

LCIC Model 1106a User's Guide

June '07

TABLE of CONTENTS

<u>Section</u>	<u>Page</u>
1 INTRODUCTION	1
1.1 GENERAL DESCRIPTION	1
1.2 CARD INSTALLATION	1
1.3 CARD VERSION	2
1.4 OPTIONS	2
2 SOFTWARE UTILITIES	3
2.1 MEMCHECK.EXE	3
2.2 INIT.EXE	3
2.3 FINISH.EXE	4
2.4 LCIC.EXE (THE CALIBRATION UTILITY)	4
2.4.1 LCIC DISPLAY	5
2.4.1.1 WINDOW #1 – READINGS	5
2.4.1.2 WINDOW #2 – PARAMETERS	5
2.4.1.3 WINDOW #3 – SETUP	6
2.4.1.4 WINDOW #4 – INSTRUCTION	6
2.4.1.5 WINDOW #5 – CALIBRATION COUNTER	6
2.4.2 LCIC FUNCTIONS	6
2.4.2.1 F2 – CALIBRATION	6
2.4.2.1.1 STEP 1 - PARAMETER ENTRY	7
2.4.2.1.2 STEP 2 - HARDWARE CALIBRATION	9
2.4.2.1.3 STEP 3 - SOFTWARE CALIBRATION	10
2.4.2.1.4 CALIBRATION COMPLETION	10
2.4.2.1.5 POSSIBLE CALIBRATION ERRORS	10
2.4.2.1.5.1 CHECK LOAD CELL WIRING	10
2.4.2.1.5.2 TARE (DEAD LOAD) FAILURE	11
2.4.2.1.5.3 WEIGHT IS TOO SMALL	11
2.4.2.1.5.4 NONLINEAR WEIGHT	11
2.4.2.1.5.5 WEIGHT NOT WELL ACCEPTED	11
2.4.2.1.6 RESTORING CALIBRATION FROM LIBRARY	11
2.4.2.2 F3 - ZERO (previously "TARE")	12
2.4.2.3 F4 - INTEGRATION	12
2.4.2.4 F5 - FILTER ON/OFF	13
2.4.2.5 F6 - SAMPLING RATE	13
2.4.2.6 F7 - CALIBRATION LOCK OPTION	13
2.4.2.7 F8 - I/O CHECK	14
3 PROGRAMMING INFORMATION	15
4 RUNNING A PROGRAM (USER'S OR A SAMPLE)	18
5 LCIC OPIONS	19
5.1 OPTIONAL I/O PIGGYBACK CARD	19
5.2 OPTIONAL RS232	19
6 CARD RESPONSE TIME	20
7 TROUBLESHOOTING	21
7.1 BUS SPEED	21
7.2 ABORTED CALIBRATION	21

TABLE of CONTENTS (c o n t ' d)

<u>Section</u>	<u>Page</u>
APPENDIX A INSTALLATION	22
A.1 QUICK INSTALLATION	22
A.2 STEP BY STEP INSTALLATION (MEMCHECK)	23
A.2.1 BEFORE THE INSTALLATION PROCEDURE	23
A.2.1.1 CONFIG.SYS UPDATE	23
A.2.1.2 COPYING THE SOFTWARE PACKAGE	23
A.2.2 THE INSTALLATION PROCEDURE	24
APPENDIX B HOW TO ACCESS THE LCIC CARD IN WINDOWS	27
B.1 LcicConfig98	28
B.2 LcicWin	29
B.3 SmartWin	32
APPENDIX C THE CALIBRATION COUNTER	33
APPENDIX D THE "DLOAD" UTILITY	34
APPENDIX E THE MULTI CALIBRATION (MC) FEATURE	36
E.1 MC GENERAL DESCRIPTION	36
E.2 MC ACCESS TO THE CARD	37
E.3 MC DEMONSTRATION USING THE LCIC UTILITY	38
APPENDIX F THE BATCH FEATURE	39
F.1 BATCH GENERAL DESCRIPTION	39
F.2 BATCH ACCESS TO THE CARD	39
F.3 BATCH DEMONSTRATION USING THE LCIC UTILITY	41
APPENDIX G THE "SMART" PACKAGE	42
G.1 THE "SMART" UTILITY	42
G.2 "SMART" RS232 COMMUNICATION	45
G.2.1 THE RSSETUP UTILITY	45
G.2.2 "SMART" COMMUNICATION	45
G.2.2.1 COMMUNICATION PROTOCOL	46
G.2.2.2 INFORMATION BLOCK	46
G.2.3 THE "HOST" UTILITY	48
APPENDIX H WIRING	49
H.1 LOAD CELL WIRING	49
H.1.1 SIX WIRES CONNECTION	49
H.1.2 FOUR WIRES CONNECTION	49
H.2 OPTIONAL I/O CARD WIRING	50
APPENDIX I AVAILABLE SETUP MEMORY LOCATIONS	51
APPENDIX J DRAWINGS	52
J.1 LCIC 1106a CARD LAYOUT	52
J.2 LOAD CELL CONNECTIONS	53
J.3 I/O CARD 1107 (OPTIONAL) WIRING	54
J.4 I/O CARD 1107 (OPTIONAL) INPUT CONNECTIONS	55
J.5 I/O CARD 1107 (OPTIONAL) OUTPUT CONNECTIONS	56
J.6 LCIC 1106a RS232 (OPTIONAL) CABLE	57

1. INTRODUCTION

1.1 GENERAL DESCRIPTION

The LCIC (Load Cell Interface Card) is used to sample the output of up to six load cells (350 ohm or higher each, wired in parallel) and to convert these analog signals into a digital format via a precision Analog to Digital (A/D) Converter.

The A/D data can be either displayed directly (using the supplied software) or further manipulated by a user's program.

The LCIC is designed for PC/AT and compatible computers. The card is accessible by software (either the provided, or user developed) running on the PC.

Software is provided to aid in the installation of the card(s) and to perform calibrations. Using a "calibration library", the user may save his calibrations for later recall, simplifying the procedure of reproducing a past configuration.

The user is not limited to the programs supplied - he may satisfy his specific requirements by developing his own software, using almost any programming language. The manual guides how to do that, and sample programs with source code in C, BASIC and Visual Basic are supplied.

The programs demonstrate how the LCIC can be used to read and display a load cell signal and/or to control a process using the I/O option.

1.2 CARD INSTALLATION

The card is a memory mapped hardware device, utilizing a dual port RAM, through which it supplies quickly and reliably updated readings, usable by the software in the PC.

The dual port RAM occupies 1K of the upper PC memory area (between 640K and 1M). To eliminate conflict with other software/hardware devices, the address of the dual port RAM is programmable – there are 16 potential memory locations.

Due to the various locations available for the dual port RAM, more than one card may be installed. Up to 16 cards may be installed on one PC platform. The actual quantity depends on user's PC configuration.

The manual guides the user by "step by step" instructions how to install his card(s). The relevant drawings are supplied too.

The software package includes a utility to aid in the installation, detecting a free location available for the dual port RAM.

Once the user has activated that utility and a free location has been found, each card should be set accordingly by a DIP switch.

If the card's preset address is vacant, a faster single card installation procedure is given in section A.1.

For Windows operation please refer to Appendix B.

1.3 CARD VERSION

Since recent versions of the software in LCIC card's ROM include various improvements, you might have to know your card's ROM version.

Find out card's ROM version by either of these two ways:

- Watch the title of LCIC.EXE utility (see section 2.4).
- Watch ROM label on the LCIC card:
 1. Locate the label using drawing #1 ("ROM LABEL").
 2. Consider label's format:

I.M.S. LCnnVmmm date

Where:

nn is internal clock speed.

V stands for "Version".

mmm is version number

E.g., "LC12V013" means internal clock speed=12, version=013.

1.4 OPTIONS

Besides the standard configuration, some options are available:

- I/O Piggyback card. This option turns the LCIC into a control system. Its four inputs and eight outputs (all opto-isolated) allow the LCIC board perform process control and monitor external events. The I/O's are accessible both by the software supplied and by user's application program.
The I/O piggyback card mounts onto the LCIC card - no additional slot in the PC is needed. Refer to section 5.1.
- RS-232. With the RS-232 option (CTS, RTS control), the LCIC card may communicate with the "external world", supplying the weights of the load cell(s) to a remote device (such as a computer or terminal). Refer to section 5.2.
- Hardware calibration lock. This option is used to block unauthorized access to the calibration parameters. This is particularly useful for the inspection authorities. Refer to section 2.4.2.6.

2. SOFTWARE UTILITIES

The software package supplied includes four utilities:

MEMCHECK.EXE	An installation utility that identifies free space in the PC available as common memory for the card's dual port RAM. The card can then be set to one of the available locations.
INIT.EXE	Activates card(s). Performs hardware and calibration test.
FINISH.EXE	Terminates activity of the card(s).
LCIC.EXE	Calibration, setup and I/O test.

2.1 MEMCHECK.EXE

MEMCHECK utility is used only during the installation process.
Refer to Appendix A.

2.2 INIT.EXE

FUNCTION

The INIT utility performs the following functions:

1. Complete availability check of the installed card(s) - hardware and calibration diagnosis.
2. Setting the card(s) into active mode.

OPERATION

1. Activate INIT.EXE using either of the following two forms:

- * Type "INIT" and <Enter>.
- * Type "INIT n" and <Enter>,
where n = the number of cards.
E.g. "INIT 2" for two cards.

The first form of the INIT command will prompt the user for a response.

The second form does not prompt the user and therefore may be used for unattended operation or in a batch file.

2. INIT determines the number of cards which are expected to be installed, according to the SEGx file(s) (created during the installation).
3. The first form of the INIT command will ask the user to confirm the number of cards.
E.g., "Data about 2 cards detected. Sure? (y/n)".
4. If the user answers "no" to the first form of the INIT command, or there's an error in the second form:
 - The INIT program will NOT communicate the card(s).
 - The DOS ERROR_LEVEL variable will be set to 4.
 - The INIT program will terminate.
 Otherwise, INIT flows to next step.
5. INIT performs the availability check.
6. INIT sets the card(s) into active mode.

RESPONSE

INIT's findings are reported by three means:

1. The display:
The display reports the results of INIT's operation. In case of failure, a corresponding message is given.
2. Card's LEDs:
Each card includes some LEDs shown on drawing #1.
BEFORE the INIT process, the STATUS LED should flash at a VARIABLE RATE, and the other ones should light, indicating proper power supply.
AFTER a successful INIT process, the STATUS LED should flash at a UNIFORM RATE, and the other ones should still light.
A turned off STATUS LED indicates that the card is uncalibrated.
3. ERRORLEVEL:
The result of the INIT command is reported in ERRORLEVEL of DOS.
The user may employ this information in a program or batch file.
ERRORLEVEL codes are as follows:

CODE	I N T E R P R E T A T I O N
0	Successful operation.
1	Calibration error or missing parameters.
2	Critical hardware error (the specific error is reported on the display).
3	Missing SEGx file – either MEMCHECK was not run or the file(s) were erased.
4	Mismatch in number of cards.

NOTES

1. INIT operation takes some seconds to complete its tasks.
2. INIT should only be run once as long as the PC is not turned off, and FINISH has not been run.

2.3 FINISH.EXEFUNCTION

The FINISH utility sets each of the installed cards into an inactive mode, as it was before INIT was run.

OPERATION

1. Activate FINISH.EXE by either of the following two forms:
 - * Type "FINISH" and <Enter>.
 - * Type "FINISH n" and <Enter>,
where n = number of cards.
E.g. "FINISH 2" for two cards.
2. FINISH operation is similar to INIT's. See INIT operation for details.

2.4 LCIC.EXE (THE CALIBRATION UTILITY)

This is the main utility, enabling card's calibration and I/O test.

Activate LCIC.EXE by either of the following two forms:

* Type "LCIC" and <Enter>.

* Type "LCIC i" and <Enter>,
where i = card's serial number
E.g. "LCIC 2" for 2nd card.

The second form is required only in case of more than one LCIC card. However, if there is more than one LCIC card and the **first** form is used, the user is asked to select the required one. Cards' sequencing is same as with the SEGx files - refer to note 2 at the end of section A.2.2.

2.4.1 LCIC DISPLAY

LCIC display includes four windows.

Note that some of the fields get their values only after calibration process is performed.

The four windows are described in the following sections.

2.4.1.1 WINDOW #1 - READINGS

Window #1 displays the current measurement and mode of operation as follows:

A/D.	Raw A/D points of current measurement
WEIGHT	Current weight in user selected units (kg. etc.).
CEN. of ZERO	Center of Zero indication (ON/OFF)
MODE	Operation mode - one of the following: * Run mode * Hardware cal * Software cal. * Cal. check

2.4.1.2 WINDOW #2 - PARAMETERS

Window #2 displays the current LCIC parameters as follows:

ZERO (previously TARE)	Current zero in A/D points. For Zero change refer to section 2.4.2.2.
INTEGRATION	Integration Factor. See section 2.4.2.3.
FILTER	ON/OFF. Specifies whether the Digital Filter is enabled or disabled. See section 2.4.2.4.
POINTS PER UNIT	How many A/D points are spread over each resolution unit. E.g., Points Per Unit = 4, and Resolution = 0.001 kg (the resolution is displayed in the SETUP window, see section 2.4.1.3): There are 4 A/D units per each 1 gr.
SAMPLING RATE	A/D sampling rate in ms. See section 2.4.2.5.
LOCK	LOCKED/UNLOCKED calibration state. See section 2.4.2.6.
INPUT	Reports status of the four card inputs. Each "ON" state is indicated by a gray background.
OUTPUT	Reports status of the eight card outputs. Each "ON" state is indicated by a gray background. For output change refer to section 2.4.2.7.

