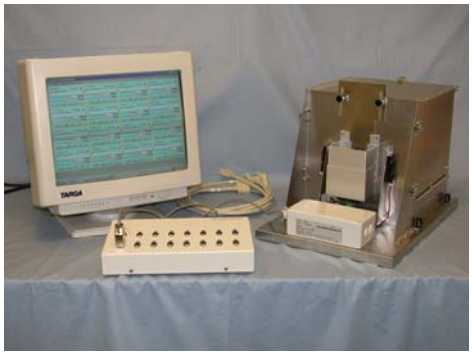
CAMPDEN INSTRUMENTS LIMITED

INSTRUCTION MANUAL

FOR

Model 80350 series
Microstructural Feeding Analysis System
for Rat.



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Introduction.

Packaging.

Please NOTE, the feeding station load cells are extremely sensitive and great care should be paid when unpacking and handling these units. Please retain original packaging for future.
Instruments will not be accepted for service or repair unless the unit is returned adequately and properly packaged as inadequate packing has resulted in transit damage in the past.

The chamber load cell and food hopper have been supplied to you partly assembled in order to minimise damage in transit. The load cell is very delicate and may be damaged or put out of calibration if excess force is applied. To reassemble the food hopper assembly, carefully remove the black tape from the load cell bracket. With great care, fix the hopper tray to the bracket using the supplied screws. Ensure that the hopper tray is aligned parallel to the chamber wall with a minimal clearance gap. Carefully place the hopper on the hopper tray. The food hoppers and trays are numbered and must be kept as pairs if more than one chamber is supplied.

Overview of System.

The Campden 80350 feeding system is a PC based data acquisition system capable of monitoring rodent feeding behavior in up to 32 experiment chambers.
For a system of up to 16 chambers one interface module is required and for a system of up to 32 chambers two interface modules are required.
The system is designed for use with powdered diet of P2.5 grades (granule size) available from BioServe or Charles River.
The maximum weight of food allowed in the hopper is 50g.

