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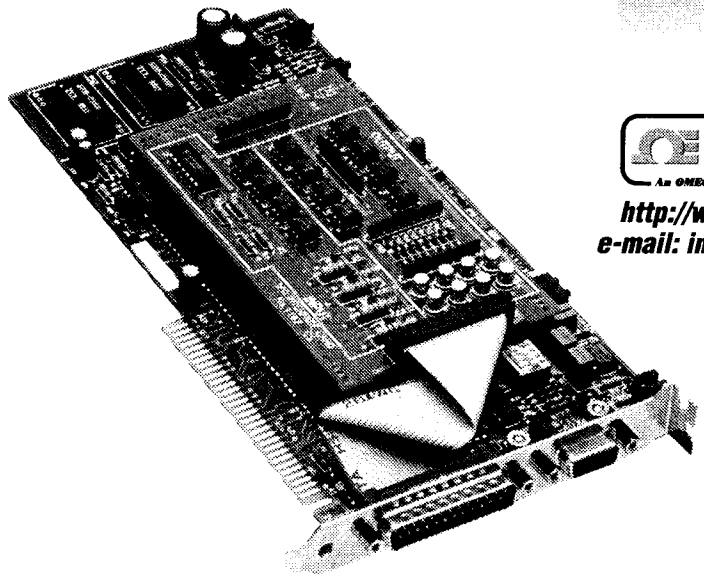

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LCIC-1106A
Load-Cells Interface Card for PC/AT or Compatibles

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QUICK START *LCIC*-1106a

Trying to save your time, the card has already been factory preset, and a corresponding SEG1 file is already supplied on the utility diskette included with the card. Both have been set to address CE40 (2nd selection in Appendix D). 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=CE40-CE80" to that statement.
   (It will look like:
   DEVICE= "C:\DOS\EMM386.EXE AUTO X=CE40-CE80".)
2. Make a directory (MD command) where you wish to install *LCIC* software package, and copy all the files from the root of the *LCIC* utility diskette to this directory. Preferably, backup the diskette.
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 **LED**s. 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 **LED**s' status is correct, proceed to step 6.
   * Otherwise (**LED**s' 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. Change the directory (CD command) to where you installed the *LCIC* software package in step 2.
7. Run the LCIC.EXE program (the calibration utility) by typing *LCIC* and <Enter>.
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 after connecting the load cell cable to the *LCIC* board (refer to drawings #1 and #2).
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.

The description supplied in this QUICK START is included also as an integral part of the manual (Appendix A.1).

TABLE of CONTENTS

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 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 in code C and BASIC are supplied.
The programs demonstrate how the LCIC can be used to read and display 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, utillizing 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.

1.3 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), allows 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 in needed.
  Refer to section 5.

* 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 8.

* 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.

1.4 DRAWINGS

The following drawings are supplied:

1. LCIC 1106a CARD LAYOUT
2. LOAD CELL CONNECTIONS
3. I/O CARD 1107 (OPTIONAL) WIRING
4. I/O CARD 1107 (OPTIONAL) INPUT CONNECTIONS
5. I/O CARD 1107 (OPTIONAL) OUTPUT CONNECTIONS
6. LCIC 1106a RS232 (OPTIONAL) CABLE

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 diagnostics.
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.
   This 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 is an error in the second form, the INIT program will terminate and the DOS ERROR_LEVEL variable will be set to 4. 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 NON UNIFORM RATE, and the other leds should turn ON, indicating proper power supply.
   AFTER a successful INIT process, the STATUS LED should flash at a UNIFORM RATE, and the other leds should remain ON.
   An OFF STATUS LED indicates that the card is uncalibrated.

3. ERROR_LEVEL:
   The result of the INIT command is reported in ERROR_LEVEL of DOS. The user may employ this information in a program or a batch file.
   Error 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 about 15 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.EXE

FUNCTION

The FINISH utility sets each of the installed cards into a "standby" 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 no.
  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 f i r s t 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: 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	Number of A/D points per 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.

