.3](#)).

2. Zeroing

The actual zero of your scale may creep due to environmental conditions or temperature changes. For example, dust is accumulated on the scale. To tackle this creeping, there are the Auto Zero and the Manual Zero. These functions zero your scale, either automatically or manually.

2.1 Auto Zero

Within the CatchWeigher-mode, if the current weight is within the 'Auto Zero' range for a certain amount of time (user-defined, refer to section [4.3.4](#)) then the software will auto zero.

2.2 Manual Zero

The Manual Zero function **supplements** the Auto Zero operation (previous section). Use it when scale's zero moved too far away to be caught by the Auto Zero mechanism. The Manual Zero is an explicit request to zero the scale, just for this case.

The Manual Zero Function is available by two ways:

- * A digital input – refer to [input #1](#).
- * A command – refer to the commands ['z'](#) and ['Z'](#).

Notes

- * 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 for the user 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 effect of the 'manual zero' is both in the CatchWeigher mode and in the general mode.
In other words, the zero point is always the same in both modes.
- * The 'manual zero' may be requested even if the 'auto-zero' option is not active.
- * Allowed range for manual zero:
Unlike the Auto Zero, the Manual Zero range is **not limited** – this operation is absolutely **on user's responsibility**.
- * The effect of this function is temporary — it expires upon card reset.
- * To cancel the manual zero operation use the ['Z'](#) command.

3. Digital I/O

(Refer also to [appendix A](#) – I/O Wiring.)

The board handles the following inputs and outputs:

Inputs	
#	Description
1 (Push Button)	<p>The function of input #1 depends on the Static/Dynamic mode (as set by input #3) as follows.</p> <p><u>In dynamic mode (input #3 = off)</u> Clear Error Exit the Error Status. (Equivalent to the command ‘e’, see section D.1.)</p> <p><u>In static mode (input #3 = on)</u> Manual Zero</p> <p>Note: In both modes a <u>two second pulse</u> is required.</p>
2	<p>"IN-sensor" indication produced by an optical sensor (or any similar device) mounted in front of the conveyor <u>just before</u> a box arrives the scale. (See note.)</p>
3 (Toggle Button)	<p>On = Set Static Mode. Off = Set Dynamic Mode.</p>
4	<p>"OUT-sensor" indication produced by an optical sensor (or any similar device) mounted in front of the conveyor where a box starts leaving the scale. (See note.)</p>

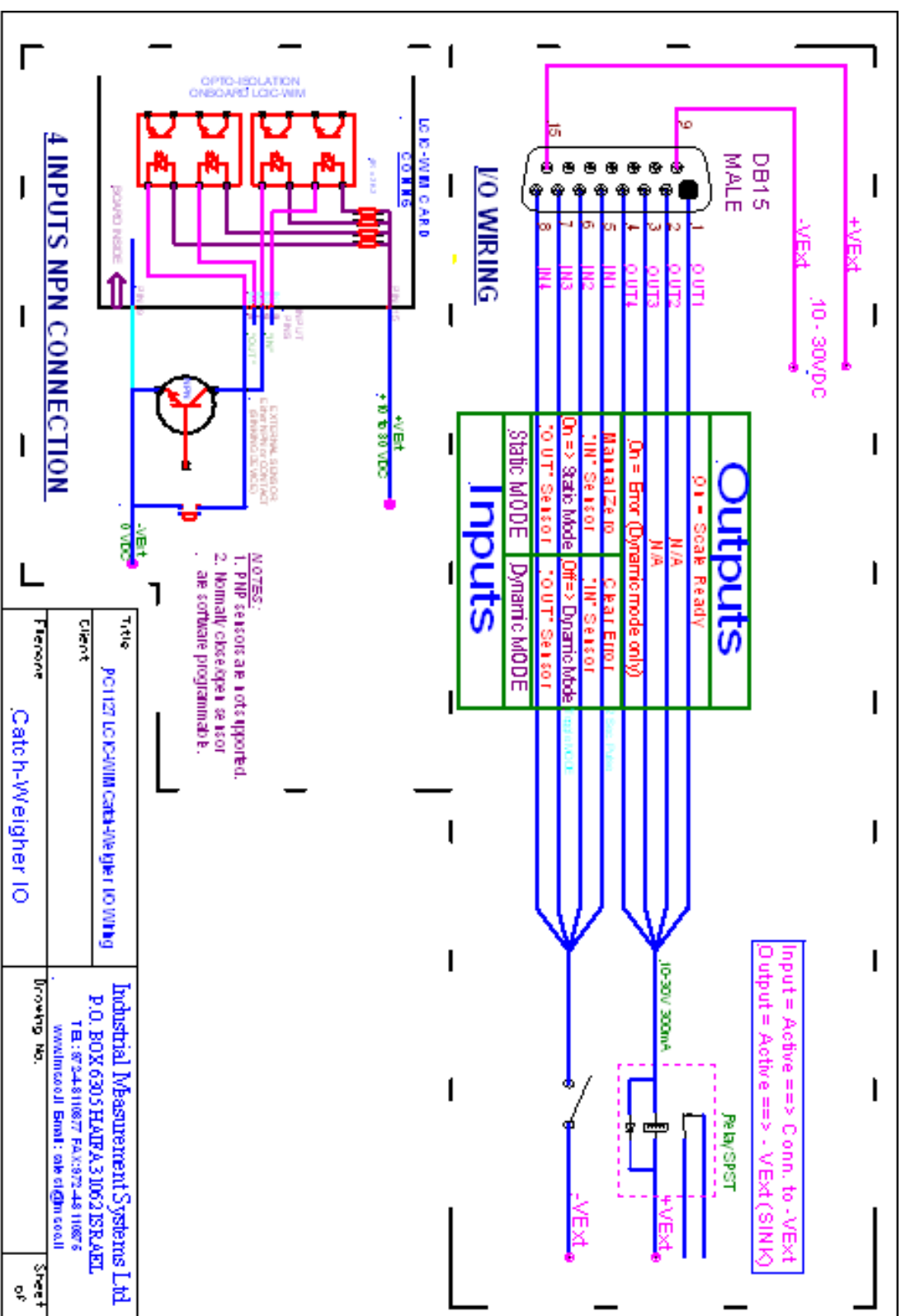
Note

Inputs 2 & 4:

Sensor Polarity is user programmable.

Refer to section [4.3.2](#) (Sensor Polarity).

Outputs	
#	Description
1	<p>Scale Status: Off = Not Ready. On = Ready. Scale Status is Ready when the scale is empty (inside the auto zero range) and both sensors are free (not covered). 'Ready' means that the system is ready to weigh the next box.</p>
2	N/A
3	N/A
4	<p>"Error": Off = No error. On = Some error occurred, a human intervention may be required. However, if the reason for the error vanishes, the "Error" indication goes low (that is, becomes '0') automatically. → Please refer to input #1 and to the command 'e'.</p>



4. The CATCH-WEIGHER Application

The top part of the screen includes two parts:

1. A common display of the **Weight on Scale**.
2. An additional display (the large frame) which depends on the tab selected, as described below.

The large frame includes four tabs:

1. "[Operate](#)"
2. "[Operator Parameters](#)"
3. "[General](#)"
4. "[Advanced](#)"

4.1 Operate

Most of the elements of this display are obvious, therefore only the elements that require explanation are described below.

4.1.1 Dynamic mode / PAUSE

During the process, or when the scale is empty, this frame is titled '**Dynamic mode**'. When the scale is not empty (out of the 'Auto Zero' range), and there was no change in the IN-sensor, the frame is titled '**PAUSE**'. This is useful in order to weigh a package statically.

In both cases the '**Manual Zero**' button is shown, followed by a message telling whether the 'Manual Zero' operation is currently available (input #3 is ON) or not (input #3 is OFF).

4.1.2 Logging

The logging option lets save the results in a file.

The interface of the logging option includes four buttons and two displays of counters.

The four buttons are:

- * Start **or** Stop
- * Pause **or** Cont.
- * Clear
- * Save

The two displays of counters are:

- * Saved Boxes.
- * Unsaved Boxes.

Click the '**Start**' button to start one logging cycle.

The program determines automatically a name for a new file where the logged data will be saved when the user will click '**Save**'.

The file name is based on the actual date & time, for example:

Log_CaW_15_Nov_2010_16_37_01.txt. Whenever you click '**Save**', the new (unsaved) data is **appended** to this file, until you close the current logging cycle (by '**Stop**').

Notes:

- * Of course, you may later rename file's name to your favored name. If you rename (or even delete) the file **before** the current logging cycle ended (that is, before clicking '**Stop**'), the next '**Save**' command will first restore the file and only then append the new data.
- * File's folder is the LOG sub-folder under the folder where the application was installed, for example:
C:\Program Files\IMS\LCIC-WIM-CATCH-WEIGHER-V1.08\LOG

Click '**Save**' to append the new (unsaved) data to the file. You may watch the two counters displays in order to verify that the operation was really done. You have the option to erase the new (unsaved) data using the '**Clear**' button (without harming the saved data):

Click '**Clear**'; the '**Clear**' button becomes red and the following message is displayed on the bottom of the screen:

"Re-click 'Clear' to confirm clearing the ... unsaved box(es)"

(If during 5 second you do not click '**Clear**' again, the clearing operation is aborted and the '**Clear**' button returns to its normal mode.)

You have the option to pause temporarily the logging operation using the '**Pause**' button. To resume the logging (to the same file) re-click the same button (which is now named '**Cont.**').

Finally, click the '**Stop**' button. This will automatically append the unsaved data (if there is such) to the current file. Therefore, in case you are **not** interested in saving the unsaved data, use the '**Clear**' button before clicking '**Stop**'.