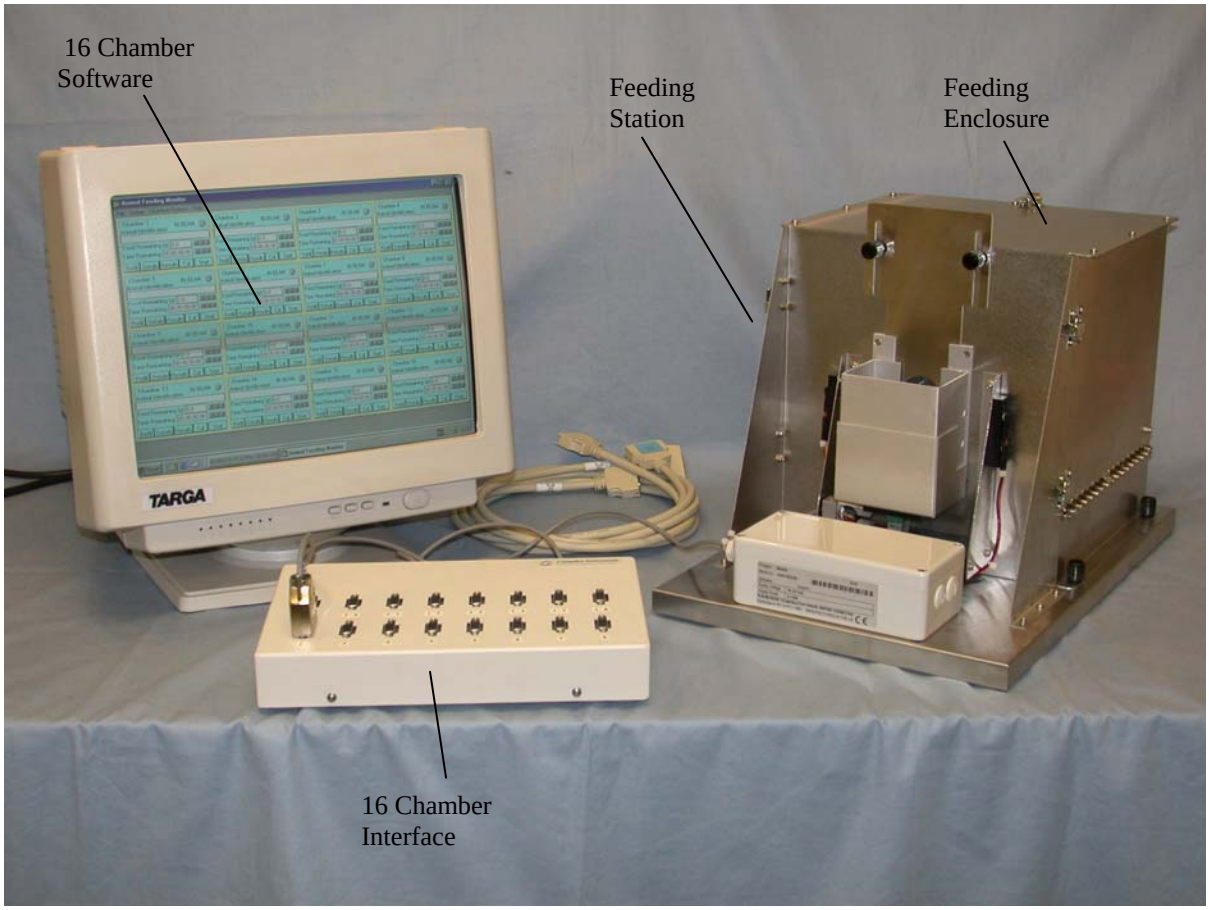

Figure 1. Feeding System Components.

Software.

The feeding acquisition software is available in 16 and 32 chamber formats. A minimum PC specification for running this product is 2GHz Pentium 4 or equivalent. Acquired data files can be accessed and manipulated using Microsoft Excel spreadsheet.
All feeding chambers are monitored from the main screen, which details for each experiment; animal identification, food in hopper and experiment time remaining. An alarm system is also displayed to show at a glance if food or time, are running low.
Experiment details are entered before the experiment begins and are presented at the beginning of the results file.
Results can be displayed as the acquisition takes place.
A refill facility is provided, this halts the experiment clock for the duration of the refill and logs refill start and finish times and weights.
Results are recorded for each feeding bout. When the animal begins feeding, time and hopper weight are logged. When the animal finishes feeding, time and hopper weight are logged. These results are then processed and the acquired data can be logged in any of the following fields: Start Meal time (Experiment), Finish Meal time (experiment), Start Meal time (Actual), Finish meal time (Actual), Date, Start Meal Weight, Finish Meal Weight, Meal size, interval time, Meal time, Returns to meal, Meal number and Feed rate.
Drivers for the Keithley Instruments data acquisition boards KPCI-3107 are supplied.

Interface.

Interfacing the chambers with the PC is accomplished using a Keithley Instruments data acquisition board KPCI-3107 in conjunction with Campden Instruments interface module, which also provides power to the feeding chambers. Power supply and interconnecting cables (x2) for each module are supplied. For a 17 to 32 chamber acquisition system two data acquisition boards and interface modules are required.

Feeding Station and Chamber. (Figures 2 and 3)

The feeding station consists of a base with fixed end wall to which the load cell hopper, IR feed monitor beam and electronics enclosure are attached. The chamber with grid floor and a hinged Acrylic door is detachable from the feeding station for cleaning purposes. Connection to the interface module is via a 5M long cable with 9pin D-connector termination.