2.4.1.3 WINDOW #3 - SETUP

Window #3 displays the values specified during the last calibration. The name and the date of the calibration are shown in window title.

MAXIMUM LOAD	Maximum planned load (in user selected units (kg. etc.)).
ACCURACY	Maximum allowable deviation from linearity during calibration process (in percent).
RESOLUTION	Required resolution of the displayed weight (in user selected units (kg. etc.))

2.4.1.4 WINDOW #4 - INSTRUCTION

Displays instructions related to the current activity.

2.4.1.5 WINDOW #5 - CALIBRATION COUNTER

Displays the "Calibration Counter", available with card version 13 and upward using LCIC.EXE version 5.03 and upward. For details on the "Calibration Counter", refer to appendix C.

2.4.2 LCIC FUNCTIONS

The LCIC uses function keys F2 through F8 to select operating parameters or functions as follows:

F2	Calibration
F3	Zero (previously Tare)
F4	Integration
F5	Filter On/Off
F6	Sampling Rate
F7	Calibration Lock
F8	I/O Check

To quit the LCIC utility, press Alt-X.

2.4.2.1 F2 - CALIBRATION

The system includes a "calibration library" that saves the data of each new calibration. The user may recall a previous calibration from the library instead of repeating the actual calibration. Each card supplied from the factory includes an initial calibration in the library, named IMS.

Consequently, the calibration data is obtainable by two means:

- * RESTORING a past calibration by reading its data from the "calibrations library" (stored on the disk).
- * Carrying out a PHYSICAL (real) calibration process.

Once running LCIC.EXE, the user is first asked:

Restore calibration from library?

Answer "Y" (Yes) to load a previous calibration, and refer to section 2.4.2.1.6.

Answer "N" (No) to proceed with a physical calibration.

The calibration is a DESTRUCTIVE operation, since it erases the old information. In other words, the card loses the old calibration. (However, the data in the "calibration library" remains available - only the information stored on the card is lost.)

Before starting the operation, the program will verify that the user wants to proceed.

The following message appears...

WARNING - Actual calibration parameters will be lost. Continue?

...preventing the user from accidentally starting the calibration process.

Answering "Y" (Yes) begins a three-step calibration process.

2.4.2.1.1 STEP 1 - PARAMETER ENTRY

The user should insert the following parameters:

1. Calibration name:

User selected name for current calibration - an identifying string in the calibration library.

This name and calibration date will be displayed as the title of the SETUP window (section 2.4.1.3) and in the calibration list (section 2.4.2.1.6).

Note that if the string specified as "calibration name" is already used by another calibration in the library, there are two possibilities:

1. The user really means to overwrite the old data in the library.
2. The user is not aware that the name is already in use.

Therefore, the LCIC utility will ask:

Such calibration already exists. Overwrite it?

Responding "Y" (Yes) will overwrite the existing data, "N" (No) will prompt the user for another name.

On completion of the calibration, the data is automatically saved in the library under the specified name. The current date is also saved in the library.

2. Calibration point(s):

There are three options:

- Three point calibration.
- One point calibration.
- Quick calibration.

The conventional procedure is "three point calibration". It includes three weights that should be added or removed according to the instructions. This option assures the most accurate calibration results.

Sometimes such a calibration is impractical or unnecessary. For example, masses are very large, or an easier calibration method (using another option) supplies satisfactory results.

The "one point calibration" requires only one weight. The weight is added or removed according to the instructions.

When circumstances don't allow removal of the weight, use the "quick calibration" which includes two steps:

* First step: Start with no load.

* Second step: Add a known weight.

Calibration is complete - no need to remove the load!

Note: The accuracy of the quick calibration may be reduced under extremely exceptional conditions. Such a situation may happen if the maximum planned load is 10% or less of load cell capacity, **and** the weight used during the calibration process is 10% or less of the maximum planned load.

Note that in such a case calibration's weight is only 1% (or less) of the load cell capacity!

In spite of the exceptional conditions, the calibration will still work, but possibly with slightly less accuracy.

The user should respond with "3", "1" or "Q".

Comparing “three point”, “one point”, and “quick” calibration modes

The “*three point*” calibration procedure includes the following steps:

1. Empty scale
2. Some weight
3. Empty scale again
4. 1st weight (not necessarily the same one as in step #2)
5. 2nd weight
6. 3rd weight

(This is the minimum sequence, but some steps may repeat themselves.)

The “*one point*” calibration procedure includes steps 1-4 of the “*three point*” calibration. (As in the “*three point*” calibration procedure, some steps may repeat themselves.)

The “*quick*” calibration procedure involves only one weight. The sequence is:

1. Empty scale
2. Weight

Now, when comparing the three modes:

Obviously, the “*quick*” mode is much easier.

However, the “*three point*” mode has the following advantages:

- * The results of the calibration are more accurate as the card is used more efficiently.
- * The linearity of the weights is checked and in case of deviation larger than the "Accuracy" parameter the calibration will be rejected. This eliminates human mistakes while calibrating (for example, specifying a wrong value of the weight).
- * Due to the averaging, the effect of some inaccuracy in a weight is reduced.

The “*one point*” calibration is in the middle of the two other modes.

Finally, the user has to decide whether he prefers to have a more complicated calibration procedure but yielding better results (“*three point*” mode), or an easier one yielding less accurate results (“*quick*” mode), or some compromise (“*one point*” mode).

3. Units:

Ton, kg., gr., oz or lb.

The selected unit will be used in all weight displays.

4. Load Cell Division:

This is an "administrative" parameter serving for check whether the resolution that the user requires is beyond the stated specification of load cell's manufacturer. The user's required resolution is the quotient of the "Maximum Planned Load" and the "Display Resolution" parameters. For example, if "Maximum Planned Load" = 300 kg and "Display Resolution" = 0.1 kg, the implied resolution is $300/0.1=3000$. If load cell's resolution, as inserted by the user in the "Load Cell Division" parameter, is less than 3000 (say 2000), then the calibration program warns the user: "Display resolution too high". This warning is only a tip - the user may ignore it and confirm the parameters in spite of the conflict, being aware that his requirement is actually higher than the load cell - theoretically - supplies.

5. Maximum Planned Load:

The maximum net weight to be measured by the load cell.

6. Accuracy:

The maximum permitted deviation from linearity, which will still be acceptable.

This parameter is relevant only in the case of "three point calibration" (parameter number 2), where the various weights usually have some deviation.

Should a larger deviation result during the calibration process, an error will be shown (see section 2.4.2.1.5.4).

7. Display Resolution:

Resolution of the displayed weight.

After all calibration values have been inserted, the following warning may be displayed:

Display resolution too high - accept?

This message indicates that there is a conflict within the specified Load Cell Division, the Maximum Planned Load and the Display Resolution (parameters number 4, 5 and 7, respectively).

However, as described in paragraph 4 above, the user is permitted to override the warning and proceed. A "Y" (Yes) answer overrides the warning, and an "N" (No) answer enables the user to specify new parameters.

Following a successful entry of parameters, the user is presented with the message:

Confirm calibration parameters?

Answering "Y" (Yes) confirms the parameters. An "N" (No) answer enables the user to specify new parameters.

2.4.2.1.2 STEP 2 - HARDWARE CALIBRATION

This step is indicated by a "Hardware cal." message in the "mode" line of the READINGS window.

This step sets internal card zero and gain.

For one point calibration, the step takes place only once. For three-point calibration, the step is repeated two or more times, in order to attain the best performance.

1. Press the space bar when you are ready to sample tare (dead load). BEWARE OF ACCIDENTALLY PRESSING THE SPACE BAR IF THE SCALE IS NOT

EMPTY!

2. Place a weight on the load cell. The recommended value of the weight is around 70% of the maximum planned load. When ready, type in its value and press <Enter>.

At this point the READINGS window should report current A/D points, but the weight is still unknown.

2.4.2.1.3 STEP 3 - SOFTWARE CALIBRATION

This step is indicated by a "Software cal." message in the "mode" line of the READINGS window.

A new "GAINS" window appears below the READINGS window, displaying the accepted gain(s), so that the user may calculate the ratio between the weights used.

Except in very sophisticated cases, no action with the GAINS window is required.

Next...

1. Press the space bar when ready to sample dead load (and set the zero point).
2. Place a weight on the load cell. This weight is not necessarily the same one as used in STEP 2 (section 2.4.2.1.2).
3. Type the weight value and press <Enter>.
4. Only for three point calibration:
 1. Place a second weight and enter its value when ready.
 2. Place a third weight and enter its value when ready.

NOTES:

1. **This is the minimum sequence, but it may occur that more repetitions will be required.**
2. **The recommended value of the total weight is around 70% of the maximum planned load, in any case not more than 95%.**
3. **Each sampled point results in an associated gain display in the GAINS window.**

2.4.2.1.4 CALIBRATION COMPLETION

After the hardware and software calibration have been completed, the user is asked:

Press any key to exit calibration check.

Before the user exits by pressing a key, the calibration may be checked by changing the weight applied. The response time in this mode is large, so that fast fluctuations are **not** displayed. Once a key has been pressed, the following message is displayed:

Please wait...

after which the LCIC main menu appears.

Calibration data is stored in file CALIB1.SET and/or LIST1.SET for the first LCIC card, CALIB2.SET and/or LIST2.SET for the second one (if exists), etc. Cards' sequencing is same as with the SEGx files - refer to note 2 at the end of section A.2.2.

2.4.2.1.5 POSSIBLE CALIBRATION ERRORS

2.4.2.1.5.1 CHECK LOAD CELL WIRING

This error may occur during the hardware calibration in two cases:

- * Incorrect load cell wiring.
- * Calibration procedure has not been followed correctly.
For example, after tare (empty scale) sampling, a weight has been removed instead of being added.

2.4.2.1.5.2 TARE (DEAD LOAD) FAILURE

Should this error occur during the tare operation, the A/D reading is too high or too low. This may occur if the load cell is not working properly. Alternatively, it may occur when using a very **high** tare (around full load cell capacity), and a very **low** Maximum Planned Load (about 1-2% of load cell capacity).

To resolve this problem, re-enter the Maximum Planned Load slightly higher or lower (refer to section 2.4.2.1.1, parameter #5).

For example:

Assumed full scale load cell capacity 10kg

Tare (dead load) 8kg

Maximum planned load 2kg

Resolution 0.001 kg

Repeat the calibration procedure with slightly different Maximum Planned Load such as 1.8 or 2.2 kg.

2.4.2.1.5.3 WEIGHT IS TOO SMALL

Occurs during the software calibration when the weight used is too small to assure accuracy. Select a heavier weight to resolve the problem.

2.4.2.1.5.4 NONLINEAR WEIGHT

Occurs during the software calibration when the ratio between the two gains has exceeded the specified Accuracy (parameter number 6 in section 2.4.2.1.1).

Check the GAINS window and...

- * Restart the process from the point of dead load sampling

or

- * Re-enter the last weight.

The second option is useful when the value of the last (current) weight was misspelled.

2.4.2.1.5.5 WEIGHT NOT WELL ACCEPTED

Occurs in case of unstable load cell. The system returns to the 'Zero' stage prompting the user to press 'Z' so he'll surely notice the case.

2.4.2.1.6 RESTORING CALIBRATION FROM LIBRARY

If you answered "Y" to the question...

Restore calibration from library?

(see section 2.4.2.1) - you will see a list of the calibrations saved in the library.
The list includes following columns:

1. Name - calibration's name as inserted by the user (parameter #1 in section 2.4.2.1.1).
2. Date - calibration's date, as inserted automatically by the system after calibration (note that date format depends on "COUNTRY" in the CONFIG.SYS file).

Additionally, the current calibration is titled by "actual:".

At this point, the user may take one of the following actions:

1. Scan the list by <Up>, <Dn>, <PgUp> & <PgDn> keys.
2. Select the highlighted calibration by <Enter>, making it the new actual.
3. Delete the highlighted calibration by pressing .

Note: In order to avoid human mistakes, the actual calibration **cannot** be deleted.

In case you really need to delete the actual calibration, first select another calibration as actual.

4. Quit by <Esc>
(the highlighted calibration does **not** become actual).

DIRECT RESTORING FROM USER'S APPLICATION

There's an additional means to restore a calibration from the library, without using the LCIC.EXE - the DLOAD utility. Its advantages are:

- * DLOAD doesn't require manual interaction and is therefore better suited for automated operation.
- * DLOAD is available within user's application program.

For details refer to Appendix D.

2.4.2.2 F3 - ZERO (previously "TARE")

The ZERO function is used to define a new zero weight. First, the following message appears:

WARNING - Actual calibration parameters will be lost. Continue?
--

...preventing the user from accidentally starting the ZERO process.

The loss of the actual calibration parameters is not "certain". It might occur only if the new zero differs significantly from the original one. If the loss does occur, then a new full calibration will be required.

When ready, the user should press the space bar to sample the new zero.

2.4.2.3 F4 - INTEGRATION

The card includes an integrator that averages the raw readings of the A/D, thus supplying a much more stable value. The level of the integration is controllable by the Integration Factor (IF) so that the user may fit it to the application.