4.1.3 'Show Details' Frame

If you have unsatisfactorily weight result although you are using a good mechanical system, you can try improve your result by changing some parameters after analyzing details of the last result according to the graph that the application produces.

The graphs produced by clicking the '[Last Box](#)' or '[Coming Data](#)' button (see below) are automatically saved in a text file in the \HISTORY sub-folder below the application folder, for example, **C:\Program Files\IMS\LCIC-WIM-CATCH-WEIGHER-V1.08\HISTORY.**

The file name is HG (standing for 'History Graph') followed by the current date & time. For example:
HG_28_Jun_2010_14_32_13.txt.

In Started mode (the Start/Stop button shows 'Stop')

Click '**Last Box**' in order to get a graph of the last box in the 'Last History' frame.

The graph starts when the box arrives at the IN-sensor.

Some events are shown on the graph by artificial negative values (far away from zero and unique for each event) in order to facilitate analyzing the graph.

For more details on the events refer to [appendix E](#).

The events are:

- * Change in IN-sensor or in OUT-sensor.
- * End of the 'ignore' interval (based on either the '[Ignore IN](#)' or the '[Ignore OUT](#)' parameter, according to the case).
- * End of the '[Extra Length](#)' interval (in case of a large box).

You may double-click the graph and adjust the shown rectangle in order to measure times on the graph so you can analyze the case, for example in order to optimize the '[Ignore IN](#)' & '[Ignore OUT](#)' parameters. Refer to section [4.2.8](#) (Operator Parameters / Examples).

In Stopped mode (the Start/Stop button shows 'Start')

Click '**Coming Data**' in order to start sampling the current weight during 2 seconds (default) and then display the readings on a graph.

You may double-click the graph and adjust the shown rectangle in order to measure times on the graph. Make this test when the scale is empty and the conveyor is active (runs) in order to find out the proper value for the '[Noise Cycle](#)' parameter. To change the 2 seconds default of the sampling interval, click 'Operator Parameters' and <Ctrl>+I. On the right-down corner of the screen you get a 'P1' frame. Specify in the box whose tip is 'GraphNoiseSize' a value (in ms) in the range 1000-5000. For example, 1500 for 1.5 sec.

4.1.4 Times of Last Box

Here the actual times of the highlighted box in the 'Last History' frame are displayed. (In case the highlighted box is **not** the last one, the title of this frame changes accordingly to 'Times of Box #...'.)

- * IN-sensor

The time that the IN-sensor was covered.

- * Between-sensors

The time that both sensors were free (the box being inside).

- * OUT-sensor

The time that the OUT-sensor was covered.

- * Relevant

The net time of the readings that produced the result.

This time is calculated according to the 'Between-sensors' time and the '[Ignore IN](#)', '[Ignore OUT](#)' & '[Extra Length](#)' parameters, whatever is applicable in the current case.

4.1.5 Summary – where the findings are reported?

The findings for each box are reported on the PC display by the following means:

1. The Result Weight frame shows the weight of the last box.
2. The last box may be detailed graphically and numerically by clicking the '[Last Box](#)' button in the 'Show Details' frame.
3. The last "n" result weights are shown in the 'Last History' frame. ("n" is the Volume parameter in "Last History Size" frame of the "Operator Parameters" tab (section [4.2.2](#)).)
4. The actual times of the highlighted box in the 'Last History' frame are displayed in the 'Times of Last Box' (or 'Times of Box #...') frame.
5. A log file (provided that the logging option is enabled).

4.2 Operator Parameters

The top part of the screen shows the **Save to Board** button.

The various parameters are visible also when Operate is running, but **they may be changed only after Operate has been stopped.**

It is recommended to start with **liberal values** to the parameters in order to avoid error conditions. Later on, you may examine the graphs (using the '[Show Details](#)' frame) learning better your system in order to restrict the parameters to their real values.

4.2.1 Timing (ms)

4.2.1.1 Max. Relevant Time on Scale

'Time on Scale' (TOS) is the **relevant** time that a package is on the scale.

Notes

- * TOS includes also the 'extra length' in case of a large package (see section [4.2.4.3](#)).
- * TOS does not include the '[Ignore IN](#)' time.
- * In case there are on the scale two packages at the same time, the TOS of the second package does not include the '[Ignore OUT](#)' time.

This parameter defines the maximum allowed actual value of TOS.

4.2.1.2 Min. Relevant Time on Scale

This parameter defines the minimum allowed actual value of TOS (TOS is defined in section [4.2.1.1](#)).

4.2.1.3 Noise Cycle

Sometimes there is a **cyclical** mechanical and/or electrical noise.

If this is the case, specify here the **cycle time** of the noise (for example, from peak to peak), in ms. The program tries to improve the results according to the value specified in this parameter. To find out the value of the 'Noise Cycle' on your system, use the [Stopped mode](#) and click the '**Coming Data**' button. To disable this option, define this parameter as 0. Refer to [example #1](#) in section 4.2.8.

4.2.1.4 Max. Time on Sensor

The maximum time that a box may be in front of an ('IN-' or 'OUT-') sensor.

4.2.1.5 Min. Time on Sensor

The minimum time that a box may be in front of an ('IN-' or 'OUT-') sensor.

4.2.1.6 Sensor Timeout

The board will report an error in the following cases:

1. An ('IN-' or 'OUT-') sensor is covered during an interval longer than 'Sensor Timeout' (error [#419](#) or [#421](#)).
2. There was an IN-sensor indication and within 'Sensor Timeout' there was no OUT-sensor indication ([error #431](#)).

4.2.1.7 Ignore IN

Time after leaving the IN-sensor during which the weight readings are ignored, as they show unstable weight due to impact and/or other causes.

Refer to [example #1](#) in section 4.2.8.

Board firmware V4.275 and up (supported by LCIC-WIM-CATCH-WEIGHER application V1.16 and up) lets you define the Ignore IN parameter also as percent of the actual IN-sensor time.

Board firmware V4.30 and up (supported by LCIC-WIM-CATCH-WEIGHER application 2.01 and up) calculates the Ignore IN value automatically (as may be inspected in the graph), provided that there is only one box on the scale at the same time.

4.2.1.8 Ignore OUT

Time after leaving the OUT-sensor during which the weight readings of the next package are ignored, as they still reflect also the first package (or a part of it) since it has not completely left the scale yet.

Refer to [example #2](#) in section 4.2.8.

Board firmware V4.275 and up (supported by LCIC-WIM-CATCH-WEIGHER application V1.16 and up) lets you define the Ignore OUT parameter also as percent of the actual OUT-sensor time.

4.2.1.9 Max. Gap Time

Sometimes a box includes a gap (or some ones) that is caught by the optical sensors. Of course, we want to consider such a box as one box. But how the board can know whether an object is one 'gapped' box or two boxes? This is the role of this parameter: A break that takes **less** than 'Max. Gap Time' is considered as a **gap** and is ignored (is not interpreted as the end of the box). A larger break is considered as a **space** between two boxes.

(Specify 0 if there are no gaps in the boxes.)

Obviously, the user should take care that the space between two boxes will always take more than 'Max. Gap Time', otherwise these two boxes will be considered as one box with a gap.

Limitations

1. The **sum** of 'Max. Gap Time' and '[Ignore IN](#)' time should be **less** than the smallest expected actual time between the sensors. Otherwise, there will be [error #453](#).

2. The availability of the result is always **delayed** by 'Max. Gap Time' as the board has to wait in order to make sure that the box really ended (that is, the 'OUT-sensor → OFF' was not a beginning of a gap).

4.2.2 Last History Size

4.2.2.1 Volume: ... Items

Determines the volume (how many items included) of the 'Last History' frame.

4.2.3 Valid Weight Limits

When a weight of an item is beyond the 'Valid Weight Limits', [Error #403](#) or [Error #405](#) will be issued.

4.2.3.1 Max.

Maximum valid weight limit.

4.2.3.2 Min.

Minimum valid weight limit.

4.2.4 Large Boxes

(Refer to [example #3](#) in section 4.2.8.)

4.2.4.1 TBS Large (ms)

Time Between Sensors indicating a large package:

If the actual time between the sensors is less than 'TBS Large', then the package is considered 'large' – provided that this actual time is still more than 'TBS Alert' (see next).

The 'TBS Large' parameter is irrelevant in case the 'Extra Length' parameter (section [4.2.4.3](#)) is 0 (the default).

Default: 300

Range: 0-10000

4.2.4.2 TBS Alert (ms)

Time Between Sensors Indicating a **too large** package:

If the actual time between the sensors is less than 'TBS Alert', then the package is considered '**too large**' – [error #437](#) is issued.

The 'TBS Alert' parameter is irrelevant in case the 'Extra Length' parameter (section [4.2.4.3](#)) is 0 (the default).

Default: 80

Range: 0-10000

4.2.4.3 Extra Length (%)

Extra Length percentage for a large package:

In case of a large package (the actual time between the sensors is between '[TBS Alert](#)' and '[TBS Large](#)'), this parameter supplies an option to consider more readings even though the package crossed the OUT-sensor, as long as the specified percent of package's length passes. For example, if package's length is 10 cm and the 'Extra Length' parameter is 30%, then more readings will be considered as long as 3 cm of the package are beyond the OUT-sensor.

Default: 0 ('Large Package' option disabled)

Range: 0-40

4.2.5 Correction Factor

The Correction Factor is the ratio between **static** weight and **dynamic** weight. For example, if item's static weight is 100 g and its dynamic weight (during motion) is 80 g, then the Correction Factor should be 1.25. The default value of the Correction Factor is 1.

Refer also to section [4.4](#).

4.2.6 Zero upon IN-Sensor

When this option is enabled, the board zeroes the scale if during *MEST* (see below) successive ms before the IN-sensor goes ON the scale was empty.

This may improve the results in case scale's zero is not stable.