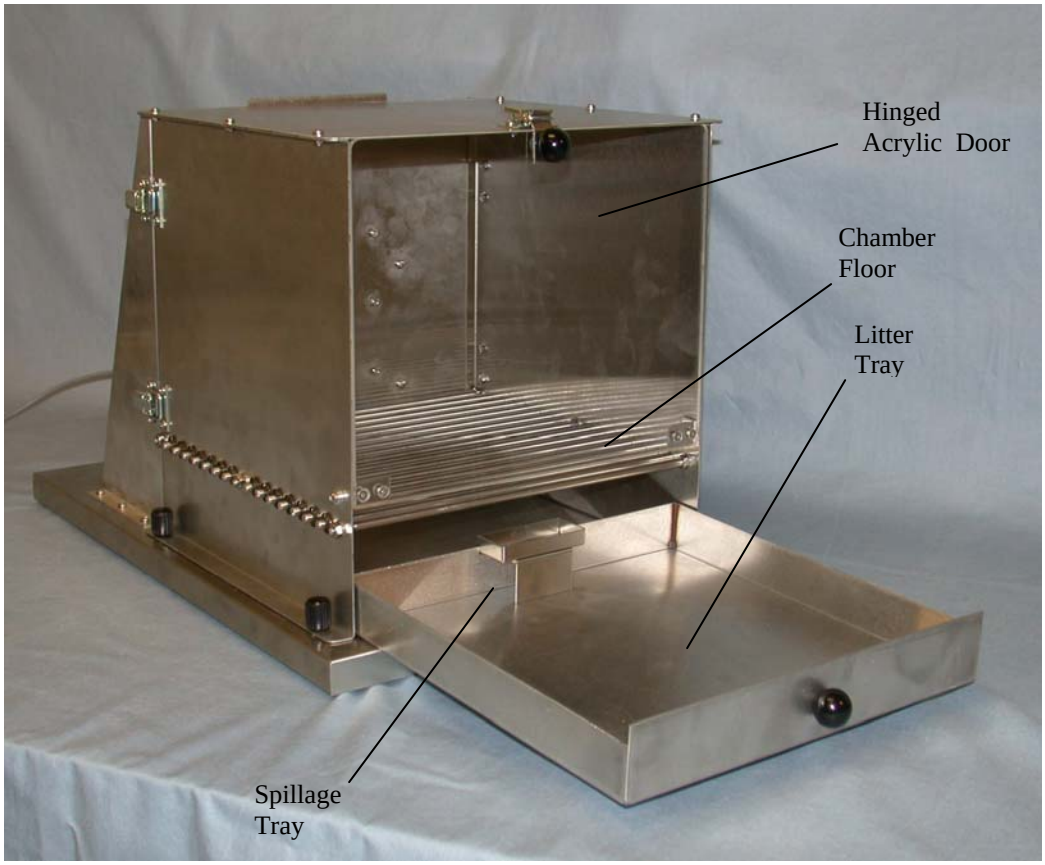

Figure 2. Animal Enclosure.

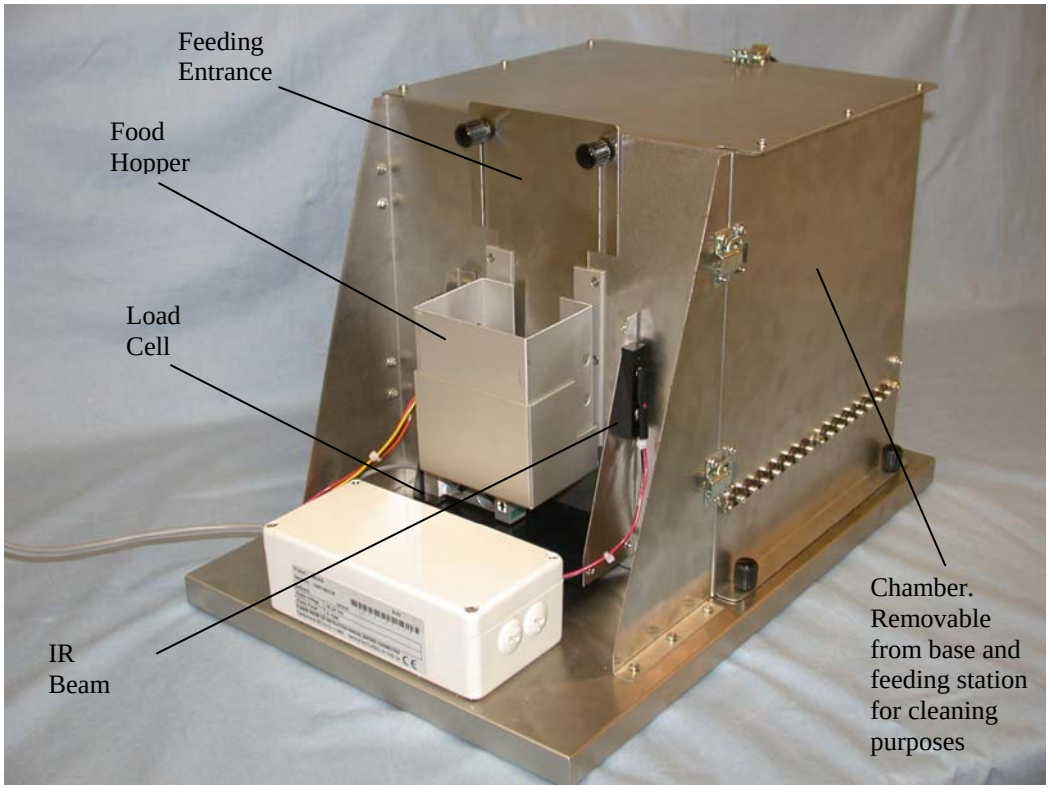

Figure 3. Feeding Station

Installation.

Your Campden Model 80350 System has high sensitivity in order to achieve a resolution of 0.1g. Therefore in order to achieve the best results and accuracy from the feeding system weighing stations, the animal chambers should be positioned on solid benches or tables. This will prevent undue oscillation of the weighing elements. The laboratory room temperature should be kept constant for the duration of the experiment to avoid drift in the load cell outputs.
Install the system as described in points 1 to 10 below.