The IF may be set to one of eight levels - from 0 to 7. While a higher IF results in more stable readings, it increases exponentially Card Response Time (see section 6).

IF = 0 specifies the lowest level of integration.

Useful when the user prefers to process the raw A/D readings by his own program.

IF = 7 specifies the highest level of integration.

Useful when the user does not average the readings by his own program.

Obviously, the values of 1 through 6 are mean levels.

For **very fast** material flow, select level 0 through 3.

For **normal** material flow, select level 4 through 7.

Type in the INSTRUCTION window the required IF.

2.4.2.4 F5 - FILTER ON/OFF

This switch turns the Digital Filter feature ON or OFF. When ON, variations due to noise are reduced due to a mechanism that disregards unacceptable readings caused by random disturbances. This feature is useful if the user has NOT implemented a filtering algorithm in his application program, and the process is relatively slow. Alternatively, with the Digital Filter OFF, the user can implement a filtering algorithm more specific to his application. The default (preset) value of the Digital Filter is ON. Unless user's application program implements filtering, it's recommended to leave the Digital Filter in the default ON state.

Refer also to section 6 - Card Response Time.

2.4.2.5 F6 - SAMPLING RATE

The Sampling Rate (SR) parameter should only be changed by the advanced applications programmer. The Sampling Rate is the time interval between consecutive samplings of the A/D. SR is adjustable over the range 2 to 12 ms in 0.5 ms steps.

The default (preset) SR is 2.5 ms, which provides a satisfactory performance for most applications, both static and dynamic.

The Sampling Rate's value is displayed in the Parameters window of the LCIC display (refer to section 2.4.1.2).

Refer also to section 6 - Card Response Time.

Notes:

1. In LCIC.EXE versions 5.03 or lower, SR is set through the Sampling Rate Factor (SRF) as follows:
$$SR = 2 \text{ ms} + SRF \times 0.5 \text{ ms.}$$

E.g. SRF = 8 results in SR=6 ms.
2. The 2.5 ms default refers to card version 14 and on. Lower version's default is higher.

2.4.2.6 F7 - CALIBRATION LOCK OPTION

The Calibration Lock option is used to block unauthorized access to the calibration and to the parameters. This is particularly essential for the inspection authorities.

Provided that a "Protection Plug" is connected to the parallel port of the PC (LPT1), the user may "Lock" or "Unlock" the calibration state of the card.

Once the "Lock" procedure has been applied, the current calibration becomes permanent until the next "Unlock" operation. Since the "Unlock" procedure requires the Protection Plug, an unauthorized access to the calibration is blocked. Reading the A/D and the weight, as well as the I/O check function, are still available also when calibration is locked.

The procedure for **locking** a calibration is:

- * Connect Protection Plug
- * Press F7 to Lock
- * Remove Protection Plug

The procedure for **changing** a locked calibration is:

- * Connect Protection Plug
- * Press F7 to Unlock
- * Press F2 and perform Calibration
- * Press F7 to Lock
- * Remove Protection Plug

2.4.2.7 F8 - I/O CHECK

The I/O Check permits the user to inspect the I/O states of the optional I/O Piggyback card and to change the outputs.

Changes to the outputs can be accomplished in two ways:

1. SINGLE OUTPUT CHANGE

- * Select the output to be changed by moving the displayed frame using the right and left arrow keys.
- * Press the space bar to toggle the output state.

2. MULTIPLE OUTPUT CHANGE

- * Press the F2 key to toggle **all** output states.

3. PROGRAMMING INFORMATION

The LCIC is memory-mapped in PC memory in a region which is normally not in use. The user may communicate with the LCIC card by almost any programming language according to the following description.

DATA FORMAT

There are two LCIC load cell reading formats:

1. ASCII representation.
2. Floating point representation.

The float format used conforms to the IEEE 32 bit standard and supports 24 bit of precision. The upper bit (MSB) of the mantissa is always a '1' and is therefore not stored.

Using the floating-point format significantly accelerates the rate of the bus data updating. It provides the ability to update the PC bus each ~3 ms.

Refer to example #3 in C (EX3_C.C) & example #2 in BASIC (EX2_B.BAS) in the \EXAMPLES subdirectory of the LCIC DOS Utilities diskette for usage of the floating point representation. Additional examples for the Windows programmer are supplied in the "Drivers and Utilities for Windows" diskettes.

MEMORY BLOCK ADDRESSING

The address of each card register is composed of two parts:

- * SEGMENT - the address of the specific CARD.
- * OFFSET - the address of the specific REGISTER.

The SEGMENT part is actually a base address assigned to each card by the MEMCHECK installation utility, allocating the card a unique address range within the upper memory area of the PC (refer to appendixes A & I). The SEGMENT values (in hex.) reside in a series of "SEGx" files (SEG1., SEG2., etc.) created by the MEMCHECK utility during the installation. For example, if one card has been installed using the factory preset adjustment, the file "SEG1." contains the text "CE40" which represents the card's SEGMENT. The OFFSET part of the address assigns the location of each register, as described in the following table:

REGISTER	OFFSET (hex)	NOTES	
LOAD CELL READING	0350	ASCII: Null terminated string, 16 characters max.	
	03A0	FLOAT: IEEE Standard, 32 bit.	
LOAD CELL FLAG	0304	Data Request	ASCII: Write 0 FLOAT: Write 5.
		Data Ready	Read 1.
LCIC OUTPUTS	0309	All 8 bits	
LCIC INPUTS	030A	4 low bits	
CENTER OF ZERO	0306	ON: 12 (Hex).	
		OFF: 21 (Hex).	

GENERAL LOAD CELL READING PROCEDURE

To get a current reading, issue a "Data Request", wait for "Data Ready" indication, then read the data. More specifically:

1. Request a reading by writing 0 (for ASCII) or 5 (for FLOAT) into LOAD CELL FLAG.
2. Wait until LOAD CELL FLAG becomes 1.
3. Get the current reading residing in LOAD CELL READING (offset 0350 for ASCII, 03A0 for FLOAT).

READING MULTIPLE CARDS

The procedure of reading multiple cards is identical, except that the SEGMENT portion of the address changes for each card.

For example:

Suppose that...	...then to read FLOAT data -
SEG1. contains C7C0	address of card #1 is C7C0:03A0
And	and...
SEG2. contains CE80	address of card #2 is CE80:03A0

PROGRAMMING EXAMPLES

(Suppose that SEG1. and SEG2. are still as above)

1. C Language, Load cell reading of card #1:

```
float far* FLOATPTR ;
float RESULT ;
FLOATPTR = (float *far) MK_FP (0xC7C0, 0x03A0) ;
RESULT = *FLOATPTR ;
```
2. PASCAL Language, Load cell reading of card #2:

```
var FLOATPTR : ^single ;
RESULT : single ;
FLOATPTR := ptr ($CE80, $03A0) ;
RESULT := FLOATPTR^ ;
```
3. BASIC Language, Load cell reading of card #2:

```
DEF SEG = VAL("&H" + CE80)          ' Set segment
F$ = CHR$(PEEK(&H3A0)) + CHR$(PEEK(&H3A1))
+ CHR$(PEEK(&H3A2)) + CHR$(PEEK(&H3A3)) ' Read 4 bytes
RESULT$ = CVS(F$)                  ' Convert 4 bytes to single precision
```

INTERRUPT CONVERSATION MODE

(Available for card version 12 and upward.)

Interrupt conversation mode with the PC is available either. For demonstration, refer to file TIMING.CPP in the \EXAMPLES subdirectory of the LCIC DOS Utilities diskette. This mode uses PC interrupts (IRQ9). To use this mode, the JP4 jumper (at the bottom of the LCIC card) should be connected.

PROGRAMMING IN WINDOWS

Refer to Appendix B for information how to program in Windows.

RESTORING A CALIBRATION FROM LIBRARY

The programmer is able to restore a calibration previously saved in the calibrations library, as done by the "restore calibration from library" function of the LCIC calibration utility (section 2.4.2.1.6). For details refer to Appendix D.

4. RUNNING A PROGRAM (USER'S OR A SAMPLE)

Using the programming information supplied in the previous section, the user may create his own application program. A sample program, supplied in \EXAMPLES subdirectory of the LCIC DOS Utilities diskette, may be run as well. In both cases, INIT should be activated before running the program, and FINISH afterwards (refer to sections 2.2 & 2.3). However, to facilitate software development, only **one** INIT is required as long as the PC is not turned off, and FINISH has not been run. For ease and reliability, a batch file like the following may be used (two LCIC cards are assumed):

```
@ECHO OFF
INIT 2
IF ERRORLEVEL 4 GOTO ERR4
IF ERRORLEVEL 3 GOTO ERR3
IF ERRORLEVEL 2 GOTO ERR2
IF ERRORLEVEL 1 GOTO ERR1
user's application program / sample program
FINISH
GOTO EXIT
:ERR1
ECHO No calibration, or missing parameters.
GOTO EXIT
:ERR2
ECHO Critical hardware error.
GOTO EXIT
:ERR3
ECHO Missing SEGx file.
GOTO EXIT
:ERR4
ECHO Number of cards detected mismatch.
:EXIT
@ECHO ON
```

The LCIC utility, however, is an exception:

The INIT & FINISH are included integrally, so there is no need to run them separately.

5. LCIC OPTIONS

5.1 OPTIONAL I/O PIGGYBACK CARD

DESCRIPTION

The optional I/O piggyback card turns the LCIC into a control system. Due to its four inputs and eight outputs (all opto-isolated), the option permits control of external or program events. The I/O's are accessible both by the software supplied and by user's application program. The I/O piggyback card mounts onto the LCIC card - no additional slot in the PC is needed.

- An external 5 to 30 VDC supply is required.
- All the outputs are transistors in current source mode.
- The outputs are FAIL SAFE, requiring careful system integration.
I.e., if the external DC supply is on and the computer is still off, all the outputs are in ON state.
In other words, the situation that all the outputs are ON indicates computer/card failure.
- Maximum current per output: 80 mA.
- For I/O check by the LCIC.EXE utility refer to section 2.4.2.7.
- For wiring information refer to drawing #3 or to Appendix H.2.
- For input/output connections refer to drawings #4 and #5.

RECOMMENDED OUTPUT PRACTICES

1. PLC (Programmable Logic Controller): Connect all eight outputs to the PLC. Program the PLC to recognize a power failure when all eight outputs are high.
2. Discrete Relays: Dedicate a free output to signal a power failure.
3. Power Sequencing: Always turn on the PC **before** applying power to the LCIC external power supply, to avoid false failure indications at startup.

PROGRAMMING - I/O ADDRESSING

- The four inputs are accessible via the low order bits of the LCIC INPUTS register - bits 0 through 3 correspond to inputs 1 through 4, respectively.
- The eight outputs are accessible via the eight bits of the LCIC OUTPUTS register - bits 0 through 7 correspond to outputs 1 through 8, respectively.
- For details on the INPUTS and OUTPUTS registers, see section 3 (Programming Information), "MEMORY BLOCK ADDRESSING" paragraph.

5.2 OPTIONAL RS232

With the RS-232 option the LCIC card may communicate with the "external world", supplying the weights of the load cell(s) to a remote device (such as a computer or terminal).

The string transmitted is composed of the following:

1. Weight in ASCII;
2. Null string terminator (0).

The transmission rate is one string every two seconds. Communication characteristics: 2400 Baud, 1 stop bit, 8 data bits, parity none, RTS/CTS hardware handshake.

Refer also to drawing #6.

6. CARD RESPONSE TIME

Card Response Time (CRT) is the time required by the card to respond with a stabilized reading after a change at its input.

CRT depends on the following factors:

- * INTEGRATION FACTOR (IF) (programmable by F4, section 2.4.2.3)
- * FILTER ON/OFF SWITCH (programmable by F5, section 2.4.2.4)
- * SAMPLING RATE (SR) (programmable by F6, section 2.4.2.5)

When the Filter switch is ON, the A/D readings are filtered. Changing the filter switch does not influence the response time significantly. It's highly recommended to leave the filter switch in the default ON selection.

CRT can be approximated by the following formula:

$$\text{CRT} = \text{SR} \times 2^{\text{IF}+1}$$

CRT is linearly proportional to Sampling Rate.

For example, assume SR = 2.5 ms and IF = 7 (the default values), then:

$$\text{CRT} = 2.5 \text{ ms} \times 2^{7+1} = 640 \text{ ms}$$

It's recommended to use:

- * The default (preset) SR: 2.5 ms.
- * The maximal IF that still results in CRT that satisfies the application.

Note:

The above default values relate to card version 14 and on.

7. TROUBLESHOOTING

7.1 BUS SPEED

If the PC bus speed is much higher than the ISA standards, it may occur that "BAD RAM" or "CARD COMMUNICATION FAILURE" error message appears, or the screen is not updated during the calibration process.

In such a case, the clock speed of the PC should be reduced using the BIOS SETUP PROGRAM, modifying a parameter such as "clock speed", "divide clock by", "ISA CLK Speed" etc. E.g., if "divide clock by" is 2, change it to 4.

7.2 ABORTED CALIBRATION

In case of POWER FAILURE or RESET while running the calibration utility (LCIC.EXE), the card is liable to stay in a transitional state, being **uncalibrated**: The old calibration was already wiped out, while the new one has been aborted. In such a case, running the INIT.EXE utility will lead a "BAD RAM" or "CARD COMMUNICATION FAILURE" error message.