The level of the new zero will be the average of the last x ms before the IN-sensor goes ON. x will be the *MEST* parameter, but never more than 500.

That is, if *MEST*=300 then x is also 300, so the average will be on the last 300ms. But if *MEST*=800, we indeed require 0.8 second empty scale, but the average will be only on the last half second (500ms).

4.2.6.1 Activate

Enables/disabled the option (default=enable).

4.2.6.2 MEST=Minimum Empty Scale Time (before 'Zero upon IN-sensor')

Refer to the above description.

Minimum: 0 ms

Maximum: 1000 ms

Default: 500 ms

4.2.7 The 'Rejecting' Option

The 'Rejecting' option enables activating an output according to the weight of the current box.

This option is supported by:

Board firmware: Version 4.30 and up.

LCIC-WIM-CATCH-WEIGHER application: Version 2.01 and up.

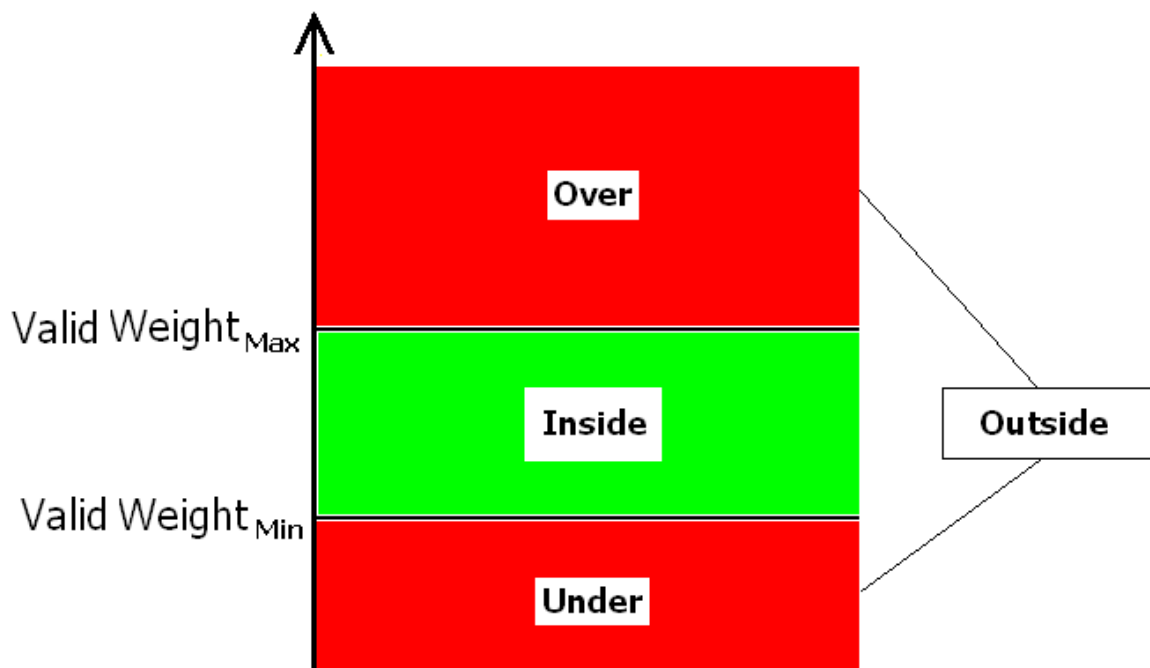
4.2.7.1 'Rejecting'

Check [here](#) in order to enable the 'Rejecting' Option.

4.2.7.2 Rejection Types (Cases leading to Output2 / Output3)

There are 2 outputs (Output2 & Output3) that may be activated conditionally according to the weight of the current box.

The weight of the current box always falls in one of 3 ranges (Under, Inside or Over), like this:



You may select one of the following four options in order to define which cases will result in activation of Output2 or Output3.

In each option:

* The **first** word describes the case resulting in activation of **Output2**

* The **second** word describes the case resulting in activation of **Output3**

Examples

1. In the first option (Inside / Outside):

* Weight is 'Inside' → activate Output2.

* Weight is 'Outside' → activate Output3.

(Note that 'Outside' = either 'Under' or 'Over', as shown in the illustration above.)

2. In the second option (Under / Over):

* Weight is 'Under' → activate Output2.

* Weight is 'Over' → activate Output3.

* Weight is 'Inside' → no output is activated.

The four options are:

1. Inside / Outside

2. Under / Over

3. Inside / Under

4. Inside / Over

4.2.7.3 Outputs Timing

Each of the two outputs (Output2 & Output3) has two timing parameters – Delay & Duration – described below.

Delay

The time that should pass **from** start leaving the scale (sensor OUT met) **to** turning on the output.

Duration

The time that the output should be 'on'.

4.2.8 Examples

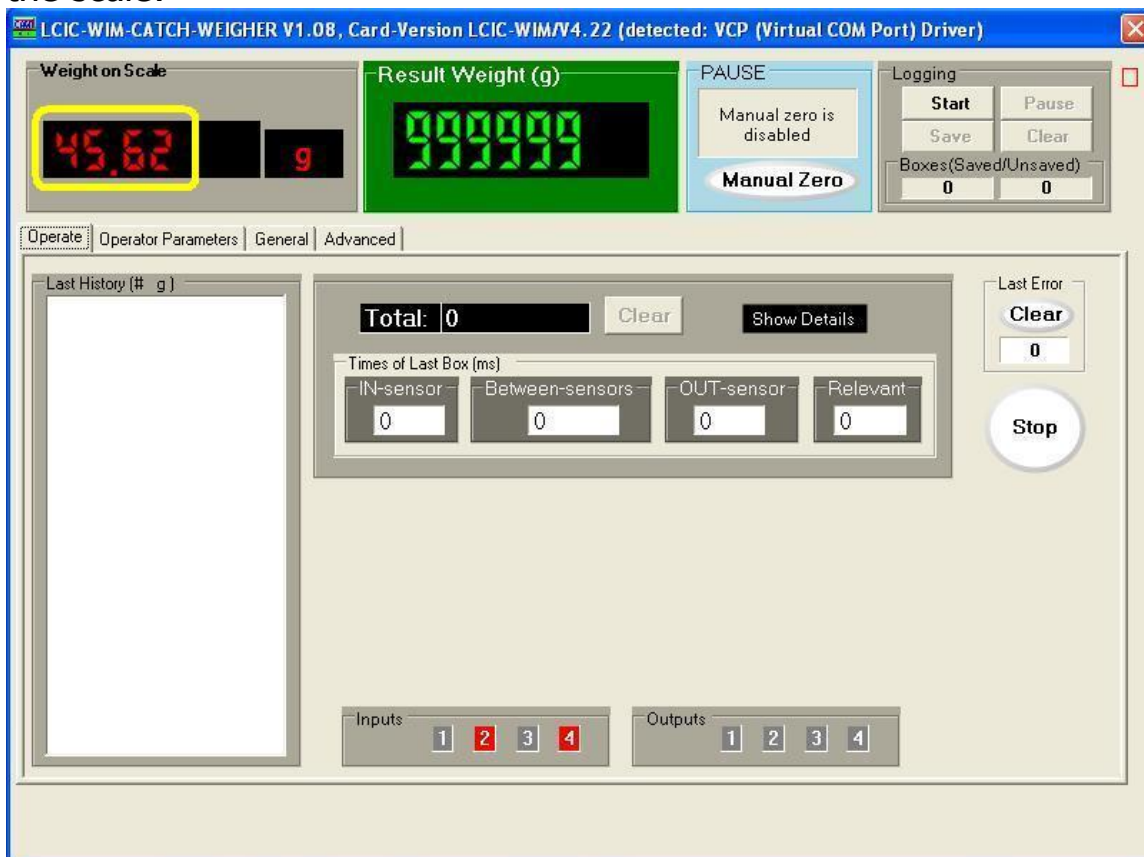
Example #1 – 'Ignore IN' & 'Noise Cycle' Parameters

This example demonstrates how to correct a wrong **Ignore IN** parameter (section [4.2.1.7](#)) and how the **Noise Cycle** parameter (section [4.2.1.3](#)) affects.

(Note that some markings were added manually in order to make the description more clear – they are **not** a part of the original displays.)