2.4.2 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 Factor
F7	Calibration Lock
F8	I/O Check

To quit the software, 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; 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 - just 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 software will ask:

Such calibration already exists. Overwrite it?

   Responding "Y" (Yes) will overwrite the existing data , "N" (No) will not.
   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 points 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, when masses are very large, or if an easier calibration (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 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, the 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 (up to 1%) less accuracy.

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

3. Units:
   kg., gr. or lb.
   The selected unit will be used in all weight displays.

4. Load Cell Division:
   Load cell division according to manufacturer's specification.
   This parameter is used to warn the user if resolution beyond the load cell's capability is required.
   The user can override this warning.

5. Maximum planned load:
   The maximum net weight to be measured by the load cell.
   ---> Note that the weight(s) used during the calibration process should not exceed 95% of the maximum planned load.

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 no. 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 between the specified load cell division and the required display resolution (parameters no. 4 and 7).

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 a "N" (No) answer returns the user to the main screen, where a new load cell division and/or display resolution may be entered.

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

Confirm calibration parameters?

Answering "Y" (Yes) confirms the parameters. A "N" (No) answer returns the user to the main screen, where new parameter values may be entered.

2.4.2.1.2 STEP 2 - HARDWARE CALIBRATION

This procedure is specified by "Hardware cal." in the "mode" line of the READINGS window.

This procedure sets internal card zero and gain.

For one point calibration, the procedure takes place only once. For three point calibration, the procedure 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. 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 procedure is specified by "Software cal." 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.
3. Enter the weight value and press <Enter>.
4. Only for three point calibration:
   1. Place second weight and enter its value when ready.
   2. Place third weight and enter its value when ready.

NOTE: 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 calibrations have been completed, the user is asked:

Press any key to exit calibration check.

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 POTENTIAL 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, when using a very high tare during three point calibration, the gain may have been set to a borderline value.
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 SMALL WEIGHT

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 no. 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 first option should be selected if the incorrect gain is NOT the last one.
The second option is useful when the value of the last (current) weight was incorrectly entered.

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 the 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 <del>.
   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. Exit by <Esc>.

DIRECT RESTORING FROM USER'S APPLICAION

There's an additional way to restore a calibration from the library, without using the LCIC utility. Its advantage is that it doesn't require manual interaction, and is therefore better suited for automated operation. For details refer to the DLOAD.DOC file in the \load_cal subdirectory of the LCIC utility diskette.

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 will occur only if the new zero differs significantly from the original one. If the loss does occur, then a new full calibration is 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.

Answer in the INSTRUCTION window by the required IF.

2.4.2.4 F5 - FILTER ON/OFF

This switch turns the Digital Filter feature ON or OFF. The filter reduces signal noise. Unless user's application program implements fitering, it's recommended that the Digital Filter remains in the ON state.

Refer also to section 6 - Card Response Time.

2.4.2.5 F6 - SAMPLING RATE FACTOR

The Sampling Rate Factor (SRF) parameter should only be changed by the advanced applications programmer. Through the SRF, the user may set a Sampling Rate which is the time interval between consecutive samplings of the A/D.
SRF = 0 sets Sampling Rate to 2 ms., while each SRF increment adds 0.5 ms. In brief, Sampling Rate = 2 + 0.5 X SRF (ms.).
SRF is adjustable over the integer range from 0 to 20, resulting in Sampling Rate from 2 to 12 ms., respectively.
The default (preset) SRF is 8, resulting in Sampling Rate = 6 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.

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.

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.

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 bits 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 utility diskette for usage of the floating point representation.