In order to avoid it, take the following steps:

- * Turn the PC off.
- * Turn the PC on.
- * Re-calibrate the card using the LCIC.EXE utility.

NOTE: **Do not** run your application program, nor the INIT.EXE utility, prior to the re-calibration! Otherwise, the "BAD RAM" or "CARD COMMUNICATION FAILURE" message will re-appear.

APPENDIX A - INSTALLATION

The software package includes a utility named MEMCHECK which can detect a free location available for the LCIC dual port RAM (described in section 1.2). Once such location has been found, the LCIC card should be adjusted accordingly by a DIP switch. The MEMCHECK utility automatically creates a file named "SEG1.", containing the segment address of the location detected (refer to Appendix I). If there are several LCIC cards, **some** "SEGx" files are created - SEG1., SEG2., SEG3., etc.

However, refer first to "Quick Installation", that might simplify the procedure for single LCIC card.

A.1 QUICK INSTALLATION

Trying to save your time, the card has already been factory preset, and a corresponding SEG1 file is already supplied on LCIC DOS Utilities diskette. Both have been set to address CE40 (2nd selection in Appendix I). The DIP switch setting on the LCIC is as follows:

S1	S2	S3	S4
OFF	ON	ON	ON

If the default address is not occupied, you may skip the full "STEP BY STEP INSTALLATION" (section A.2) and carry out the following sequence:

1. Review the CONFIG.SYS file on your boot diskette/hard disk with any text editor. If there's a DEVICE=C:\DOS\EMM386.EXE statement, append "AUTO X=C000-CFFF" to that statement. (It will look like:
DEVICE=C:\DOS\EMM386.EXE AUTO X=C000-CFFF)
2. There are two types of installation diskettes:
#1: LCIC – DOS UTILITIES DISKETTE
#2: LCIC – DRIVERS AND UTILITIES FOR WINDOWS
In order to operate the LCIC card under DOS, just copy the files in the root of diskette #1 to your hard disk. However:
* More advanced applications might require file(s) from diskette #1 subdirectories (EXAMPLES and \LOAD_CAL).
* The Windows programmer needs the type #2 diskettes, and should refer to Appendix B. Preferably, backup the diskettes.
3. Turn the PC OFF, remove its cover and locate a free ISA slot.
4. Install the LCIC card inside the free ISA slot. **MAKE SURE THAT THE BOARD CONNECTOR IS WELL INSERTED INTO THE SLOT. Do not** close the cover yet.
5. Turn the PC ON. Watch LCIC card's LEDs. The LED marked as STATUS LED in drawing #1 should blink non-uniformly. The others should light up. If this is **not** the case, then:
* Turn the PC OFF.
* Try to re-install the LCIC card in the slot.
* Turn the PC ON.
* If LEDs' status is correct, proceed to step 6.
* Otherwise (LEDs' status is still wrong), there might be a problem with the connector of the selected ISA slot.
* Turn the PC OFF.
* Locate another free ISA slot.
* Return to step 4.
6. Use the subdirectory where you installed the LCIC software package in step 2.
7. Run the LCIC.EXE program (the calibration utility).

8. If the main screen of the calibration utility appears, your card is properly installed and ready for use - close the PC's cover and proceed with the calibration.
9. If your computer "hangs up", or displays any message such as "Please wait" or "Please shut off your computer" - the preset address is conflicting with some other device in your system. Please refer to the "STEP BY STEP INSTALLATION" procedure.

A.2 STEP BY STEP INSTALLATION (MEMCHECK)

A.2.1 BEFORE THE INSTALLATION PROCEDURE...

A.2.1.1 CONFIG.SYS UPDATE

Review the CONFIG.SYS file on your boot diskette/hard disk with any text editor. If there's a DEVICE=C:\DOS\EMM386.EXE statement, some steps should be taken before carrying out the installation procedure to eliminate memory conflicts with the card(s).

Either of the following two procedures will do the job. However, in case you already carried out the "quick installation", sequence "a" is **almost** done - except the range of the "X" field that should be as specified in para. a.1.

a. Manual modification of the DEVICE=C:\DOS\EMM386.EXE statement

- a.1 Include in the beginning of your CONFIG.SYS file the statement:
DEVICE=C:\DOS\EMM386.EXE AUTO X=C000-EFFF
- a.2 Re-boot your PC.
- a.3 Apply the LCIC installation procedure and make sure that the INIT operation completes successfully.

b. Automatic modification of the DEVICE=C:\DOS\EMM386.EXE statement

- b.1 Remove the EMM386.EXE statement from CONFIG.SYS (alternately, you may put REM in the beginning of this statement).
- b.2 Re-boot your PC.
- b.3 Apply the LCIC installation procedure and make sure that the INIT operation completes successfully.
- b.4 Run MEMMAKER.EXE (available in DOS version 6 and up). This utility will recognize your installed card(s) and return to CONFIG.SYS a revised DEVICE statement with such parameters that consider the new card(s), so that no memory conflicts will occur.

A.2.1.2 COPYING THE SOFTWARE PACKAGE

There are two types of installation diskettes:

#1: LCIC – DOS UTILITIES DISKETTE

#2: LCIC – DRIVERS AND UTILITIES FOR WINDOWS

In order to operate the LCIC card under DOS, just copy the files in the root of diskette #1 to your hard disk. However:

- * More advanced applications might require file(s) from diskette #1 subdirectories (\EXAMPLES and \LOAD_CAL).
- * The Windows programmer needs the type #2 diskettes, and should refer to Appendix B. Preferably, backup the diskettes.

A.2.2 THE INSTALLATION PROCEDURE

The step by step installation process includes three passes, each requiring execution of the MEMCHECK utility.

The task of this utility is to locate free space in the PC memory available for the dual port RAM of the card(s).

* In pass one, the utility prompts the user for the ROM version number of the card to be installed, then starts its examination of the PC memory configuration.

* In pass two, the utility completes the examination of the PC memory configuration and displays the available locations. Once this pass has been completed, the user selects an available address location by setting a DIP switch in the card.

* Pass three reports how many cards have been recognized.

Note: In passes one and two the card(s) are **out** of the PC. The card(s) are inserted during the third pass.

Pass one

(Card(s) **not** inserted in the PC.)

1. Use the subdirectory where you installed the software package in step A.2.1.2.
2. Run the MEMCHECK.EXE program. Utility responds with:

```
MEMCHECK  free memory utility  Ver 2.00 (June 1993)
Enter  Card Version  -
```
3. Type the card version number obtained by carrying out the second way described in section 1.3 (Card Version), e.g., 013.
4. Turn the PC OFF.

Pass two

(Card(s) still **not** inserted in the PC.)

1. Turn the PC ON.
2. Use the subdirectory where you installed the software package in step A.2.1.2.
3. Run the MEMCHECK.EXE program.

MEMCHECK responds with a report dividing the PC memory locations into three categories:

1. Locations definitely available.
2. Locations definitely not available.
3. Locations that may be available.

4. Set card's DIP switch accordingly. Refer to "MEMORY SELECT" circle in drawing #1. To determine the actual memory addresses corresponding to DIP switch setting, consult the table of Appendix I.
5. Turn the PC OFF.

Pass three

(The PC is still turned OFF!)

1. Remove PC cover and locate a free ISA slot.
2. Install the LCIC card into the free ISA slot. MAKE SURE THAT THE BOARD CONNECTOR IS INSERTED WELL INTO THE SLOT. Do **not** close the cover yet.
3. Turn the PC ON. Watch the LCIC card's LEDs. One of them, marked as STATUS LED in drawing #1, should blink non-uniformly. The others should light up. If this is **not** the case, then:
 - * Turn the PC OFF.
 - * Try to re-install the LCIC card in the slot.
 - * Turn the PC ON.
 - * If LEDs' status is correct, proceed to step 4.
 - * Otherwise (LEDs' status is still wrong), there might be a problem with the connector of the selected ISA slot.
 - * Turn the PC OFF.
 - * Locate another free ISA slot.
 - * Return to step 2.
4. Use the subdirectory where you installed the software package in step A.2.1.2.
5. Run the MEMCHECK.EXE program.

MEMCHECK responds with the number of cards that have been recognized.
6. Turn the PC OFF.
7. Turn the PC ON.
8. Use the subdirectory where you installed the software package in step A.2.1.2.
9. Run the LCIC.EXE program (the calibration utility) - refer to section 2.4. The main screen of the calibration utility should appear, indicating that your card is properly installed, ready for use - proceed with the calibration.
10. Close PC's cover.

Notes:

1. NUMBER OF CARDS DETECTED.

The number of cards detected may be less than the actual number of cards inserted. If this occurs, check whether two cards have the same DIP switch settings. Alternatively, MEMCHECK may fail to recognize a card because of some other memory conflict. In this case, please consult note 3.

2. SEGx FILES.

MEMCHECK creates one or more files called "SEGx", where x = 1, 2, 3,... corresponding to the number of cards recognized. Each SEGx file contains a four-character ASCII text identifying the segment address allocated for the corresponding card.

The sequencing of the files relates to the order in the list displayed in pass two.

Example: If three cards are installed and respectively set to the 3rd, 4th and 7th DIP switch settings (as shown in Appendix I), the SEGx files would contain the following:

FILE NAME	SEG1	SEG2	SEG3
CONTENTS	CE80	CEC0	CF80

The user is **not** involved in the creation and use of these files, but he should be aware that they are necessary for proper operation of the LCIC and they should not be deleted or modified.

3. MEMORY CONFLICTS.

In most cases, one or more of the addresses that MEMCHECK identifies as available will work OK. However, there is the remote possibility, that none of those addresses are actually available.

In this case:

1. Check the contents of your CMOS RAM, in particular the CACHE options. Turn off the cache for any locations that the card(s) might occupy.
2. Check the contents of your CONFIG.SYS file to ensure that no memory address conflicts with a TSR (Terminate and Stay Resident) program or a driver.
3. Similarly, check the contents of your AUTOEXEC.BAT file to eliminate TSR or driver conflicts.
4. Sometimes, other add-on cards made by various manufacturers might use the same address, so another location should be selected for the LCIC. Specifically, check your display controller.

SUMMARY OF STEP BY STEP INSTALLATION

1. Examine and modify if necessary the CONFIG.SYS file.
2. Copy files from the LCIC installation diskette(s).
3. Do **not** install card(s).
4. Run MEMCHECK.
5. Turn PC OFF & ON.
6. Run MEMCHECK.
7. Select LCIC location(s) according to the data supplied.
8. Turn PC OFF.
9. Install card(s).
10. Turn PC on.
11. Run MEMCHECK.
12. Turn PC OFF & ON.
13. Run LCIC.EXE.

APPENDIX B: HOW TO ACCESS THE LCIC CARD IN WINDOWS

The LCIC – DRIVERS AND UTILITIES FOR WINDOWS diskettes contain the required files for the Windows programmer supplying the following functions:

- * INIT
- * FINISH
- * Get weight reading in float mode
- * Get input status
- * Set output status
- * Get output status

To avoid conflicts, make sure that only one task communicates with the LCIC simultaneously.

There are the following packages for the various environments:

For Windows 3.x:

- * The "DLL" package, compressed into DLL.ZIP, supporting Borland 4.02 C++ and Microsoft Visual Basic 3.0 users.

For Windows 95/98:

- * The "OCX" package, compressed into OCX.ZIP, supporting Visual C++ 5.0, Visual Basic 5.0 and more. Usually, this is the recommended package for the Windows 95/98 programmer.
- * The "VxD" package, compressed into VXD.ZIP, to cover environments where the "OCX" package is not applicable.

Retrieve the package that satisfies your requirements using an unzip utility.

After installing the driver, install (in this sequence) the LcicConfig98, the LcicWin and (optionally) the SmartWin, as described below.

For Windows NT:

Unzip the file 'Windows NT Driver.zip' and follow the instructions in LCIC_NT.Doc, including running LcicCfg.exe.

After installing the driver, install (in this sequence) the LcicWin and (optionally) the SmartWin, as described below.

B.1 LcicConfig98

The LcicConfig98 is the configuration utility for the Win95/98 user.

Installation

PLEASE READ THIS SECTION ***BEFORE*** RUNNING SETUP.EXE!!!

* Make sure that your PC includes:

- * Pentium processor
- * One free ISA bus slot for the LCIC-1106a
- * Win95 or Win98 operating system

* The following Microsoft system files are needed for the LcicConfig98 program. Normally, they already exist in your system folder (\\Windows\\System). However, if any of them is missing, please download from the web.

The files are:

- * ADVAPI32.DLL
- * GDI32.DLL
- * KERNEL32.DLL
- * MFC40.DLL
- * MSVCRT.DLL
- * MSVCRT40.DLL
- * USER32.DLL
- * WINMM.DLL

* Run SETUP.EXE. The recommended destination directory to be specified during the setup is a new folder allocated for the LCIC installation.