Step 1

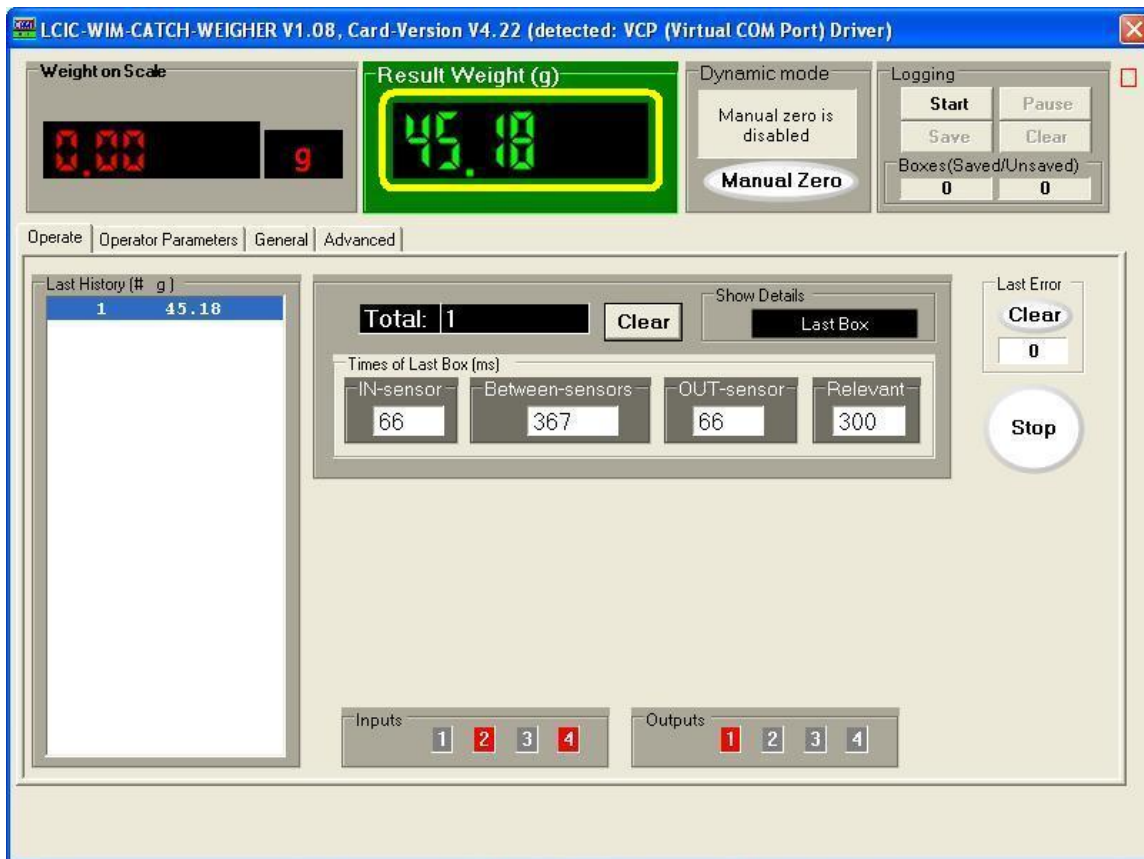
We find out what is the real weight of our test box, so we put it statically on the scale:



The board switches to PAUSE status and we realize that the real weight of the test box is 45.62g.

Step 2

We weigh the same box dynamically:



The result (45.18 g) is unsatisfactory and we observe the graph looking for the problem:



Some **events** are shown on the graph by artificial negative values in order to facilitate analyzing the graph. (The markings with the **yellow background** were added manually, they are **not** included in the graph.)

In this specific graph there are four events manually marked by

1, 2, 3 & 4. Here is their description:

1: IN-sensor goes OFF, the 'Ignore IN' interval starts.

(The point where the IN-sensor goes **ON** is the beginning of the graph (Readings=0).)

2: End of the 'Ignore IN' interval according to the '[Ignore IN](#)' parameter (50 ms in this case). The 'relevant' interval starts.

3: OUT-sensor goes ON, the 'relevant' interval ends.

In fact, if '[Noise Cycle](#)' is not 0 (as in our case), the actual 'relevant' interval is usually shorter, as it has to fit a multiple of 'Noise Cycle'.

4: OUT-sensor goes OFF.

Indeed, the graph shows that the [Ignore IN](#) parameter (50 ms, the interval between event 1 & event 2) is too small, as **it ends before the weight has stabilized**.

Step 3

We increased the **Ignore IN** parameter to 130 ms and took one more weighing. This time the result was satisfactory (deviation < 0.1%).

We observe the graph:

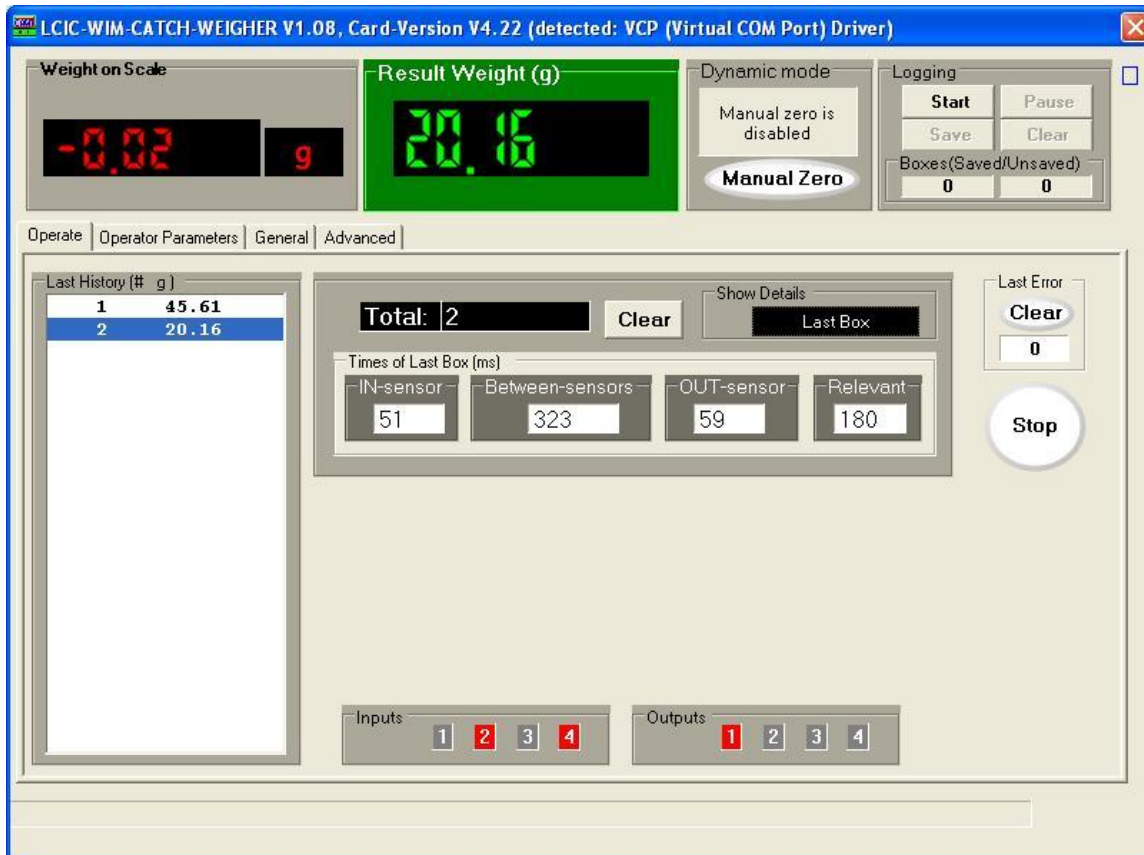


The Average (theoretically the same as board's result) is 45.66 g (vs. the real weight – 45.62 g – that we found out in step 1). Note that the interval that we took for the averaging ends **before** the OUT-sensor indication although there are still valid readings. The reason is the **Noise Cycle** parameter – we take its largest multiple (200 ms in this case) throwing away the remaining readings, as they might **spoil** the result – this is actually what the board does.

Example #2: Two boxes on the Scale

This example demonstrates the importance of specifying correctly the '**Ignore OUT**' parameter (section [4.2.1.8](#)) in the case of two boxes on the scale at the same time.

We dispatch two boxes while they were close to each other and get an unsatisfactory result (20.16 g) for the second box, whose real weight (measured statically) is 19.10 g:



We want to analyze what happened, so we click '[Last Box](#)' in the 'Show Details' frame and double-click the graph in order to get a frame; then we locate the left side of the frame at the end of the 'Ignore OUT' interval and adjust frame's width to the Relevant Time as reported by the above display (180 ms).

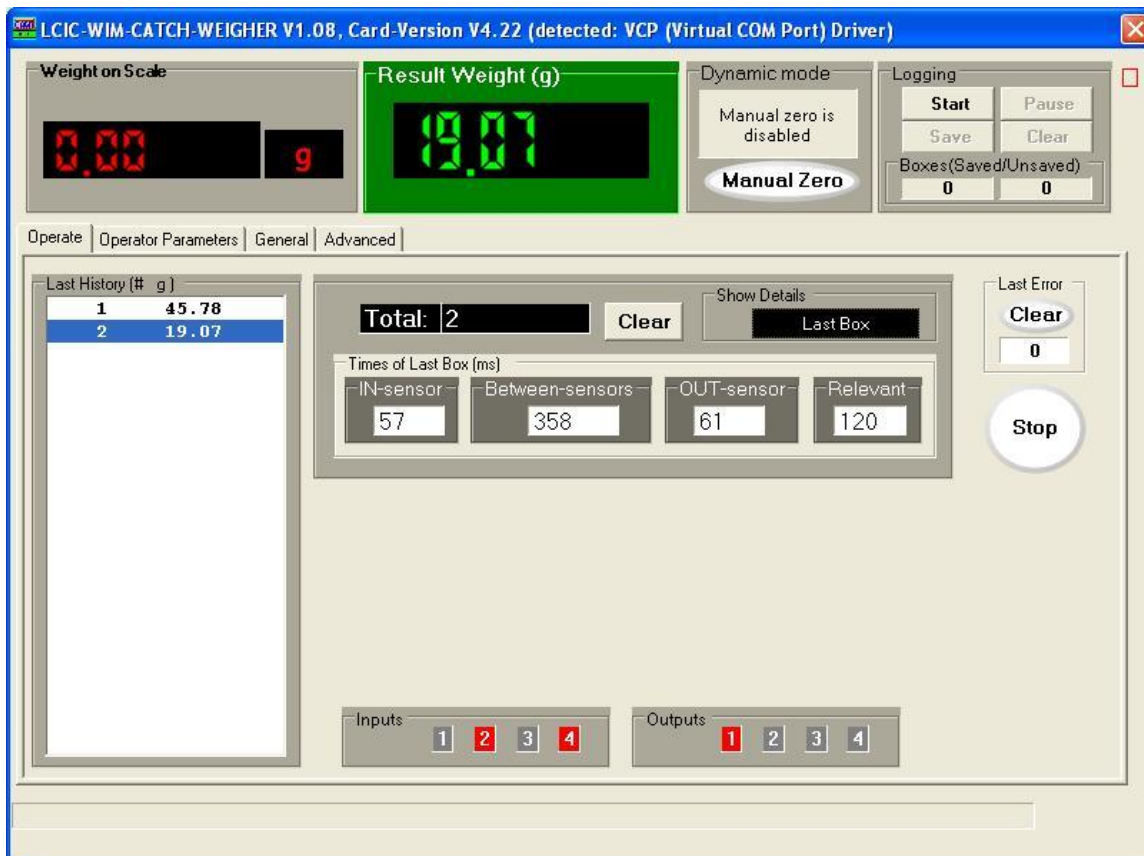
The following graph of the two boxes appears:



We realize that the average (20.24 g) is very close to the 20.16 g result (theoretically it should be the same, but practically there is usually a small deviation). Furthermore, we realize that the 180 ms frame started **before the first box completely left the scale**. We know that the '[Ignore OUT](#)' parameter that we have specified (in the Operator Parameters tab) is 50 ms. We verify it in the graph:



The graph confirms that the actual size of the 'Ignore OUT' interval was really 50 ms; as we clearly observed, this interval is **too small**, so we increase the '[Ignore OUT](#)' parameter to 90 ms and repeat the test. Now the results are far better:



The deviation of the result (19.07 g) is only 0.16% from the real weight (19.10 g)!