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 appendices A & D). 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 and... SEG2. contains CE80	address of card #1 is C7C0:03A0 and... 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 (C7C0, 03A0) ;
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
```


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 utility 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.
Moreover, if card(s) are already active, run FINISH before running the LCIC utility.

5. 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 process control and 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 should be allocated.

* 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 C.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.

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 FACTOR (SRF) (programmable by F6, section 2.4.2.5)

When the Filter is ON, the A/D readings are filtered.
Changing the filter parameter does not influence the response time significantly. It's highly recommended to set the filter parameter to ON.

Denoting "to the power of" by "**" (e.g., 2**3 = 8), then:
CRT can be approximated by the following formula:
CRT = [2 ms + (SRF X 0.5 ms)] X [2 ** (IF + 1)].
Note that the first multiplier ([2 ms + (SRF X 0.5 ms)]) is the time interval Sampling Rate mentioned in section 2.4.2.5.
CRT is linearly proportional to Sampling Rate.
For example, assume SRF = 8 and IF = 5, then:
CRT = [2 ms + (8 X 0.5 ms)] X [2 ** (5 + 1)] =
= [6 ms] X [64] =
= 384 ms.
(Sampling Rate = 6 ms.)

It's recommended to use:
* The default (preset) SRF: 8 (6 ms.)
* The maximal IF that still results in CRT that satisfies the application.

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 or the LCIC.EXE utilies may 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.

8. 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.

APPENDIX A - INSTALLATION

The software package includes a utility named MEMCHECK with 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 D). 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 the first LCIC card.

A.1 QUICK INSTALLATION

The card has already been factory preset, and a corresponding SEG1 file is already supplied on card's utility diskette. Both have been set to address CE40 (2nd selection in Appendix D). 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=CE40-CE80" to that statement. (It will look like: DEVICE=C:\DOS\EMM386.EXE AUTO X=CE40-CE80)
2. Make a directory (MD command) to where you wish to install LCIC software package, and copy all the files from the root of the LCIC utility diskette to this directory. Preferably, backup the diskette.
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. Change the directory (CD command) to where you installed the LCIC software package in step 2.
7. Run the LCIC.EXE program (the calibration utility) by typing LCIC and <Enter>.
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", procedure "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=C700-E000
a.2 Re-boot your PC.
a.3 Apply the LCIC installation procedure and make sure that the calibration 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 calibration 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 parameters that consider the new card(s), so that no memory conflicts will occur.

A.2.1.2 COPYING THE SOFTWARE PACKAGE

Make a directory (MD) in which you wish to install LCIC software package, and copy all the files from the root of the LCIC utility diskette to this directory. Preferably, backup the diskette.

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. Change directory (CD) to where you installed the software package in step A.2.1.2.

2. Type MEMCHECK and <Enter>.
   Utility responds with:

```
MEMCHECK   free memory utility   Ver 2.00 (Jun 1993)
Enter   Card  Version     -
```

3. Type the card version number obtained from the label on the ROM of the card (locate the ROM label in drawing #1) and <Enter>.

   ROM label format:

```
I.M.S
XXnnVmmm
date
```

   Where:
   XX is software type, as LC or MX.
   nn is internal clock speed.
   V stands for "Version".
   mmm is version no.

   E.g., "LC12V011" means LC software type, internal clock speed=12, version=011.
   In this example the user should type "011"and <Enter>.

4. Turn the PC OFF.

Pass two

(Card(s) still NOT inserted in the PC.)

1. Turn the PC ON.

2. Change directory (CD) to where you installed the software package in step A.2.1.2.

3. Type MEMCHECK and <Enter>.

   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 D.

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. 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 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. Change the directory (CD) to where you installed the software package in step A.2.1.2.

5. Type MEMCHECK and <Enter>.

   MEMCHECK responds with the number of cards that have been recognized.

6. Turn the PC OFF.

7. Turn the PC ON.

8. Change the directory (CD) to where you installed the software package in step A.2.1.2.

9. Run the LCIC.EXE program (the calibration utility) by typing LCIC and <Enter> - 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. NO. 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 D), 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 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 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 all the files from the root of the LCIC utility diskette.
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: 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 type SMART and <Enter>.

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 no. 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.

		MODE		
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/gr	*	*	*
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 the 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 / No. of items).

F7 - kg/lb/gr

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

Alt-X - Quit

Quit utility, return to MS-DOS.

APPENDIX C: WIRING

C.1 LOAD CELL WIRING

The card is able to power up to six load cells, 350 Ohm each, which are connected in parallel. Refer also to drawing #2.

C.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