USAGE

The usage of LcicConfig98 is simple. It is based on 'trial and error'. Insert your LCIC card(s) to ISA slot(s) while your PC is off, then turn it on and run LcicConfig. Make sure that your taskbar does not hide part of the information; there should be two columns of eight squares each. If the taskbar disturbs, reduce it. You should see each recognized card on the screen to the right of its address and DIP switch adjustment (refer to appendix I). In case you do *not* see a card, it means that the address implied by its DIP switch causes some hardware conflict. You may change carefully the DIP switch while your PC is on, consulting the table in appendix I. Make sure to use only an isolated tool in order to avoid damage to your PC components. The LcicConfig98 utility scans continuously all potential addresses, so it will immediately indicate if a suitable address was selected. To validate the suggested configuration click 'OK, I accept current configuration of the card(s)'. In case of more than one card, you may number the cards in a different order before validating. The LcicConfig98 utility produces files (Seg1, Seg2, etc.) containing the information about the address of each card. These files will be used by the Calibration utility and by your own applications. Therefore, make sure to rerun the LcicConfig98 utility upon any change in your configuration – either adding/removing a card, or changing card's address (via its DIP switch).

B.2 LcicWin

LcicWin is the calibration utility for Windows 95/98/NT, supplying friendlier interface than the older DOS utility (LCIC.EXE). Yet, the veteran LCIC.EXE serves as a backup utility for LcicWin.

Installation

PLEASE READ THIS SECTION ***BEFORE*** RUNNING SETUP.EXE!!!

- * Make sure that your PC includes:
 - * Pentium processor
 - * One free ISA bus slot for the LCIC-1106a
 - * Win95 or Win98 or WinNT operating system
- * The following Microsoft system files are needed for the LcicWin program. Normally, they already exist in your system folder (\Windows\System on 95/98, \Winnt\System32 on NT). However, if any of them is missing, please download from the web.

The files are:

- * ADVAPI32.DLL
 - * GDI32.DLL
 - * KERNEL32.DLL
 - * MFC40.DLL
 - * MSVCRT.DLL
 - * MSVCRT40.DLL
 - * USER32.DLL
 - * WINMM.DLL
-
- * Run SETUP.EXE. The recommended destination directory to be specified during the setup is:
 - * For Win95/98:
The same folder where you installed LcicConfig98.
 - * For WinNT:
A new folder allocated for the LCIC installation.

USAGE

The various functions of the calibration utility are accessible in the LcicWin by an easier way compared with the DOS utility:

In order to...	(implemented in the DOS version by...)	apply ...	and refer to section...
Open Card	program start (automatically)	'Open'	-
Close Card	'Quit' (Alt+X)	'Close' or 'Quit'	-
Run a Manual (physical) Calibration	F2 + No	'New Calibration'	2.4.2.1
Restore a Calibration from Library	F2 + Yes	'Library', selection & 'Apply'	2.4.2.1.6
Zero	F3	'Zero'	2.4.2.2
Change Integration	F4	'Change Parameters'	2.4.2.3
Change Sampling Rate	F6	'Change Parameters'	2.4.2.5
Run I/O Check	F8	'I/O'	2.4.2.7

Note: The following functions are obsolete and are not supported by the LcicWin:

- Turning the Digital Filter ON and OFF (section 2.4.2.4). The filter is now constantly ON.
- Calibration Lock option (section 2.4.2.6). The card is now constantly 'unlocked'.
- The Multi Calibration feature (appendix E).
- The Batch feature (appendix F).

DOS Calibration Utility as a Backup for LcicWin

As already mentioned before, the veteran DOS calibration utility serves as a backup for the LcicWin in case of a problem (which hopefully will never occur...).

However, you should be aware that the LCIC Card Number is the same in the DOS utility and in LcicWin. If you want to switch to the DOS utility, make sure that the Card Numbers are successive, starting at one; i.e., 1, 2, 3... If you renumber your cards, consider the fact that the files LIST*i*.SET and CALIB*i*.SET (section 2.4.2.1.4) contain your calibration data of card number *i*, so you have to rename their filename correspondingly in order to keep synchronization between the card(s) and the files. In order to run the DOS utility, follow the following steps:

* In Win95/98:

Click 'LcicDos.exe' in the folder of LcicWin.

* In WinNT:

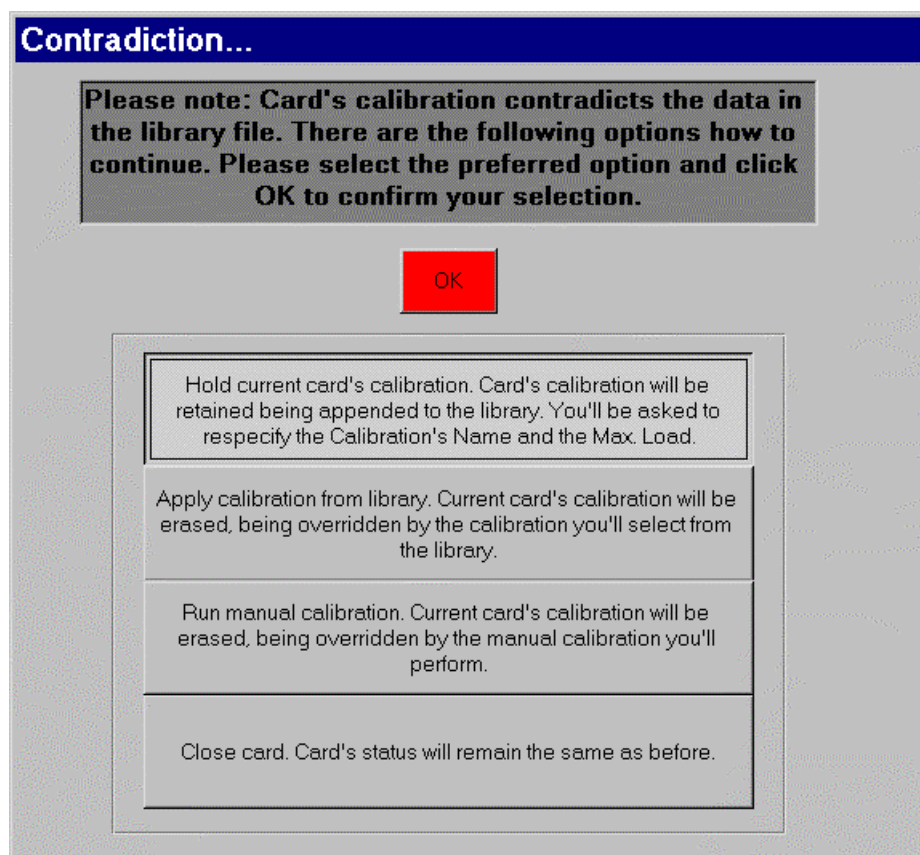
Power on your PC from DOS bootable diskette.

Change directory to the folder of LcicWin.

Run 'LcicDos'.

First Running

Upon the first running of LcicWin, you might get the following screen:



This is not a problem, just indicates that the information read from the file (on disk) was found to be not identical with that read from the card. The simplest way to continue is selecting the default (highlighted) option, appending card's calibration to the library, so next running will be smooth. Specify some new Calibration Name and the current Maximum Load. Based on the information read from the card, some approximation for the Maximum Load will be suggested; either accept it 'as is', or change it slightly to the actual value.

B.3 SmartWin

SmartWin is an auxiliary utility for Windows 95/98/NT, supplying friendlier interface and better performance than the older DOS utility (SMART.EXE).

Installation

PLEASE READ THIS SECTION ***BEFORE*** RUNNING SETUP.EXE!!!

- * Make sure that your PC includes:
 - * Pentium processor
 - * One free ISA bus slot for the LCIC-1106a
 - * Win95 or Win98 or WinNT operating system
- * The following Microsoft system files are needed for the SmartWin program. Normally, they already exist in your system folder (\Windows\System on 95/98, \Winnt\System32 on NT). However, if any of them is missing, please download from the web.

The files are:

- * ADVAPI32.DLL
 - * GDI32.DLL
 - * KERNEL32.DLL
 - * MFC40.DLL
 - * MSVCRT.DLL
 - * MSVCRT40.DLL
 - * USER32.DLL
 - * WINMM.DLL
-
- * Run SETUP.EXE. The recommended destination directory to be specified during the setup is a folder below the directory where you installed the LcicWin.

USAGE

Refer to 'SmartWin.txt' in the 'SmartWin' package.

APPENDIX C: THE CALIBRATION COUNTER

(Available for card version 13 and upward, using LCIC.EXE version 5.03 and upward.)

The "Calibration Counter", described below, supplies an indication whether the calibration has been changed since some previous state in the past. Such an indication might be a useful tool for a supervision authority.

The Calibration Counter (CC) is a numerator counting the modifications of calibration data on the card.

Completing either of the following operations increments the CC:

- * A physical (real) calibration
(F2+"NO", sections 2.4.2.1 through 2.4.2.1.5).
- * Restoring a calibration from calibrations library
(F2+"YES", sections 2.4.2.1 and 2.4.2.1.6, or
DLOAD utility, appendix D).
- * The "Zero" function
(F3, section 2.4.2.2).

The increment of the CC due to such operation is irrevocable - the user may **not** reduce it back or reset it. Therefore, the CC, which is displayed by the LCIC.EXE utility, clearly indicates whether the calibration has been changed since some previous position: identical CC's indicate that along the whole period between their reviews there were no changes in the calibration. Reviewing the CC supplies then a reliable tracing tool to detect whether the calibration has been changed or not.

The CC is **not** affected by the following operations:

- * Modifying Integration Factor (F4, section 2.4.2.3).
- * Turning Filter ON or OFF (F5, section 2.4.2.4).
- * Modifying Sampling Rate (F6, section 2.4.2.5).
- * Locking or Unlocking calibration (F7, section 2.4.2.6).

APPENDIX D: THE "DLOAD" UTILITY

(Available for card version 10 and upward.)

GENERAL DESCRIPTION

DLOAD (Down LOAD calibration) utility's operation is similar to the "restore calibration from library" function of the LCIC calibration utility (section 2.4.2.1.6). DLOAD's advantages are:

- * DLOAD doesn't require manual interaction and is therefore better suited for automated operation.
- * DLOAD is available within user's application program.

Upon completion, DLOAD reports its course to the caller, enabling him to flow accordingly. The "caller" may be either a batch file or a program, as demonstrated by the examples supplied.

The package is in the \LOAD_CAL subdirectory of the LCIC DOS Utilities diskette, consisting the following files:

- * DLOAD.EXE - The DLOAD utility.
- * DL.BAT - A batch file example invoking DLOAD.
- * EX01.C - A C program example invoking DLOAD.

USAGE

DLOAD <i> <name>

<i> card number - 1, 2, etc.

<name> required calibration name (case insensitive)

Upon successful operation, DLOAD returns the card to its original mode. Specifically, if the card was initialized, DLOAD turns it again to that mode after completing the "restore" operation. The mode "preservation" enables to invoke DLOAD by **user's program**, or DOS command line, advancing with user's application. The files EX01.C and DL.BAT illustrate how to invoke DLOAD by user's program and by a batch file, respectively.

RETURN CODE

By its completion, DLOAD reports its course to the caller, enabling him to flow accordingly. The report is supplied by a "return code", which is passed:

- * Through the "ERRORLEVEL" when the caller is a batch file.
- * Through routine's return value when the caller is a program (in EX01.C example program it's the value returned by "spawnl").

There are three categories of return codes:

- * Successful operation.
- * Non critical error - DLOAD failed to carry out the specified request, but no worsening in card's state.
- * Critical error - DLOAD failed to turn the card into a normal state. User should hardware reset the PC and run LCIC.

Refer to the following "return codes list".

RETURN CODES LIST**CRITICAL? (2)**

NAME (1)	VALUE		CODE DESCRIPTION
NO_ERRORS	0		NO errors (success).
ERR_ARGUMENT	1		Illegal number of arguments.
ERR_SEGMENT	2		Missing or illegal SEGn file.
ERR_CARD_UNCALIBRATED	4	Y	Uncalibrated card.
ERR_SOFT_VERSION	5		Incorrect card version. The utility supports LCIC card versions 10 and upward.
ERR_IN_LIST_FILE	6		LISTn.SET file read error.
ERR_NO_CALIBRATION	7		Specified calibration not found.
ERR_COMMUNICATION	8	Y	Card communication failure.
ERR_CARD_RESPONSE	9	Y	No response from the card upon exiting calibration transfer.
ERR_READ_PARAMS	10	Y	No response from the card upon reading calibration parameters.
ERR_WRITE_SETUP	11		LISTn.SET file write error.
ERR_INIT_FAILED	12	Y	Initialization failed - Hardware error or incorrect card address
ERR_FINISH_FAILED	13	Y	Can't finish the card.
ERR_MEMORY_ALLOC	14	Y	DOS memory allocation error.
ERR_MAGAZINE_FILE	15	Y	MAGn.SET: magazine file error.

NOTES

1. The NAME is the same symbol used in the "define" statements of EX01.C.
2. "Y" in this column specifies a Critical error (refer to "Return Code" section).

APPENDIX E: THE MULTI CALIBRATION (MC) FEATURE

Notes:

1. This feature is available for card version 12 and upward.
2. This feature uses PC interrupts (IRQ9).
3. To use this feature, the JP4 jumper (at the bottom of the LCIC card) should be connected.

E.1 MC GENERAL DESCRIPTION

The "Multi Calibration feature" enables an easy procedure to switch between calibrations in the card without using the conventional calibration sequence (F2 function of the LCIC.EXE utility). The switching procedure is implemented by a "calibrations magazine" in card's non-volatile memory. The magazine saves the four last calibrations, making them available by user's application program, that may, later on, retrieve the required one.

Whenever the user carries out a calibration - either physical (real) or by recalling from "calibration library" - its "data set" is automatically saved in the "calibrations magazine", whose capacity is four calibration data sets, being managed according to the concept of "First In First Out" (FIFO): If the magazine is not empty and a new data set is to be saved, the "old" data set(s) are "shifted", vacating the first location for the new set. In case the last (4th) location is occupied, its data set is "dropped" (lost).