We watch again the graph:



The average that the graph shows (19.05 g) corresponds the 19.07 g result (the small deviation is normal). Now we want to verify that the change in the '[Ignore OUT](#)' parameter (to 90 ms) really worked, so we adjust graph's frame to the 'Ignore OUT' interval:



We realize that:

- * The 'Ignore OUT' interval is really 90 ms as expected.
- * Unlike the previous dispatching, now the 'Ignore OUT' interval is large enough so it ends **after** the first box **completely left** the scale, so this time the subsequent readings refer only to the second box, as required in order to get a correct result.

Example #3 Large Box – the 'Extra Length' Option

This example demonstrates how we may take the advantage of the 'Extra Length' option for a [large box](#).

Pay attention to the marked parameters in the following 'Operator Parameters' screenshot:

LCIC-WIM-CATCH-WEIGHER V2.01, Card-Version LCIC-WIM/V4.30

Weight on Scale: 0.0 9

Save to Board Undo All Changes

☐ Built-in Virtual Keyboard

Operate Operator Parameters General Advanced

Timing (ms)

Max. Relevant Time on Scale: 4000

Min. Relevant Time on Scale: 44

Noise Cycle: 20

Max. Time on Sensor: 2500

Min. Time on Sensor: 11

Sensor Timeout: 15000

Ignore IN: 100 ms ☐

Ignore OUT: 90 ms ☐

Max Gap Time: 0

Last History Size

Volume: 10 Items

Valid Weight Limits (g)

Max.: 200.0

Min.: 120.0

Large Boxes

TBS Large (ms): 250

TBS Alert (ms): 11

Extra Length (%): 25

Correction Factor: 1.0000

Zero upon Sensor IN

☐ Activate

MEST (ms): 200

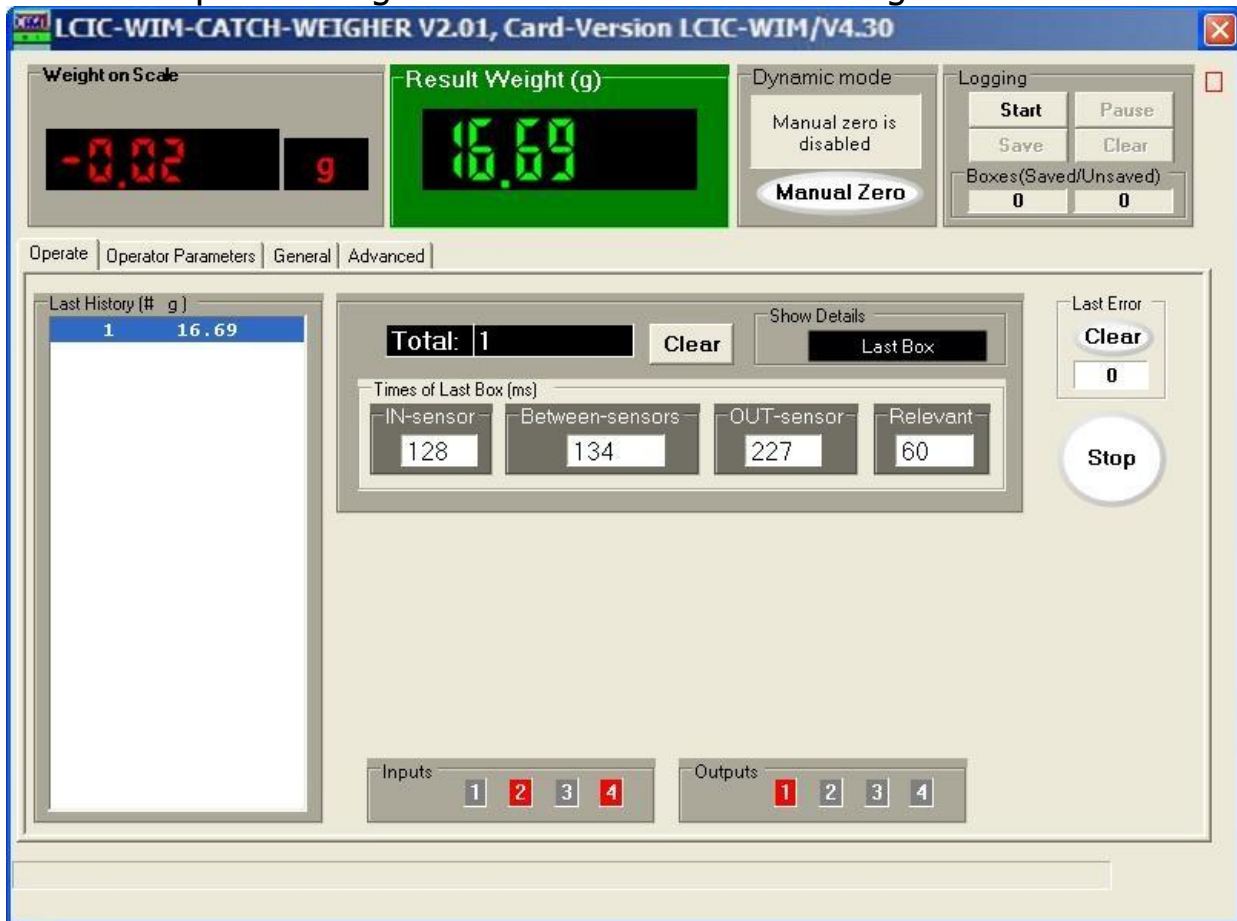
☐ Rejecting

The '[Min. Relevant Time on Scale](#)' requires that the minimum Relevant Time (reported in the Operate tab for each result) will be at least 44 ms, otherwise it will be considered as an [error](#).

→ Actually, considering the limitation that the next parameter ('[Noise Cycle](#)' = 20 ms) dictates, the real min. Relevant Time is **60** ms, which is the smallest multiple of 20 which is ≥ 44 . (For the good order, it would be better to specify '60' in '[Min. Relevant Time on Scale](#)' in this case in order to eliminate the illusion that 44 ms would be sufficient.)

The '[Large Boxes](#)' parameters specify that a box whose 'Time Between Sensors' is < 250 ms will be classified as a 'Large Box' which means that after such box crosses the OUT-sensor, more readings are still considered relevant until 25% (which is the value specified in the '[Extra Length](#)' parameter) of the box is beyond the OUT-sensor.

Now we dispatch a large box and receive the following result:



The 'Time Between Sensor' (134 ms) is really < 250 ms, so this box was classified as a 'Large Box'. We click the '[Last Box](#)' button (in the 'Show Details' frame), double-click the graph and adjust the frame so that:

- * Frame's **left edge** is at the point where the OUT-sensor was raised.
- * Frame's **width** equals the actual Relevant Time as reported in the above display (60 ms).

The following graph appears:



We realize that:

- * Some readings were rejected as they were beyond the 60 ms Relevant Time interval.
- * The average that the graph shows (Aver. = 16.66) really corresponds to board's result, as shown in the above display (16.69 g; the small deviation is normal).
- * **Without** the addition gained by the extra length option, the relevant time would be < the real '[Min. Relevant Time on Scale](#)' (60 ms) causing an [error](#).

How the start & end points of the 'Extra Length' interval are marked on the graph

Note that the start & end points of the 'Extra Length' interval are marked differently: The other events are marked by **one** negative point. But the start & end points of the 'Extra Length' interval are marked by **two** points – one **below** the actual weight, and the other one *symmetrically* **above** the actual weight. The reason for this exception is that the start point of the 'Extra Length' interval is the only event that may occur **within** the range of the relevant time, which is the range where we locate the frame on the graph and watch its **average**. Without this trick, we would get a wrong average. The **end** point of the 'Extra Length' interval is marked in the same way just for symmetry, although it is not needed for the average calculation (as it is beyond the 'relevant time' interval).

4.3 General

The top part of the screen shows the **Save to Board** button.
The various parameters are visible also when Operate is running, but **they may be changed only after Operate has been stopped.**

4.3.1 Communication

4.3.1.1 Port (Read-Only)

Shows the COM number through which the board is connected to the PC.

4.3.1.2 Baud Rate (Read-Only)

Shows the Baud Rate in which the board and the PC communicate.
In order to change the Baud Rate, use our LCIC-WIM-SETTINGS utility.

4.3.1.3 RS485 Address

This is the RS485 address (1 through 64) when the PC communicates the board via RS485.

* When using RS232, the RS485 address should be 0.

* When using USB, the RS485 address is irrelevant.

(For additional description about the RS485 please refer to LCIC-WIM.PDF, section D.5.)