C.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

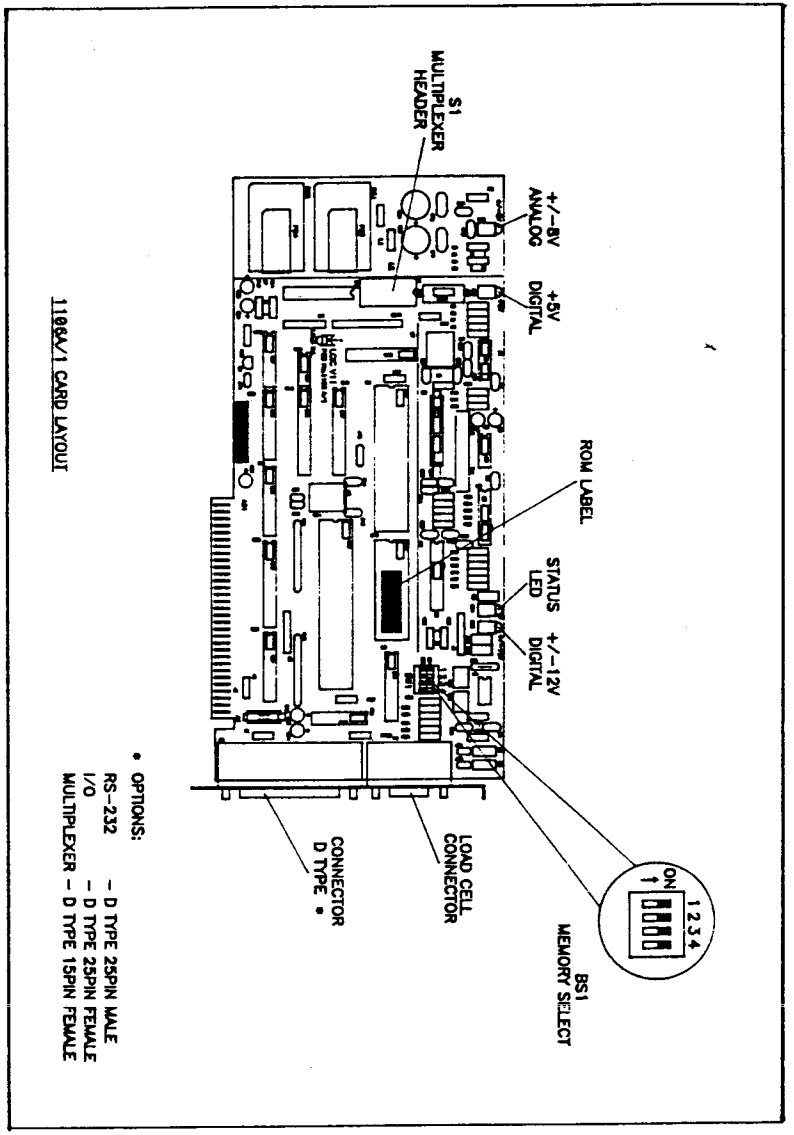
C.2 OPTIONAL I/O CARD WIRING

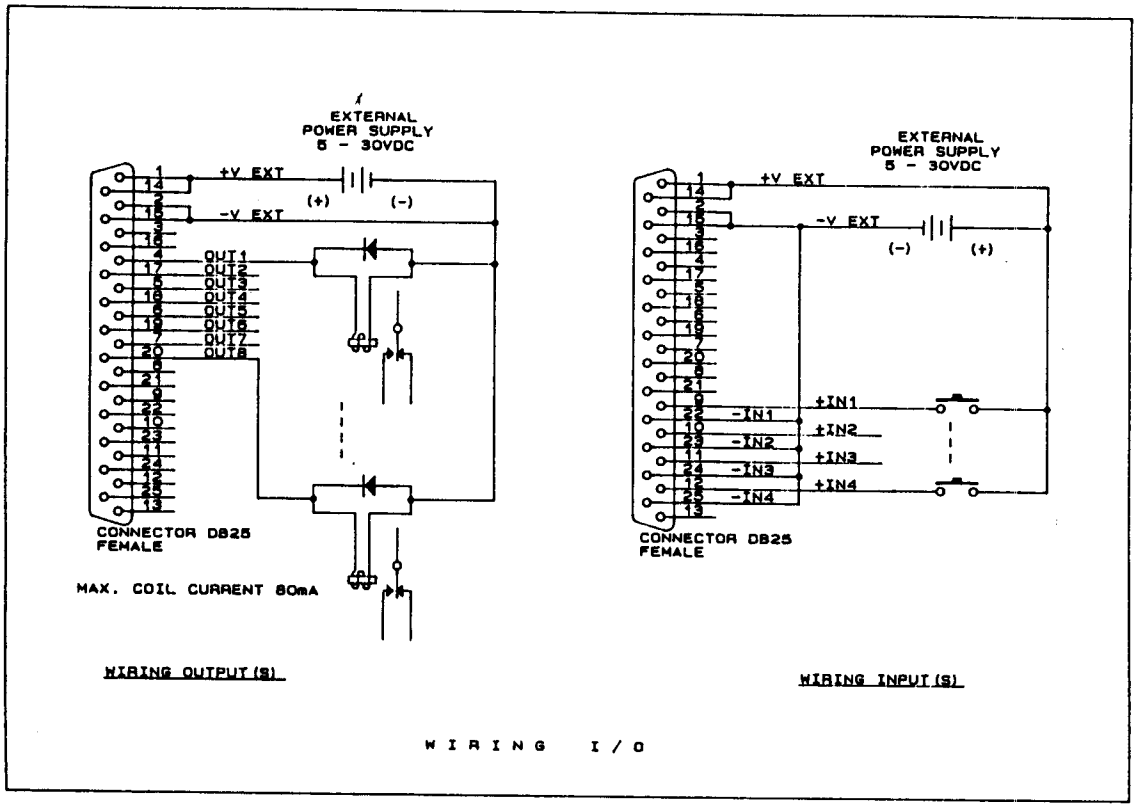
CONN. DB25 PIN No.	SIGNAL
1,14	+V EXT
2,15	-V EXT
4	OUT1
17	OUT2
5	OUT3
18	OUT4
6	OUT5
19	OUT6
7	OUT7
20	OUT8
9	+IN1
22	-IN1
10	+IN2
23	-IN2
11	+IN3
24	-IN3
12	+IN4
25	-IN4
3,16	N.C.
8,21,13	N.C.

Refer also to drawing #3.

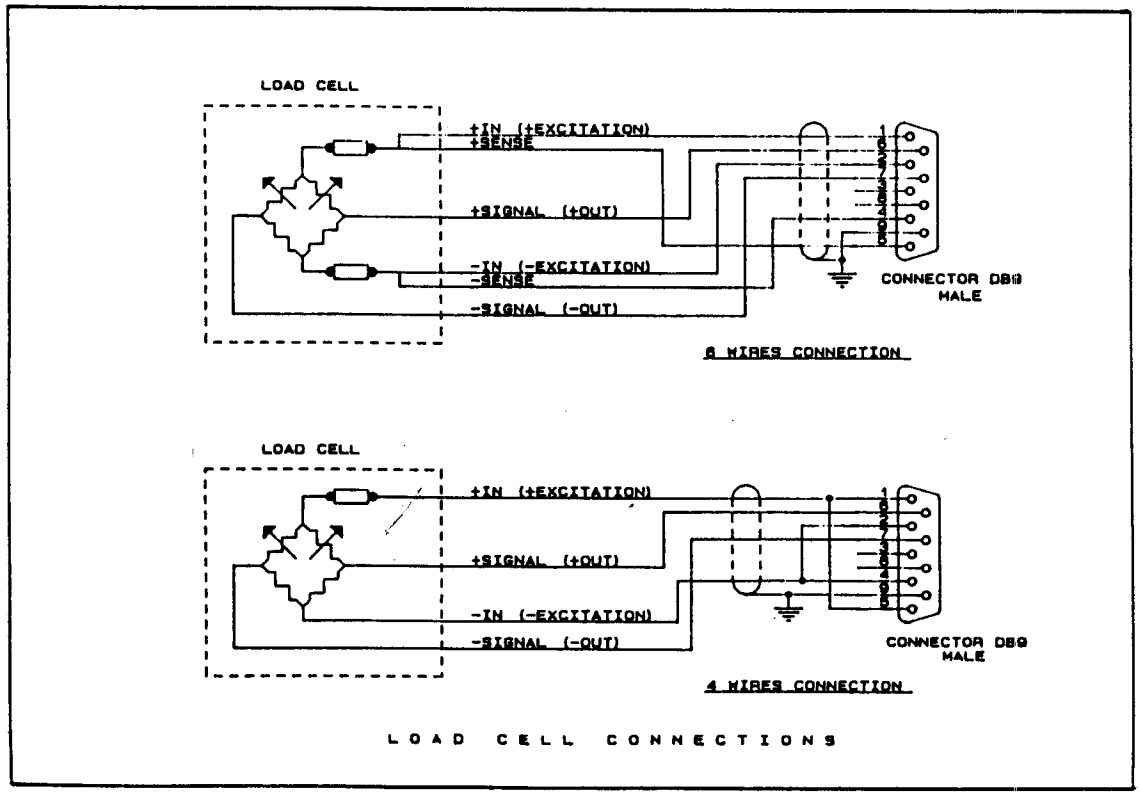
APPENDIX D: AVAILABLE SETUP MEMORY LOCATIONS (ABSOLUTE ADDRESSING)

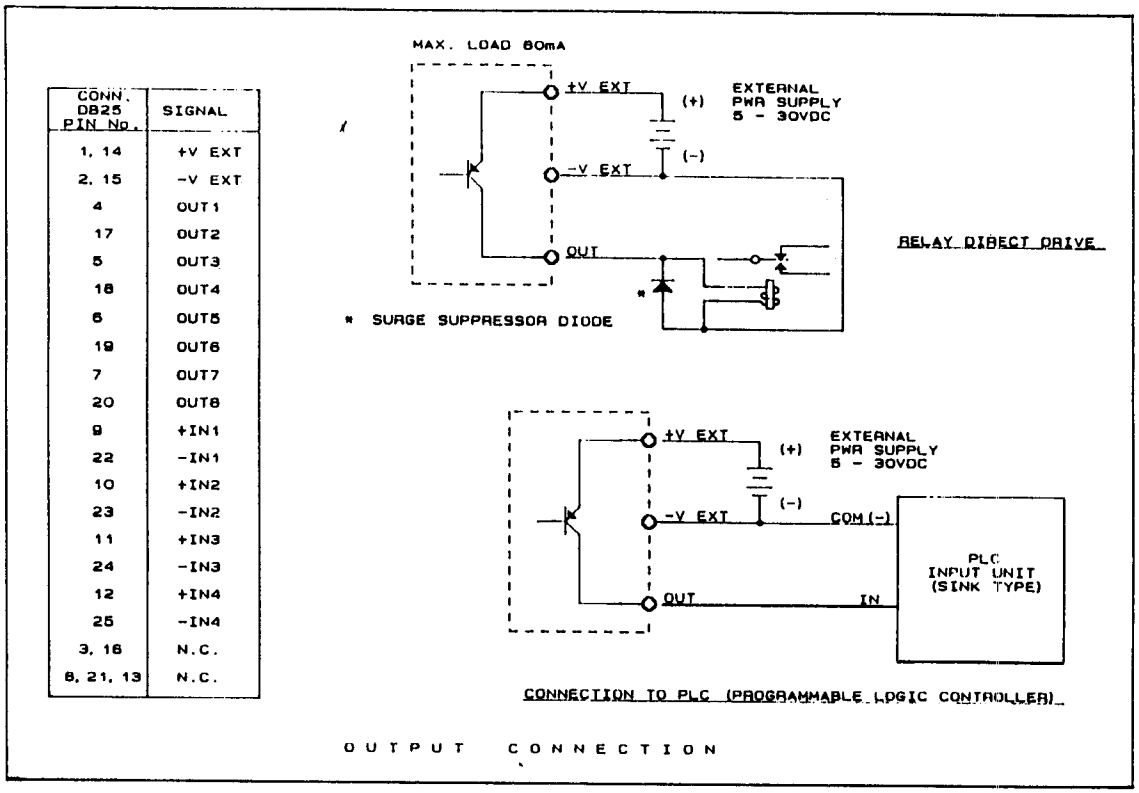
	S1	S2	S3	S4	MEMORY RANGE
1	ON	ON	ON	ON	C7C00 - C7FFF
2	OFF	ON	ON	ON	CE400 - CE7FF
3	ON	OFF	ON	ON	CE800 - CEBFF
4	OFF	OFF	ON	ON	CEC00 - CEFFF
5	ON	ON	OFF	ON	CF000 - CF3FF
6	OFF	ON	OFF	ON	CF400 - CF7FF
7	ON	OFF	OFF	ON	CF800 - CFBFF