Finally, the new data set is saved in the first location.

For example, suppose that the user calibrates five different materials in the following order:

1. Gold. 2. Silver. 3. Iron. 4. Copper. 5. Zinc.

Magazine's state in each state is shown:

Initial state:

#1	#2	#3	#4

(Magazine is empty)

Calibration #1:

#1	#2	#3	#4
Gold			

(One data set in the magazine)

Calibration #2:

#1	#2	#3	#4
Silver	Gold		

(2 data sets in the magazine)

Calibration #3:

#1	#2	#3	#4
Iron	Silver	Gold	

(3 data sets in the magazine)

Calibration #4:

#1	#2	#3	#4
Copper	Iron	Silver	Gold

(Magazine is full)

Calibration #5:

#1	#2	#3	#4
Zinc	Copper	Iron	Silver

(The Gold data set dropped!)

Using **user's application program**, he may switch LCIC current calibration to any set saved in the magazine - no need to involve the LCIC calibration utility! Obviously, this feature supplies the user with more flexibility.

E.2 MC ACCESS TO THE CARD

To switch card's current calibration to data set #n (n = 1-4) in the magazine, take the following steps in your program:

1. Write n to offset 0x3A4 in binary representation.
2. Write 0x40 to offset 0x3FF.
3. Wait for IRQ9 generated by the card.
4. Analyze card's response supplied in interrupt status (offset 0x3FE):
 - 0x50 - card switched successfully to channel #n.
 - 0x51 - switching failure.
 - 0x52 - catastrophic error - card returns to power on.

Notes:

1. Calibration switching does **not** become part of card's permanent data in the non-volatile memory! Its "lifetime" is until next power-up, after which the original calibration becomes again the active one, regardless of past switching(s). Consequently, magazine state, as shown by the LCIC utility (refer to section E.3), remains valid also after a switching operation.
2. A full sample program in C language is supplied in the file SWITCH.CPP in the /EXAMPLES subdirectory of the LCIC utility diskette.
Refer to this file in order to build your own application.

E.3 MC DEMONSTRATION USING THE LCIC UTILITY

To get magazine's state, press Ctrl+F3. The "magazine list" will appear on the screen, specifying the names and dates of the data sets. When magazine's contents are satisfactory, it would be a good practice to record it. This record will be essential when writing user's application program: The programmer will be able to correlate data set number to its contents.

Having the "magazine list" displayed, you may switch to another calibration in the magazine: Move by the up/down arrow keys to the required one, and press <Enter>. The card will be switched to the calibration selected. Note #1 in section E.2 is valid also here: Upon terminating the LCIC session, the original calibration becomes again the active one.

Note:

When applying any operation that modifies card's permanent data (i.e., F2 through F7): Be sure that the card is in a "non-switched" state, i.e., the **first** set in the magazine is active. Otherwise, the operation is rejected, to eliminate ambiguity: Such operation refers **always** to the **original** calibration, which is magazine's **first** set. If the operation was accessible when another set is active, the user may be unaware that his manipulation affects a set which is **not** the visible one.

APPENDIX F: THE BATCH FEATURE

Notes:

1. This feature is available for card version 12 and upward.
2. This feature uses PC interrupts (IRQ9).
3. To use this feature, the JP4 jumper (at the bottom of the LCIC card) should be connected.

F.1 BATCH GENERAL DESCRIPTION

The Batch feature enables implementing a filling process, using the LCIC card as a batch controller. Using his own software, the user may:

- * Specify the required set-point (filling amount)
- * Specify two-speed filling process
- * Select any of LCIC's eight outputs for activation of the valve(s)
- * Start batching
- * Stop batching (Emergency Stop)

Alternatively, the last two functions (Start and Stop) may be implemented using two of LCIC's four hardware inputs. Similarly to the outputs for valve activation, the inputs allotted for Start & Stop are user programmable.

Utilizing this alternative, the LCIC card may operate with an external-controlling device (such as PLC), independently of PC/AT software.

Card's response to the PC/AT:

Before filling: Card checks validity of the parameters inserted by the user, reporting any deviation detected.

During filling: Card continuously updates the PC/AT bus with the actual weight.

After filling: Card interrupts the PC/AT, reporting success or failure, using IRQ9.

In case of failure, the report supplied specifies its reason, enabling easy trouble-shooting.

During the filling process, the card opens/closes valve(s) as required. The filling process is stoppable at any time through user's "Emergency Stop" indication (either software or hardware, according to user's selection).

F.2 BATCH ACCESS TO THE CARD

1. BEFORE BATCH:

- 1.1. Write the required set-point to offset 0x360 in floating point representation.
The floating-point representation used conforms to the IEEE 32 bit standard: 24 bit precision, the upper bit (MSB) of the mantissa is always a '1' and therefore not stored.
- 1.2. Write the required switch-point to offset 0x364 in floating point representation:
 1. In case of one filling speed: 0.
 2. In case of two filling speeds: The switch-point (= fast part).
- 1.3. Write valves definition (1-8) in char (byte) representation:
 1. Fast or single valve to offset 0x368.
 2. If two filling speeds are used:
 - Slow valve to offset 0x369.

- 1.4. If process is controlled by **hardware** inputs:
 1. Write "Start" and "Emergency stop" inputs definition (1-4) in char (byte) representation:
 1. "START" input to offset 0x36A.
 2. "STOP" input to offset 0x36B.
 2. Write GO_TO_RUN code (0x17) to offset 0x3FF.
The card will remain in batch mode until EXIT_RUN code (0x1B) is written to offset 0x3FF (refer to para. 2.3).
- 1.5. To start process:

If process is controlled by **software** inputs:
Write "START" code (0x10) to offset 0x3FF.

If process is controlled by **hardware** inputs:
Turn ON the START input as defined in para. 1.4.
The START pulse duration should be at least 350 ms!

2. DURING BATCH:

- 2.1. Read the actual weight as described in chapter 3.
- 2.2. To abort process (emergency stop):

If process is controlled by **software** inputs:
Write "STOP" code (0x13) to offset 0x3FF.

If process is controlled by **hardware** inputs:
Turn ON the STOP input as defined in para. 1.4.
- 2.3. To exit batch mode when process is controlled by **hardware** inputs:
When the card is **not** during a batching process, write EXIT_RUN code (0x1B) to offset 0x3FF.

3. AFTER BATCH:

- 3.1. Wait for IRQ9 generated by the card.
- 3.2. Analyze card's response supplied in interrupt status (offset 0x3FE):

0x20	Success.
0x31	Failure: Wrong Set or Switch point: > max capacity.
0x32	Failure: Wrong Set or Switch point: < 0.
0x33	Failure: Wrong Switch point: > Set point.
0x34	Failure: Valves definition error.
0x35	Failure: Emergency stop.
0x36	Failure: Unexpected command.
0x37	Failure: Inputs definition error.
0x38	End of batch mode.

Notes:

1. The user should be aware that the Batch and Multi Calibration features may be combined! It's **user's responsibility** to activate the Batch feature using the required calibration. Namely, if the current calibration has been switched using the Multi Calibration feature, the Batch feature will operate on the **new** calibration. The user gets a powerful tool by combining these

features, but should program carefully.

2. At end of filling, the card returns to the normal mode, updating the AT bus.
3. A full sample program in C language is supplied in the file BATCH.CPP. in the /EXAMPLES subdirectory of the LCIC utility diskette.
Refer to this file in order to build your own application.

F.3 BATCH DEMONSTRATION USING THE LCIC UTILITY

To enter into the batch mode, press Ctrl+F3 and follow the next steps:

1. Specify if using hardware inputs -
This factor has three effects:
 1. Start & Emergency Stop inputs definition, which might be a part of the next step, takes place only in case hardware inputs **are** in use. Otherwise, obviously, this definition is irrelevant.
 2. "Start" operation (step 3) is different in each case:
 - * When hardware inputs **are** in use -
The "Start" does **not** necessarily start the batch! Instead, the batch control is passed to the hardware Start & Stop inputs, until terminating the batch mode (step 4).
There may be several fillings in the same batch mode.
 - * When hardware inputs are **not** in use -
The "Start" really starts the batch operation. One batch mode includes only one filling.
 3. The <Esc> key has another meaning in each case:
 - * When hardware inputs **are** in use -
The batch mode is terminated - the hardware inputs are not active any more.
 - * When hardware inputs are **not** in use -
The <Esc> causes "Emergency Stop", aborting the filling process.
2. Specify the filling characteristics:
 - * Set point
 - * Switch point (= the fast part. 0 in case of one filling speed)
 - * Valve(s) output definition
 - * Hardware input definition (only if used)
3. Start the batch.
Note that "Start" operation depends on step 1, as described above.
4. End the batch.
This step is due to any of the following events:
 - * When hardware inputs are **not** used:
 - * Filling completion (normal termination).
 - * The <Esc> key is pressed (abnormal termination).
 - * When hardware inputs **are** used:
 - * The <Esc> key is pressed (normal termination).

APPENDIX G: THE "SMART" PACKAGE

G.1 THE "SMART" UTILITY

GENERAL

SMART is an auxiliary utility for the LCIC.

The SMART program supplies the following three functions:

- * Weight reading displayed in user selected units (kg. etc.).
- * Weight reading converted to items' quantity.
- * Weight reading & indication - inside or outside a range.

USAGE

To run SMART, put a calibrated LCIC in the PC and run SMART.EXE.

The SMART has three modes, corresponding to the above three functions:

- * SCALE mode.
- * COUNTER mode.
- * CHECK WEIGHER mode.

The display shown has two main parts:

- * Upper part, showing weight or number of items.
The numeric value is followed by the units:
In case of weight, it's user-selected units (kg. etc.).
In case of items, "It" stands for "items".
- * Lower part, showing additional information:
 - Actual tare (= actual zero) (in all modes).
 - Average weight (only in Counter mode).
 - Lower & Upper limits (only in Check Weigher mode).

The following table shows "operations activity" in the various modes, i.e., which operation is active in each function.

		M O D E		
KEY	OPERATION	SCALE	COUNTER	CHECK WEIGHER
F1	Next mode switch	*	*	*
F2	Tare on/off	*	*	*
F3	Manual tare	*	*	*
F4	Range definition			*
F5	Average		*	
F6	Items		*	
F7	kg/lb/g/ton/oz	*	*	*
F8	Print	*	*	*
Alt 0	Zero	*	*	*
Alt X	Quit	*	*	*

F1 - Next mode switch

Switches to the next mode (cyclically).

F2 - Tare on/off (toggle)

Tare ON accepts current weight as tare, reducing it from all subsequent readings.

Tare OFF clears the tare, so that there's no reduction from subsequent readings.

In the Scale mode, Tare on/off status is indicated below weight display.

Besides, in all modes, the current tare is specified in the "Actual Tare" line of the lower part of the display: "0" means tare off, a non-zero value means tare on, having the specified value.

F3 - Manual tare

This is an alternate way to define a tare.

Specify the required tare by entering its weight.

The operation is absolutely equivalent to "Tare on" when the current weight is same as specified numerically.

F4 - Range definition

(Only in Check Weigher mode:)

Definition of a range to be considered as valid weight.

The range is defined by two values - lower & upper.

In Check Weigher mode, when the reading is inside the range, the message "IN RANGE" is shown below the weight display.

When the reading is outside the range, the background of weight display changes its color and the message "OUT OF RANGE" is displayed.

With the optional I/O card, there's one output ON describing the range status:

- 1 - Inside range.
- 2 - Below range.
- 3 - Above range.

F5 - Average
(Only in Counter mode)

Item average weight.

The number of items is set to (current reading / average weight), rounded to the closest integer.

F6 - Items
(Only in Counter mode)

Current quantity of items.

The average item weight (displayed in the lower part of the window) becomes automatically (Net Weight / Number of items).

F7 - kg/lb/g/ton/oz

Cyclical switching of weighing unit.

F8 - Print

Prints the following information:

1. Date.
2. Time.
3. Mode.
4. Gross weight.
5. Tare.
6. Net weight (in Check Weigher mode, an asterisk indicates that weight is out of range).
7. Average weight of one item (only in Counter mode).
8. Items quantity (only in Counter mode).
9. Lower weight of valid range (only in Check Weigher mode).
10. Upper weight of valid range (only in Check Weigher mode).

Alt-0 - Zeroing

The operation is actually a "master zero" function. The function re-defines a new zero, clearing also the "Actual Zero" value.

The function is needed when the real 0 varied and is shown as a non-zero value. Such a case may occur due to mechanical changes, residuals/surplus, etc.

Upon running this function, the user gets the message "Make sure that scale is empty. Esc to abort". The user may either abort operation by <Esc>, or press any other key to continue.

If the user continues, he gets another message: "Save the current Zero for future use? [Y/N]".

"Y" means that the current zero will be saved, so that it will be used also in the next SMART running.

"N" means that the current zero affects only current SMART running.

Alt-X - Quit

Quit utility and return to MS-DOS.

G.2 "SMART" RS232 COMMUNICATION

G.2.1 THE RSSETUP UTILITY

The RSSETUP utility is used to set user's communication characteristics, used by SMART communication (refer to section G.2.2).

Carry out the utility by typing RSSETUP followed by <Enter>. The current communication characteristics are shown on the left bottom part of the display.