4.3.2 Sensor Polarity

This parameter tells the board the hardware behavior of user's sensor:

Option 1 (the default):

Normally Open: Hardware sensor indication is on change from **Low** to **High**
(Free Sensor = Off).

Option 2:

Normally Close: Hardware sensor indication is on change from **High** to **Low**
(Free Sensor = On).

Note

If this parameter is not as the real polarity, the board will supply [error #433](#).

4.3.3 Filtering

For details about the following three filtering parameters, please refer to section 3.3.2.4 in LCIC-WIM.PDF.

- * Filter1

- * Filter2

- * Decimator

4.3.4 Auto Zero

(Refer to sections [2](#) & [2.1](#).)

4.3.4.1 Activate

Specifies whether the 'Auto Zero' option is active or not:

- * Checked: Active.

- * Unchecked: Not Active.

4.3.4.2 Max. Zero

Defines the maximum weight where the "Auto Zero" operation is enabled.

4.3.4.3 Min. Zero

Defines the minimum weight where the "Auto Zero" operation is enabled.

4.3.4.4 Time Limit

Defines the amount of time that the system requires the weight to be within the Min./Max. limits in order to apply the "Auto Zero" operation.

For example, suppose that:

Min. Zero = -1 kg.

Max. Zero = 2 kg.

Time Limit = 3 sec.

Then, the system will apply the "Auto Zero" operation after 3 **successive** seconds in which the weight was between -1 kg and 2 kg **referring to the previous zero**.

For example:

Stage 1

The weight was stable 1.5 kg more than the calibration zero – the Auto Zero was applied and the display shows 0.

Stage 2

The weight is now stable 1 kg higher than before – again, the Auto Zero is applied and the display shows 0. Note that the total amount in which the zero point moved from the calibration is 2.5 kg, which is more than the '[Max. Zero](#)' parameter. That is, the range in which the 'Auto Zero' is operative is floating – it moves together with the new zero.

4.3.4.5 A/Z Effect Level

This parameter enables to **moderate** the A/Z correction. That is, the user may pre-define what will be the **rate** of the A/Z correction, when it takes place. For example, suppose that:

- * The current weight is stable at x kg

- * x kg is inside A/Z range

- * The resolution is 0.2kg.

The user may choose what will happen each time the auto zero conditions are met:

- * A **full** A/Z correction (the weight will become 0.0).

or

- * A **moderate** correction, limited by some pre-defined multiple of the resolution, e.g., 0.2, 0.4, 0.6 kg, etc. That is, by each A/Z operation the weight will become **closer** to zero by (at most) 0.2, 0.4 or 0.6 kg – whatever was pre-defined.

How to set the 'A / Z Effect Level' parameter?

- * Set the 'A / Z Effect Level' to **0** in order to choose the **full** (unlimited) correction. This is the default.
- * Set the 'A / Z Effect Level' to some **non-zero** value in order to choose the **moderate** correction.
In the example above (the resolution is 0.2):
 - * 'A / Z Effect Level' = 1 limits the correction to 0.2 kg,
 - * 'A / Z Effect Level' = 2 limits the correction to 0.4 kg,
 - * 'A / Z Effect Level' = 3 limits the correction to 0.6 kg,and so on.

4.3.5 Built-in Virtual Keyboard

In case you use a physical keyboard, **uncheck** this option.

In case you need a virtual keyboard, you have two options:

- * Use an external virtual keyboard. In this case **uncheck** this option.
- * Use IMS built-in virtual keyboard (IMSVK). In this case **check** this option, and the IMSVK will appear whenever you click in the proper text field.
The advantage of the IMSVK is that it is located automatically so that it does not hide the current text field.

4.3.6 Get results immediately

Refer to section 3.3.2.1.4 in LCIC-WIM.PDF
and to section [D.3](#) in this document.

4.3.7 CatchWeigher-mode starts automatically upon card reset

- * When checked: After board reset, the board enters into the CatchWeigher-mode.
- * When not checked: After board reset, the board enters into the General-mode.

4.4 Advanced

In the 'Advanced' tab you may find out the value of the Correction Factor (refer to section [4.2.5](#)).

1. Take an item whose weight is known.
2. Specify item's real weight in the 'Static Weight' frame – either manually, or by clicking '**Use Current Weight**' – this will automatically insert the current weight into the 'Static Weight' frame.
3. Click the '**Start Statistics**' button.

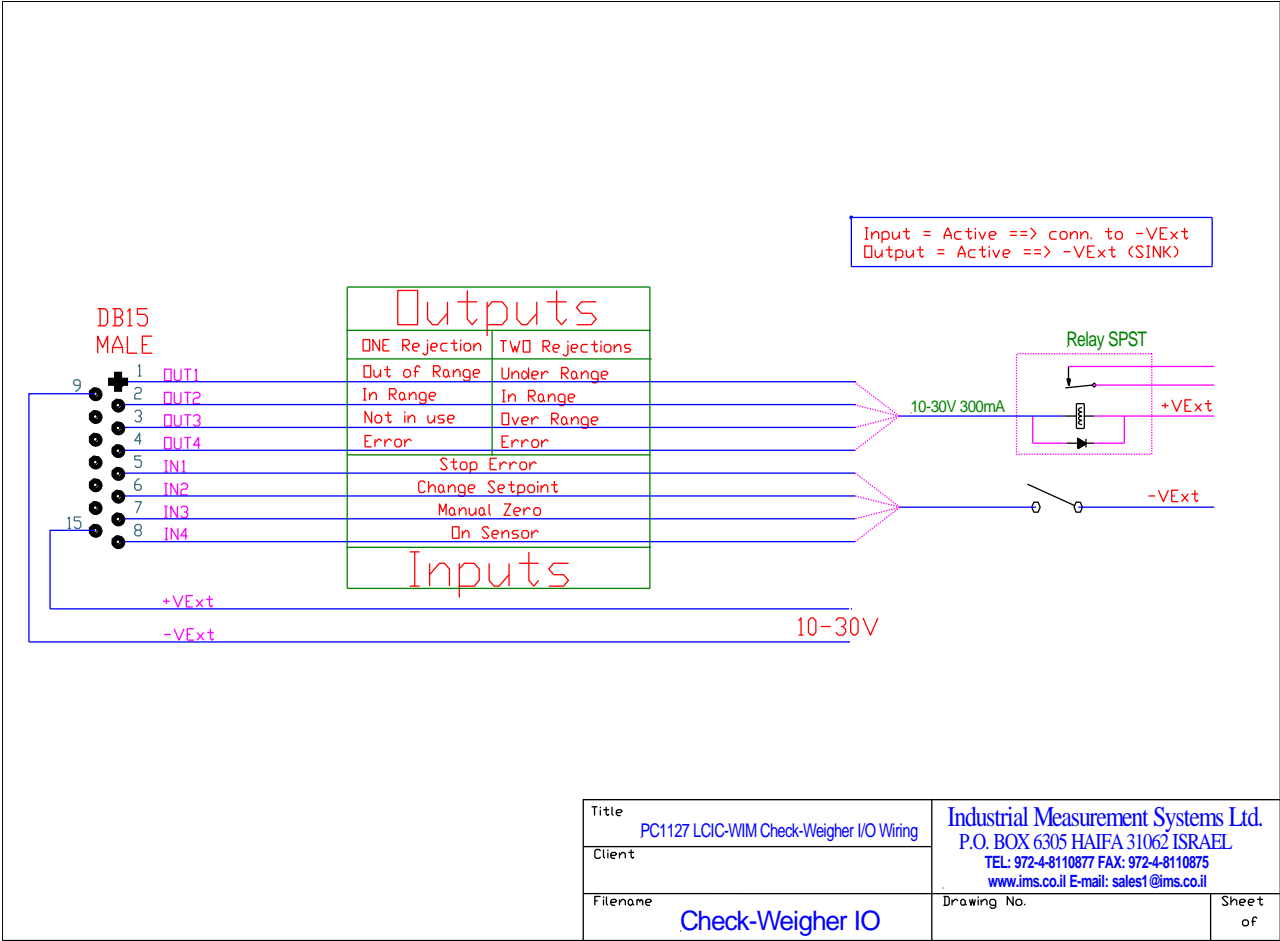
Note that the running of the Operate tab is now suspended. It may be resumed only after you click 'Stop Statistics' (step 5).

4. Let the item pass many times in the conveyor.
5. Click the '**Stop Statistics**' button.
6. You may watch the following information:
 - * No. of tests done.
 - * Weight accepted in the last test.
 - * Average Weight
 - * Standard Deviation
 - * No. of over-weight tests
 - * No. of under-weight tests
7. The program suggests a New Correction Factor which equals $(\text{Static Weight}) / (\text{Average Weight})$ and asks – "Do you want to save into board the New Correction Factor?"
If you answer 'Yes', the New Correction Factor is saved automatically into the board – you may watch it in the Operator Parameters tab.

Tip:

Inspect the 'Over Counter & Under Counter' values in order to find out whether the results have some trend. Make sure to run many tests before you make a decision. Only if most (say, 70% or more) of the results have the same trend (Over or Under), then change the Correction Factor.