8	OFF	OFF	OFF	ON	DD800 - DDBFF
9	ON	ON	ON	OFF	DEC00 - DEFFF
10	OFF	ON	ON	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





DRAWING #2: LOAD CELL CONNECTIONS

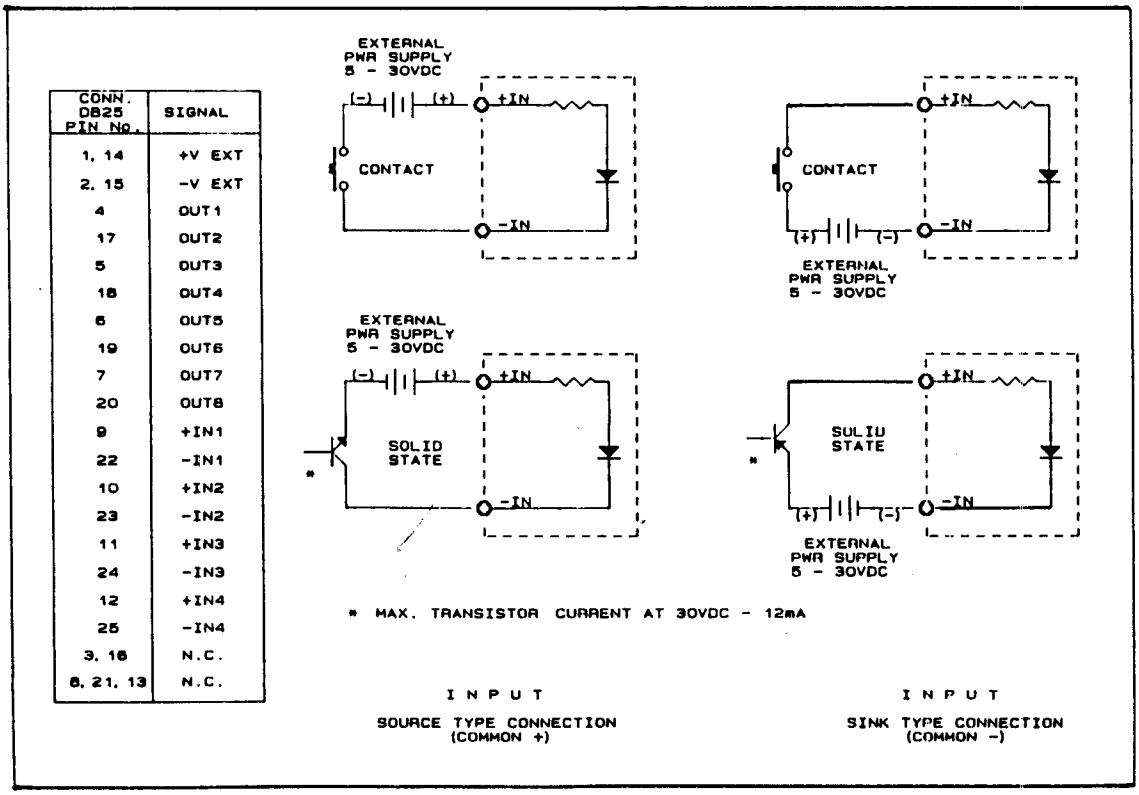




CONN. DB25 PIN No.	SIGNAL
1, 14	+V EXT
2, 15	-V EXT
4	OUT1
17	OUT2
5	OUT3
18	OUT4
6	OUT5
19	OUT6
7	OUT7
20	OUT8
9	+IN1
22	-IN1
10	+IN2
23	-IN2
11	+IN3
24	-IN3
12	+IN4
25	-IN4
3, 16	N.C.
8, 21, 13	N.C.

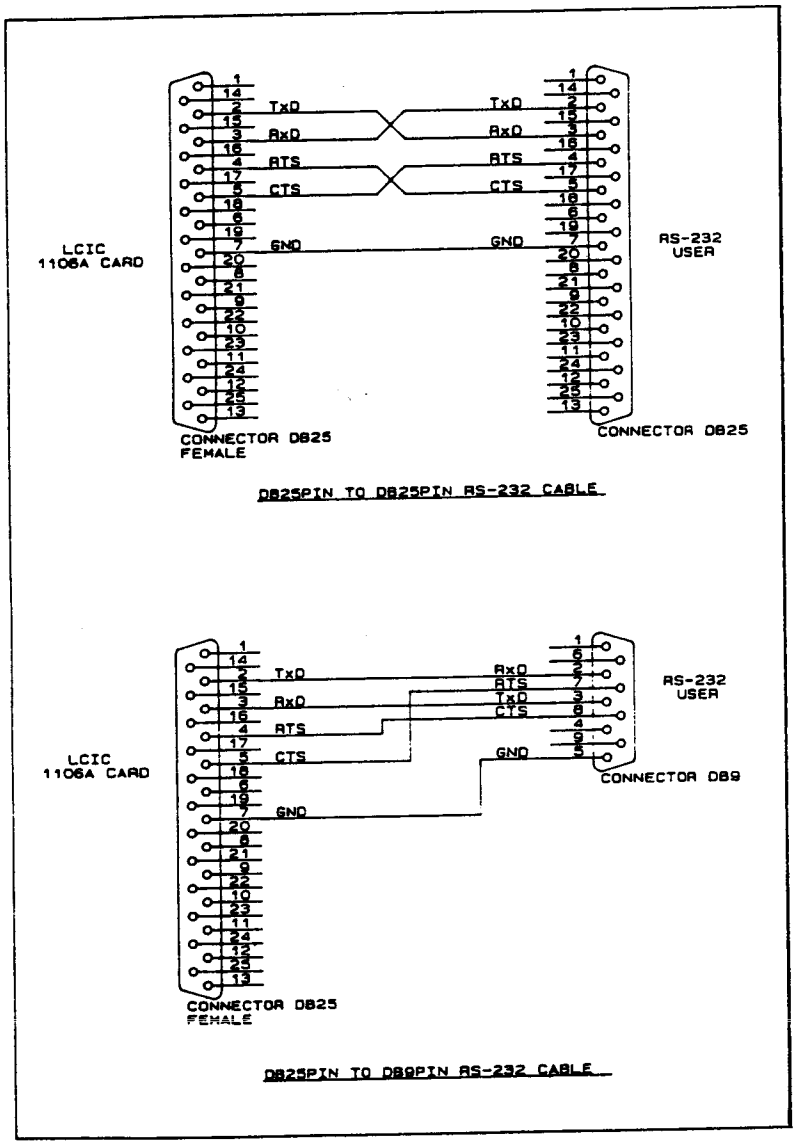
OUTPUT CONNECTION

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



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.

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



WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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