The characteristics include the following five items:

Com	Com 1, Com 2 or Com 3.
Data bits	7 or 8. Always select 8!
Stop bits	1 or 2.
Parity	None, odd or even.
Baud rate	110, 150, 300, 600, 1200, 2400, 4800 or 9600.

To change the current characteristics:

- * Press <F10>.
- * Use the right/left arrow keys moving the highlight to the item to be modified.
- * Press <Enter>.
- * Use the up/down arrow keys moving the highlight to the required selection.
- * Press <Enter>.
- * Repeat above sequence for any item to be modified.
- * Press <Alt>+X.

The information on the user-selected characteristics is saved in file RS232.SET. If, for some reason, the user prefers to return to the initial situation of no communication, just erase that file.

G.2.2 "SMART" COMMUNICATION

The SMART utility is accessible by the "external world" through an RS232 line. The "external world" may be any program running on some other user's computer (not necessarily a PC), using the protocol described in section G.2.2.1.

The line used is programmable by the RSSETUP utility (see section G.2.1). Either COM1, COM2 or COM3 may be selected. As described in section G.2.1, the RSSETUP utility also sets the other communication characteristics - Data bits, Stop bits, Parity & Baud rate.

The communication includes hardware handshake (RTS/CTS).

G.2.2.1 COMMUNICATION PROTOCOL

The communication with the SMART is implemented by sending a request by user's computer, and receiving an answer from the SMART. Both the request and the answer are composed of "data frames" having an identical structure, which includes the following fields:

#	DESCRIPTION	CONTENTS
1	STX (Start of text) byte.	2
2	n = buffer length: One word (two bytes) specifying the number of bytes in fields 4, 5 & 6. Since the lengths of fields 5 & 6 are constants (2 & 1, respectively), n = 3 + length of field 4	LOW byte of n
		HIGH byte of n
3	~n = one's complement of n.	LOW byte of ~n
		HIGH byte of ~n
4	Information Block, described in section G.2.2.2	. . . n-3 bytes . . .
5	c = checksum: One word (two bytes) specifying a 16 bits modulo sum of the bytes in field 4.	LOW byte of c
		HIGH byte of c
6	ETX (End of text) byte.	3

G.2.2.2 INFORMATION BLOCK

The "Information Block" is field #4 of the data frame. By the string passed as the Information Block, user's program may specify three types of requests, as described in the following table:

REQUEST	DESCRIPTION	STRING
Read	Get system's readings	read
tare on	Turn tare status to ON	tare_on
tare off	Turn tare status to OFF	tare_off

* The decoding of the string is case insensitive.

* In case of an unidentified string, SMART responds by a "?" frame.

The requests and their responses are described in the following sections. However, note that:

* The items of each response are separated by one or more spaces.

* Each response is terminated by carriage return and line feed.

"READ" REQUEST

This is a request to get system's various readings. Answer's "Information Block" contains the following items in ASCII:

"FILTER:"
"ON" or "OFF"
"UNITS:"
"g", "kg", "ton", "oz" or "lb"
"TARE_STATUS:"
"ON" or "OFF"
"TARE_VALUE:"
tare value
"WEIGHT:"
weight value
"MOTION:"
"YES" or "NO"

E.g.,

"FILTER: ON UNITS: g TARE_STATUS: OFF TARE_VALUE: 0.00 WEIGHT: 1.23 MOTION: NO "

NOTES:

1. The weight and tare values are expressed in the current units (g, kg etc.), which may be changed if user presses F7.
2. The weight is same as displayed by SMART. Specifically, it may be affected by the FILTER ON/OFF switch (F9), since the "zero tracking" mechanism is active only when FILTER is ON.
3. When SMART identifies that the load cell is in an unstable state (indicated by the red "MOTION" display), the "MOTION: YES" message is supplied. This indication is supplied only when FILTER = ON.
When FILTER = OFF, or if load cell reading is stable, "MOTION: NO" is specified.

"TARE ON/OFF" REQUEST

This is a request to turn ON or OFF the tare status. SMART's response is:

1. If the requested tare status differs from the current one:
Tare ON/OFF status is inverted as if F2 was pressed.
2. In any case, the following answer is returned, enabling the user to verify his operation:

"TARE_STATUS" "ON" or "OFF"

E.g.,

"TARE_STATUS: ON"

In case that inversion is required, it takes place **before** the answer is returned. Consequently, the answer reflects not only that the request was accepted well, but also that it has been successfully realized.

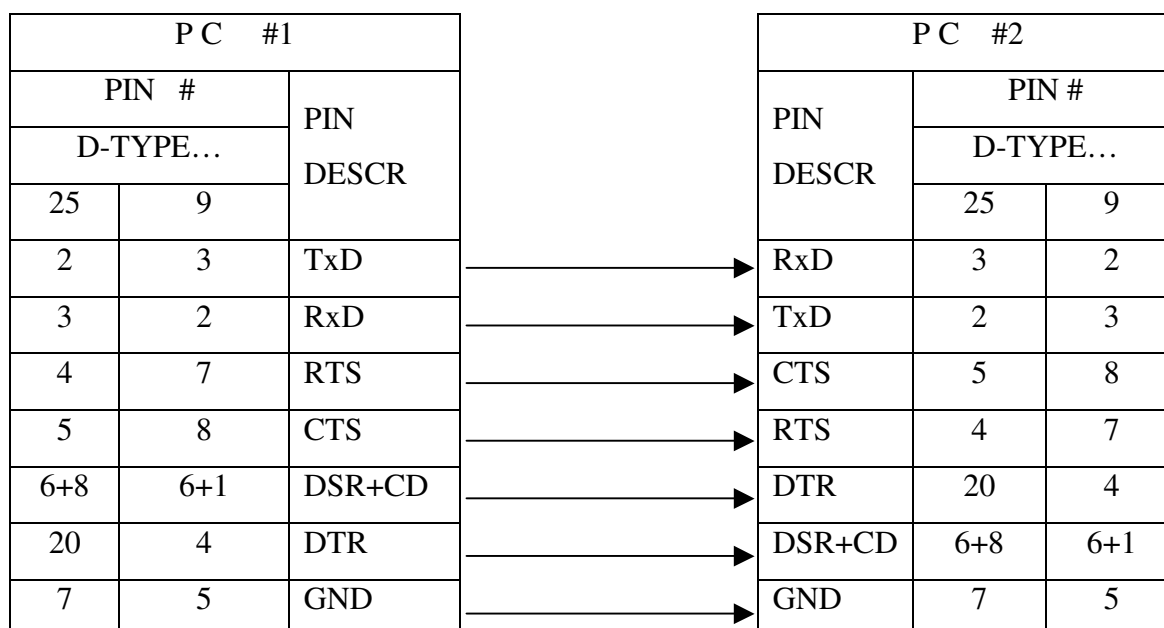
NOTES:

1. Keyboard's TARE ON/OFF function (F2) is still available, so the user should be aware that RS232 communication and the keyboard may disturb each other.
2. Any mode change by pressing F1 automatically resets tare status to OFF.

G.2.3 THE "HOST" UTILITY

Before the user starts coding his own program, using above protocol, he may prefer to use an existent utility that lets him establish a basic RS232 communication with SMART, inspecting its operation. This is what the HOST utility supplies. Follow the steps below to use the HOST utility.

- * Install the LCIC card on PC #1.
- * Install the SMART and the RSSETUP utilities on PC #1.
- * Install the HOST and the RSSETUP utilities on PC #2.
- * Run the RSSETUP utility on both PC's, taking care of the following:
 - * Select the various options as described in section G.2.1.
 - * Specifically, recall that 8 data bits should be selected.
 - * Use the same selections on both PC's, except, possibly, the COM item.
- * Connect the selected COM's of the PC's. Recall that hardware handshake is used, requiring the following connections in the cable:



APPENDIX H: WIRING

H.1 LOAD CELL WIRING

The card is able to power up to six load cells (350 ohm or higher each), which are connected in parallel. The six wires connection is recommended in case of a long distance between the load cells and the board. Refer also to drawing #2.

H.1.1 SIX WIRES CONNECTION

CONN. DB9 PIN No.	SIGNAL
1	+IN (+EXCITATION)
5	+SENSE
6	+SIGNAL (+OUT)
2	–IN (–EXCITATION)
4	–SENSE
7	–SIGNAL (–OUT)
9	SHIELDING

H.1.2 FOUR WIRES CONNECTION

CONN. DB9 PIN No.	SIGNAL
1,5	+IN (+EXCITATION)
6	+SIGNAL (+OUT)
2,4	–IN (–EXCITATION)
7	–SIGNAL (–OUT)
9	SHIELDING

H.2 OPTIONAL I/O CARD WIRING

CONN. DB25 PIN No.	SIGNAL
1,14	+V EXT
2,15	-V EXT
4	OUT1
17	OUT2
5	OUT3
18	OUT4
6	OUT5
19	OUT6
7	OUT7
20	OUT8
9	+IN1
22	-IN1
10	+IN2
23	-IN2
11	+IN3
24	-IN3
12	+IN4
25	-IN4
3,16	N.C.
8,21,13	N.C.

Refer also to drawings #3, 4 and 5.

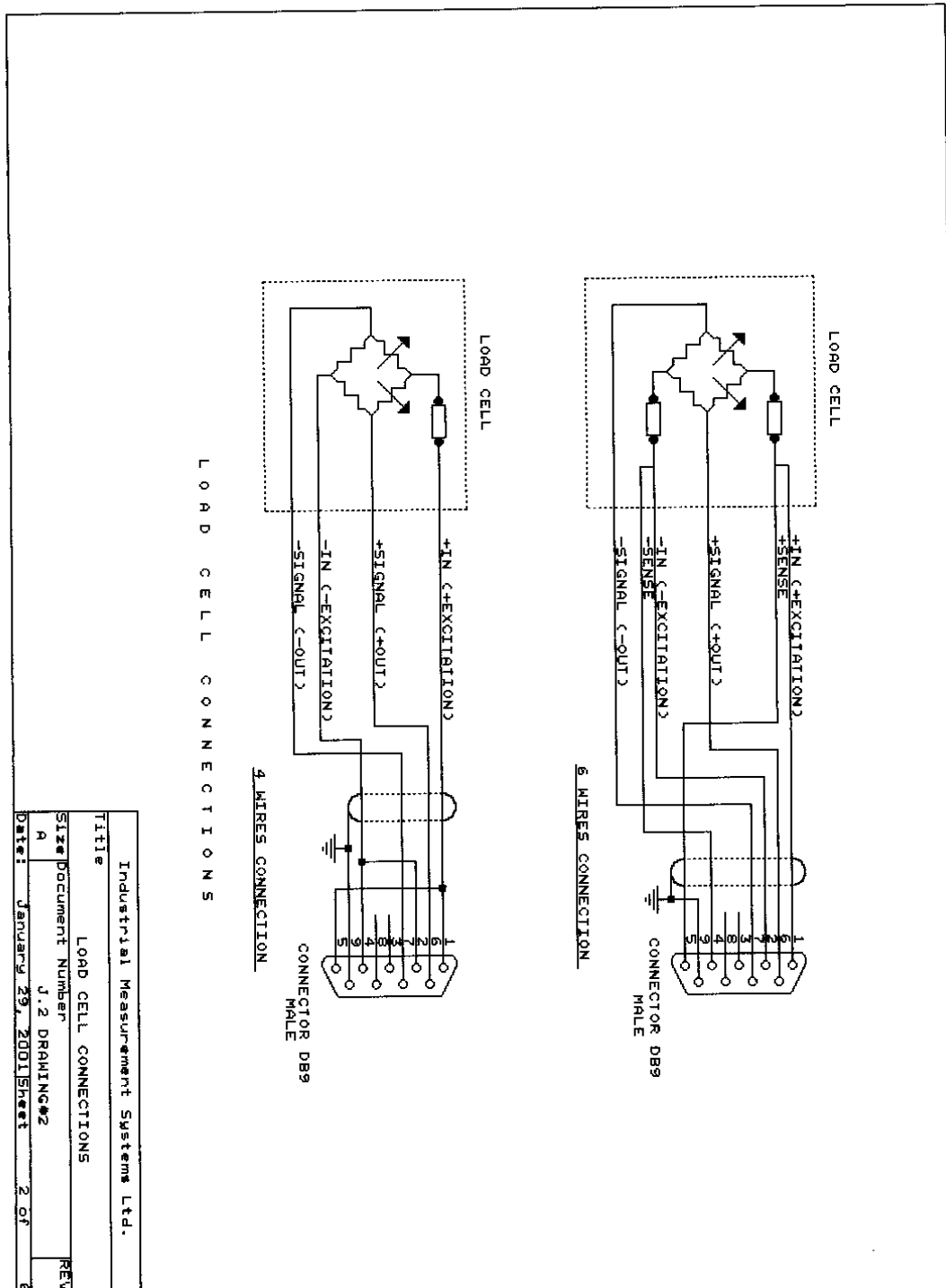
APPENDIX I: AVAILABLE SETUP MEMORY LOCATIONS
(ABSOLUTE ADDRESSING)