Appendix A: I/O Wiring



Appendix B: Error Codes

- 0 No Error (Success)
- 2 Parameter Error: '[Min. Relevant Time on Scale](#)' > '[Max. Relevant Time on Scale](#)'
- 4 Parameter Error: '[Valid Weight Limits/Min.](#)' > '[Valid Weight Limits/Max.](#)'
- 8 Parameter Error: '[Valid Weight Limit/Max.](#)' > 'Maximum Applied Capacity'
(About 'Maximum Applied Capacity' refer to section 3.2.1 in LCIC-WIM.PDF)
- 16 Parameter Error: '[Max. Time on Sensor](#)' >= '[Sensor Timeout](#)'
- 32 Parameter Error: '[Min. Time on Sensor](#)' >= '[Max. Time on Sensor](#)'
- 64 Parameter Error: '[Valid Weight Limits/Min.](#)' < '[Max. Auto Zero](#)'
- 128 Parameter Error: '[TBS Alert](#)' should be < '[TBS Large](#)'
- 256 Parameter Error: '[Max. Time on Sensor](#)' <= '[Max. Gap Time](#)'
- 401 Incorrect Activation Code
- 403 Actual result weight too low (< '[Valid Weight Limits/Min.](#)' parameter)
- 405 Actual result weight too high (> '[Valid Weight Limit/Max.](#)' parameter)
- 407 The Relevant Time that the package was alone on the scale
was too small (< '[Min. Relevant Time on Scale](#)' parameter)
- 409 Relevant time on scale is too high (> '[Max. Relevant Time on Scale](#)' parameter)
- 411 Actual IN-sensor time is too low (< '[Min. Time on Sensor](#)' parameter)
- 413 Actual IN-sensor time is too high (> '[Max. Time on Sensor](#)' parameter)
- 415 Actual OUT-sensor time is too low (< '[Min. Time on Sensor](#)' parameter)
- 417 Actual OUT-sensor time is too high (> '[Max. Time on Sensor](#)' parameter)
- 419 IN-sensor covered for more time than specified by the '[Sensor Timeout](#)'
parameter
- 421 OUT-sensor covered for more time than specified by the '[Sensor Timeout](#)'
parameter
- 423 Actual result weight < '[Max. Auto Zero](#)' parameter
- 425 A/D Underflow
- 427 A/D Overflow
- 429 Initial weight is outside the Auto Zero limits.
(Refer to the 'General' tab.)
- 431 Missing OUT-sensor indication expected after an IN-sensor indication
- 433 There is an indication from both sensors as if they are covered.
Please check the '[Sensor Polarity](#)' parameter in the 'General' tab.
- 435 '[Ignore IN](#)' parameter is too high
- 437 Actual time between sensors is too small (< '[TBS Alert](#)' parameter)
- 439 More than two boxes on the scale.
- 441 There was no Relevant Time that the package was alone on the scale.
- 447 Abnormal IN-sensor indication
- 449 Abnormal OUT-sensor indication
- 451 3 successive boxes without cease (free scale) in between
- 453 Max. Gap Time parameter is too high

Notes

1. In case of an **initial** error the weighing process **does not** take place.

There are two types of an initial error:

* Error #429 ('Initial weight is outside the Auto Zero limits'):

Although the weighing process does not start, if later on the weight changes and comes **within** the Auto Zero range, the error status vanishes automatically and the weighing process does start.

* Parameter Error:

Obviously, in this case the error will not vanish 'by itself' – you have to correct the wrong parameter(s) first.

A Parameter Error always has an **even** code. If **some** Parameter Errors exist in the same time, a **multiple** error code will be produced. For example, error code 14 indicates that both error #2, error #4 and error #8 occurred ($14 = 2 + 4 + 8$). In the supplied CatchWeigher application, click on the error code and **all** its components (errors #2, #4 and #8 in the example), including their descriptions, will be displayed. In your own application, it's your responsibility to parse the code into its components.

2. The CatchWeigher application supplies a description of the error(s):

* When there is no error (Last Error = 0):

* Click the error code in the Last Error frame (0 in this case) in order to get a **list** with the descriptions of **all** errors.

* When there **is** some error (Last Error is not 0):

* Click the error code in the Last Error frame in order to get a description of **the specific** error.

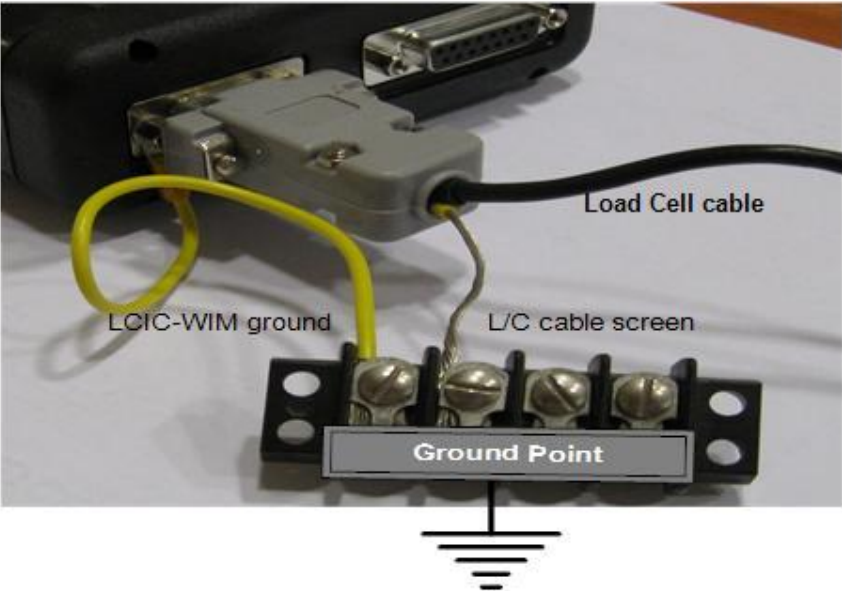
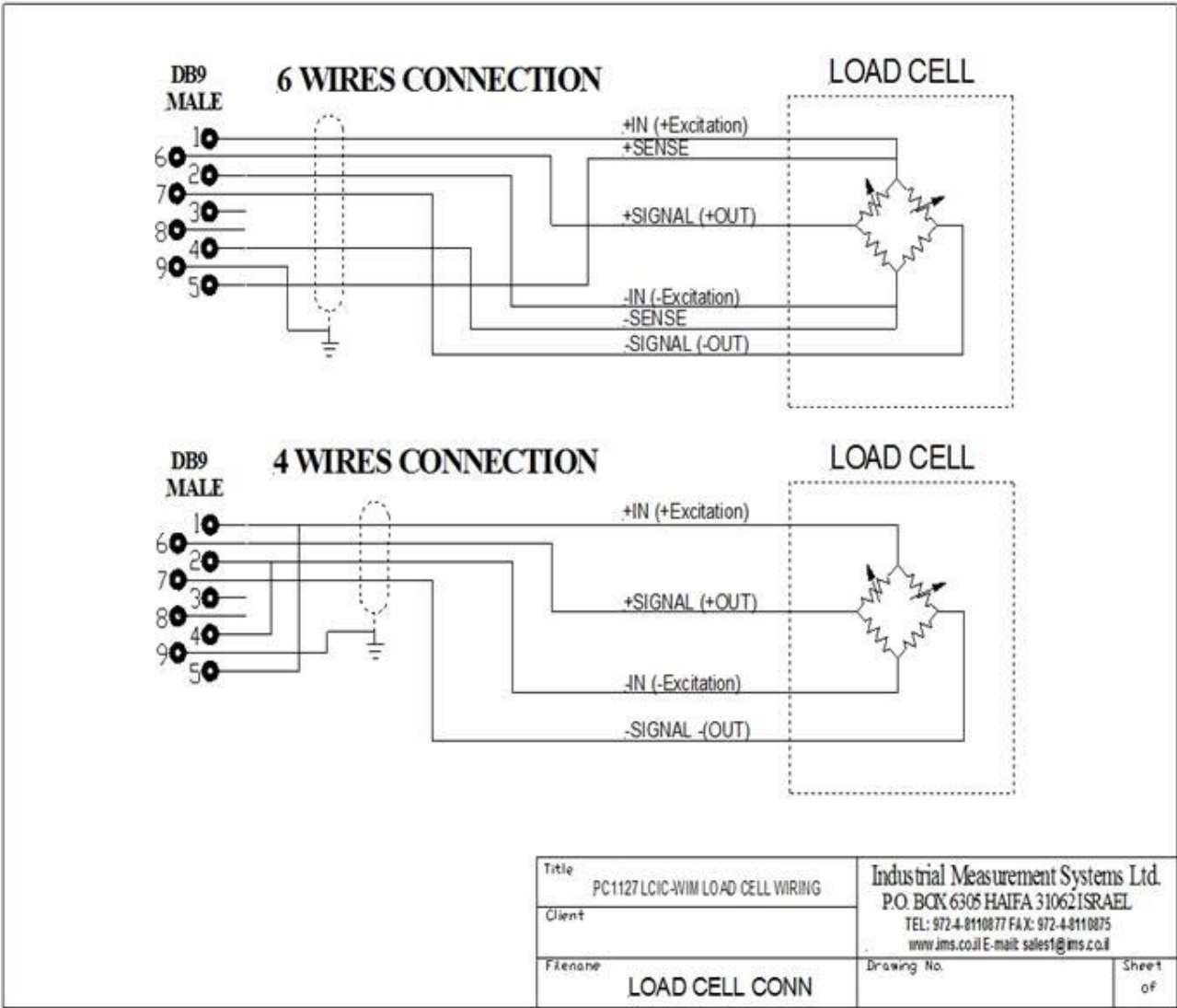
* The CatchWeigher application **holds the error code** until there is the result of the next package, then the new result (either 0 or an error code) is displayed.

* As already specified in Note #1, in case of a **multiple** error indication (e.g., 14), the descriptions of **all** its components (errors #2, #4 and #8 in the example) are displayed.

-

Appendix C: Load Cell Wiring

LCIC-WIM Load Cell wiring



Appendix D: Programming your application

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 CatchWeigher-mode.

***Within* the CatchWeigher-mode another set of commands is available, as described in section D.1 below.**

D.1 Commands in CatchWeigher-mode

→ **All these commands should not be followed by a C/R.**

'V': Mode echo. Response: "CAW-mode".

'x': Exit to general mode. Response: 'x'+C/R.