	S1	S2	S3	S4	MEMORY RANGE
1	ON	ON	ON	ON	C7C00 – C7FFF
2	OFF	ON	ON	ON	CE400 – CE7FF
3	ON	OFF	ON	ON	CE800 – CEBFF
4	OFF	OFF	ON	ON	CEC00 – CEFFF
5	ON	ON	OFF	ON	CF000 – CF3FF
6	OFF	ON	OFF	ON	CF400 – CF7FF
7	ON	OFF	OFF	ON	CF800 – CFBFF
8	OFF	OFF	OFF	ON	DD800 – DDBFF
9	ON	ON	ON	OFF	DEC00 – DEFFF
10	OFF	ON	ON	OFF	DF800 – DFBFF
11	ON	OFF	ON	OFF	DFC00 – DFFFF
12	OFF	OFF	ON	OFF	EC000 – EC3FF
13	ON	ON	OFF	OFF	EC800 – ECBFF
14	OFF	ON	OFF	OFF	ED800 – EDBFF
15	ON	OFF	OFF	OFF	EEC00 – EEFFF
16	OFF	OFF	OFF	OFF	EF800 – EFBFF

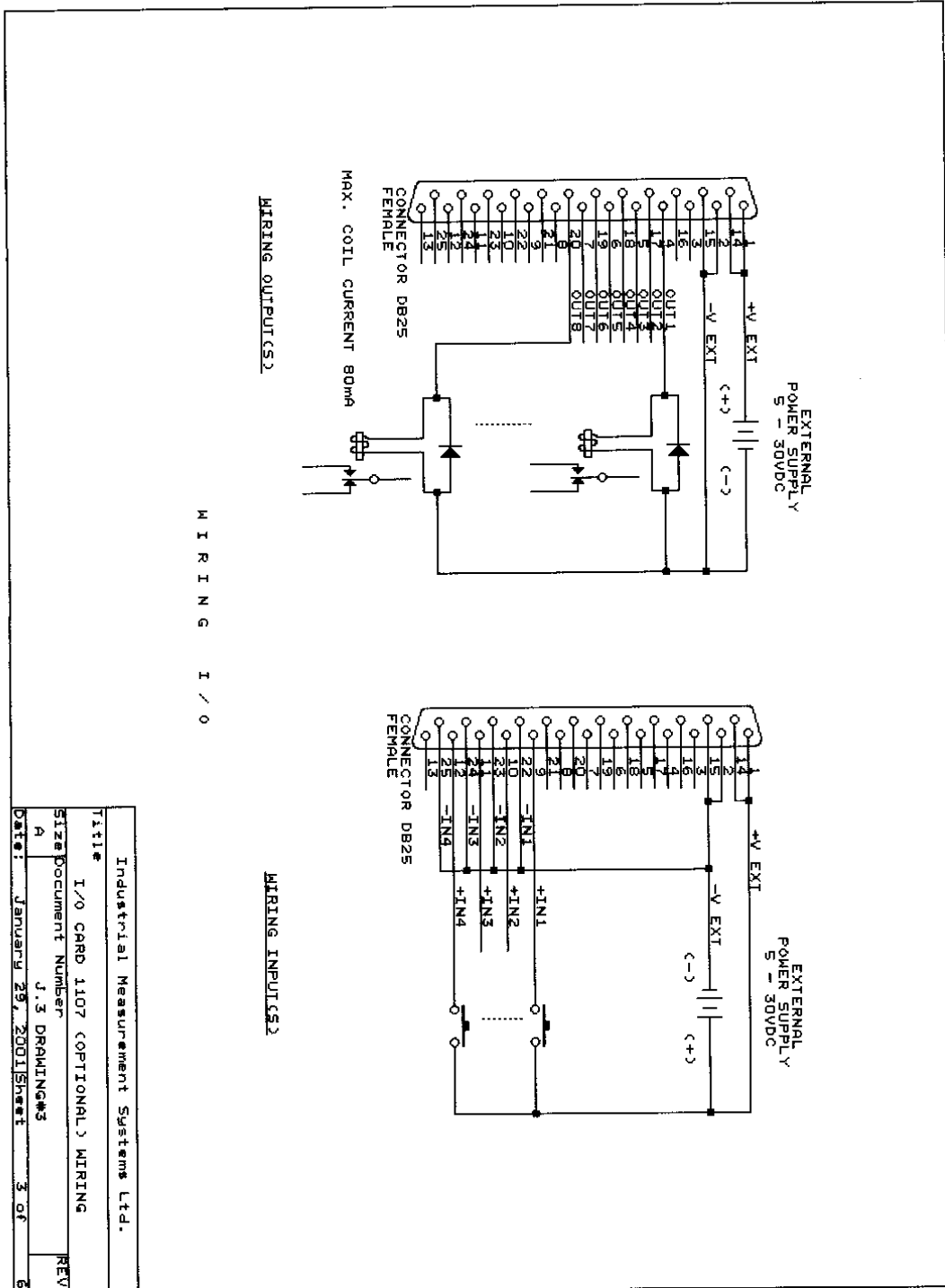
J.1 DRAWING #1: LCIC 1106a CARD LAYOUT



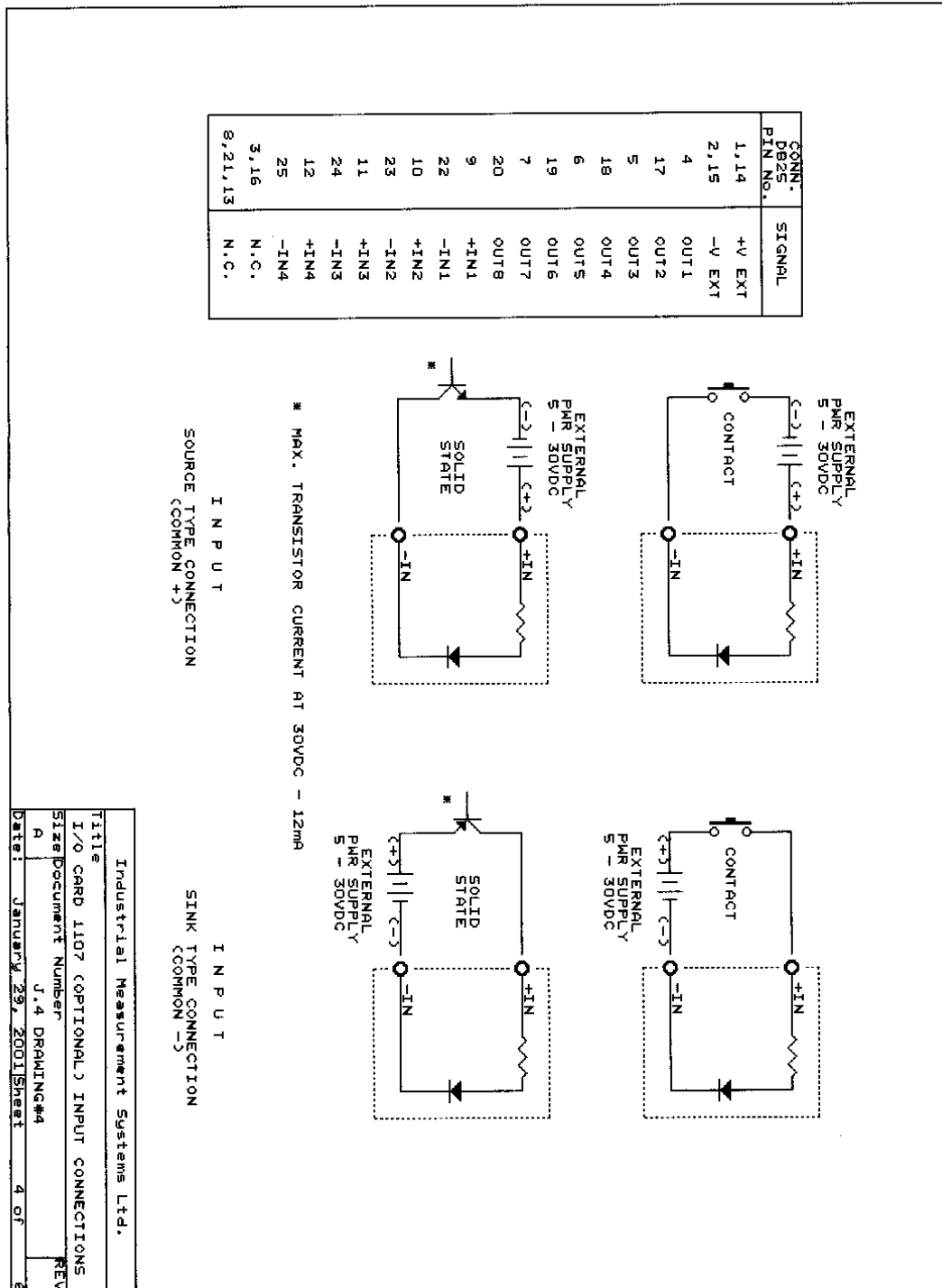
J.2 DRAWING #2: LOAD CELL CONNECTIONS



J.3 DRAWING #3: I/O CARD 1107 (OPTIONAL) WIRING

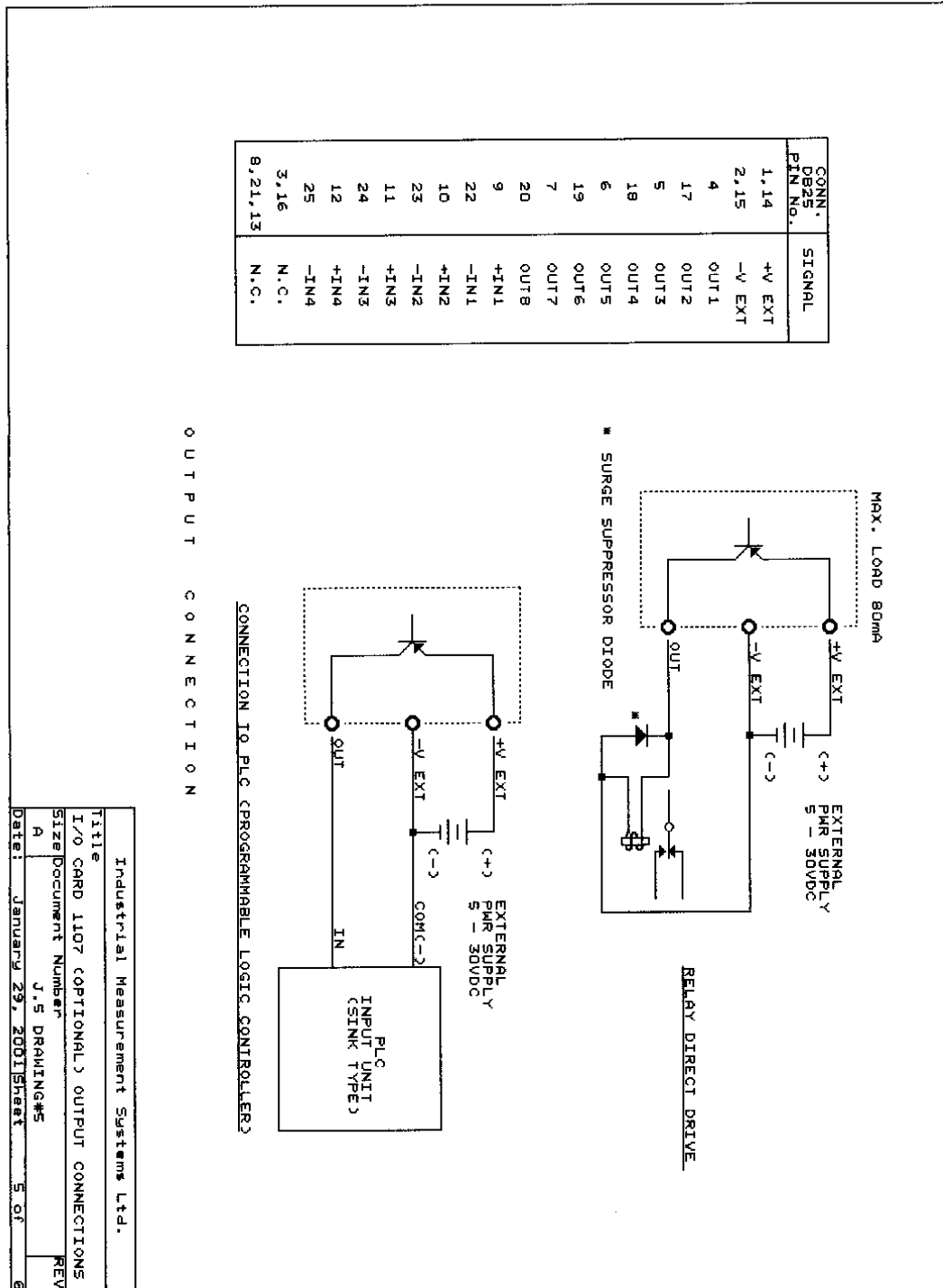


J.4 DRAWING #4: I/O CARD 1107 (OPTIONAL) INPUT CONNECTIONS



Industrial Measurement Systems Ltd.	
Title	I/O CARD 1107 (OPTIONAL) INPUT CONNECTIONS
Size Document Number	J.4 DRAWING#4
REV	6
Date:	January 29, 2001 Sheet 4 of 6

J.5 DRAWING #5: I/O CARD 1107 (OPTIONAL) OUTPUT CONNECTIONS



Industrial Measurement Systems Ltd.		
Title		
I/O CARD 1107 (OPTIONAL) OUTPUT CONNECTIONS		
Size/Document Number		
A	J.5 DRAWINGS	REV
Date: January 29, 2001 Sheet 5 of 6		

J.6 DRAWING #6: LCIC 1106a RS232 (OPTIONAL) CABLE