('): Turn the 'Get results immediately' option on.

Card responds: '('+C/R.

(Please refer to LCIC-WIM.PDF, section 3.3.2.1.4.)

')': Turn the 'Get results immediately' option off.

Card responds: ')'+C/R.

(Please refer to LCIC-WIM.PDF, section 3.3.2.1.4.)

'?': Get current weight.

Similar to the '?' command in the general mode

(LCIC-WIM.PDF, section 4.1/c), except that here the notation is simple, as opposed to the scientific notation in the general mode:

Get weight (after Filter2, rounded to resolution).

Card responds: weight+C/R.

For example:

50.000

'e': Clear error. Response: 'e'+C/R.

Note: If the reason for the error still exists, the error will occur again.

'r': Get last n results.

'n' is the Volume of the 'Last History' frame (see section [4.2.2.1](#)).

'Y': Clear Readings.

Clears all the readings & counters reported by the 'L', 'l' (Small L) & 'r' commands.

Resets the reading serial number (i.e., next reading will be #1).

Response: 'Y'+C/R.

'G': Simulate sensor input. No response.

(This is useful while developing your application. However, the simulation is not full: the virtual item does not activate the output.)

'l' (Small L): Get Weight Counters. For example:

2 0 2 0

Fields:

1. Total
2. Always 0.
3. The same as field 1 (Total)
4. Always 0.
5. C/R

'L': Get Last Results. For example:

000002 813.87 0.02 0 0000 0001 0

These 7 values are:

1. Serial no. of last result (integer; 0=no result yet)
2. Weight of last result (formatted according to resolution; 0=no result yet)
3. Current weight (formatted according to resolution)
4. Current error code (integer; see [appendix B](#))
5. Current inputs status
Format: 'dcba'. a=IN1, b=IN2., c=IN3, d=IN4
For example '0101'
IN1 = on
IN2 = off
IN3 = on
IN4 = off
6. Current outputs status
Format: 'dcba'. a=OUT1, b=OUT2, c=OUT3, d=OUT4
For example '0101'
OUT1 = on
OUT2 = off
OUT3 = on
OUT4 = off
7. Always '0' (reserved).

Notes

1. The values are separated by one tab.
2. The string is followed by a C/R.
3. There is no other C/R in the string.

'a': Turn on Output1 (No response)
'b': Turn on Output2 (No response)
'c': Turn on Output3 (No response)
'd': Turn on Output4 (No response)

'A': Turn off Output1 (No response)
'B': Turn off Output2 (No response)
'C': Turn off Output3 (No response)
'D': Turn off Output4 (No response)

'O' (upper case o): Get outputs.

The same as the 'O' command in the general mode
(LCIC-WIM.PDF, section 4.1/f):

Card returns a string of the form "nnnn"<cr>

where n is either "1" or "0" representing the status of
the 4 output opto relays OUT4,OUT3,OUT2,OUT1
respectively.

For example: 0101 (OUT4=0,OUT3=1,OUT2=0,OUT1=1).

'I' (upper case i): Get inputs.

The same as the 'I' command in the general mode
(LCIC-WIM.PDF, section 4.1/g):

Card returns a string of the form "nnnn"<cr>

where n is either "1" or "0" representing the digital input
status of IN4,IN3,IN2,IN1 respectively.

For example: 1010 (IN4=1,IN3=0,IN2=1,IN1=0).

'z' (lower case z): Manually zero the gross weight.

Response: 'z'<c/r>.

'Z' (Upper case Z) Cancel the manual zero operation (the lower case 'z').

That is, return to the original calibration zero.

Response: 'Z'<c/r>.

D.2 Parameters Addressing

The parameters are accessible by the 'R' and 'W' commands (refer to LCIC-WIM.PDF section 4.1, square 'a' in the table; the parameter # is the **Address** in the table below).

Parameter Described in Section ...	Parameter Name	Min.	Max.	Default	Address	Notes
4.2.1.1	Max. Relevant Time on Scale	0	500000	200	807	Units: ms
4.2.1.2	Min. Relevant Time on Scale	0	4000	100	806	Units: ms
4.2.1.3	Noise Cycle	0	15000	0	809	Units: ms
4.2.1.4	Max. Time on Sensor	0	499999	40000	822	Units: ms
4.2.1.5	Min. Time on Sensor	0	499998	10	821	Units: ms
4.2.1.6	Sensor Timeout	1	500000	80000	824	Units: ms
4.2.1.7	Ignore IN	0	100000	80	802	Units: ms
4.2.1.8	Ignore OUT	0	1000	80	835	Units: ms
4.2.2.1	Volume	1	19	10	825	
4.2.3.1	Max. Valid Weight Limit	0	Maximum Applied Capacity	70% of Maximum Applied Capacity	812	
4.2.3.2	Min. Valid Weight Limit	0	Maximum Applied Capacity	20% of Maximum Applied Capacity	811	
4.2.4.1	Large Boxes: TBS Large	0	10000	300	833	Units: ms
4.2.4.2	Large Boxes: TBS Alert	0	10000	80	834	Units: ms
4.2.4.3	Large Boxes: Extra Length	0	40	0	832	Units: %
4.2.5	Correction Factor	0.11	100	1	808	
4.2.6.1	Zero upon IN-sensor / Activate	0x55	0xAA	0x55	844	0x55 = Active 0xAA = Not Active
4.2.6.2	Zero upon IN-sensor / MEST	0	1000	500	846	Units: ms
4.2.7.1 & 4.2.7.2	Rejection Type	-	-	0	843	0 = None 23 = Inside / Outside 13 = Under / Over 43 = Inside / Under 53 = Inside / Over
4.2.7.3	Output2/Delay	0	60000	1000	839	Units: ms
4.2.7.3	Output2/Duration	0	60000	1000	840	Units: ms
4.2.7.3	Output3/Delay	0	60000	1000	841	Units: ms
4.2.7.3	Output3/Duration	0	60000	1000	842	Units: ms

Parameter Described in Section ...	Parameter Name	Min.	Max.	Default	Address	Notes
4.3.1.3	RS485 Address	0	64	0	301	→ The address setting takes effect only upon board reset. Refer to LCIC-WIM.pdf, section 3.3.2.1.3.
4.3.2	Sensor Polarity	0	1	1	828	0 = Normally Close 1 = Normally Open
4.3.3	Filter1	2	256	256	23	Becomes effective only after a board reset
4.3.3	Filter2	2	256	100	24	
4.3.3	Decimator	2	1000	50	25	
4.3.4.1	Auto Zero - Activate	0	1	0	1047	1 = Active 0 = Not Active
4.3.4.2	Auto Zero - Max. Zero	0	Maximum Applied Capacity	1% of Maximum Applied Capacity	1049	
4.3.4.3	Auto Zero - Min. Zero	-Maximum Applied Capacity	0	-1% of Maximum Applied Capacity	1048	
4.3.4.4	Auto Zero - Time Limit	1	1000	5	1050	Units: S
4.3.4.5	Auto Zero - A/Z Effect Level	0	100	0	314	
4.3.6	Get results immediately	0	1	1	801	1 = Active 0 = Not Active
4.3.7	CatchWeigher-mode starts automatically upon card reset	0	1	0	1074	1 = Active 0 = Not Active

D.3 Get Results Immediately

(Refer to section 3.3.2.1.4 in LCIC-WIM.PDF.)

The transmissions that the board supplies when this option is activated (in the [CatchWeigher application / General](#)) are directed to the port from which last transmission (from PC) arrived – either USB or RS232/RS485. However, if no transmission arrived from the PC since the board was powered on, the board directs its transmissions to the RS232/RS485 port. If this is improper (that is, the transmissions are required in the USB port), send from the USB port any command (e.g., 'V') before letting items pass. That would tell the board it should direct its transmissions to the USB port.

(Refer also to the commands [Y](#) and [Y](#) in section D.1.)

Appendix E: Events on the Graph

There are some events shown on the graph by artificial negative coordinates (far away from zero and unique for each event) in order to facilitate analyzing the graph. There are 16 events, numbered 1-16.

1. Parameter-independent Events:

12 Sensor Events				
OUT (Previous/Current)	IN (Previous/Current)			
	OFF/OFF	OFF/ON	ON/OFF	ON/ON
OFF/OFF	-	1	2	-
OFF/ON	3	5	7	9
ON/OFF	4	6	8	10
ON/ON	-	11	12	-

2. Parameter-dependent Events:

2 "Ignore End" Events	
End point of the " Ignore IN " interval	13
End point of the " Ignore OUT " interval	14
2 "Large Box" Events	
Start point of the " Extra Length " interval	15
End point of the " Extra Length " interval	16

Event #15 actually occurs immediately after the event of 'OUT-sensor' → ON (usually event #3); but unlike the other events, these two events (3 & 15) fall **inside** the relevant interval (whose average form the result). Therefore, we did some trick so that the artificial 'weight' of the event point on the graph will not spoil the average: we set the coordinate of event #15 **symmetrically** to event #3 (the previous point) around the current weight. That way, the average is kept true.

Event #16 actually is already beyond the relevant interval so it does not participate in the average. Yet, for the sake of symmetry, it is represented by **two** points in the same way: The first point is -40^* , and the second point is symmetric to the first one, around the current weight.

The coordinates of the various events are detailed in the following table.

Event #	Coordinate [*]
1	-10
2	-20
3	-30
4	-50
5	-60
6	-70
7	-80
8	-90
9	-99
10	-110
11	-120
12	-130
13	-140
14	-150
15	See description above
16	

* In order to fit graph's scale, an event's coordinate may be scaled up or down (always by a power of 10) according to the actual weights on the graph. So, Event #14, for example, might be represented by -150 (as specified in the table above), or by -15 or -1500, etc., according to graph's actual scale.