1) Follow the instructions provided by Keithley Instruments to install the KPCI-3108 series acquisition boards and drivers onto the PC. Only the driverLINX drivers are required to run the feeding monitor software.
2) From the driverLINX configuration panel (Figure 4) configure the board as driverLINX device0. Select the labVIEW tab (Figure 5) and add the device as labVIEW device1. If installing a 32-chamber system label the second acquisition board as driverLINX device1 and labVIEW device2.

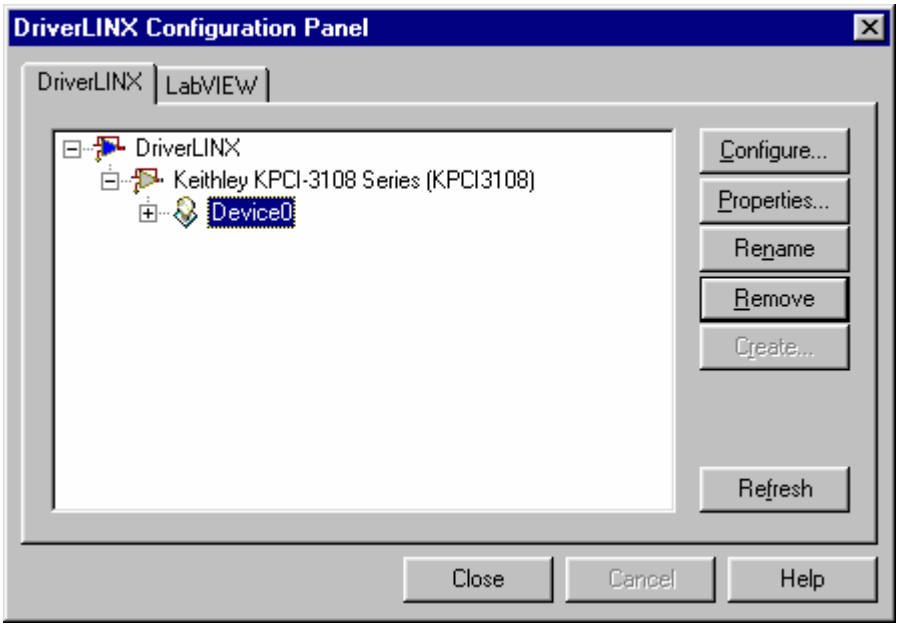

Figure 4. Configuring the Drivers for Acquisition Board.

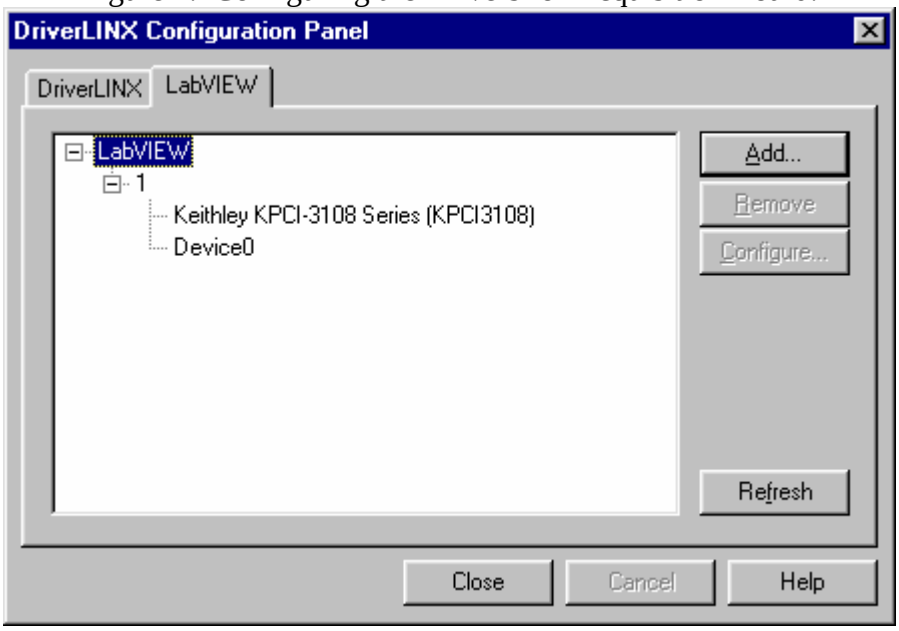

Figure 5. Configuring the driverLINX drivers for Labview.

3) From the 80350 V2.2 Feed Monitor CD, run the setup.exe file.
4) Follow the install wizard instructions to complete the software installation.

5) Referring to Figure 6. Connect the interface unit to the KPCI-3108 acquisition board using the two data cables, which have been numbered for convenience.

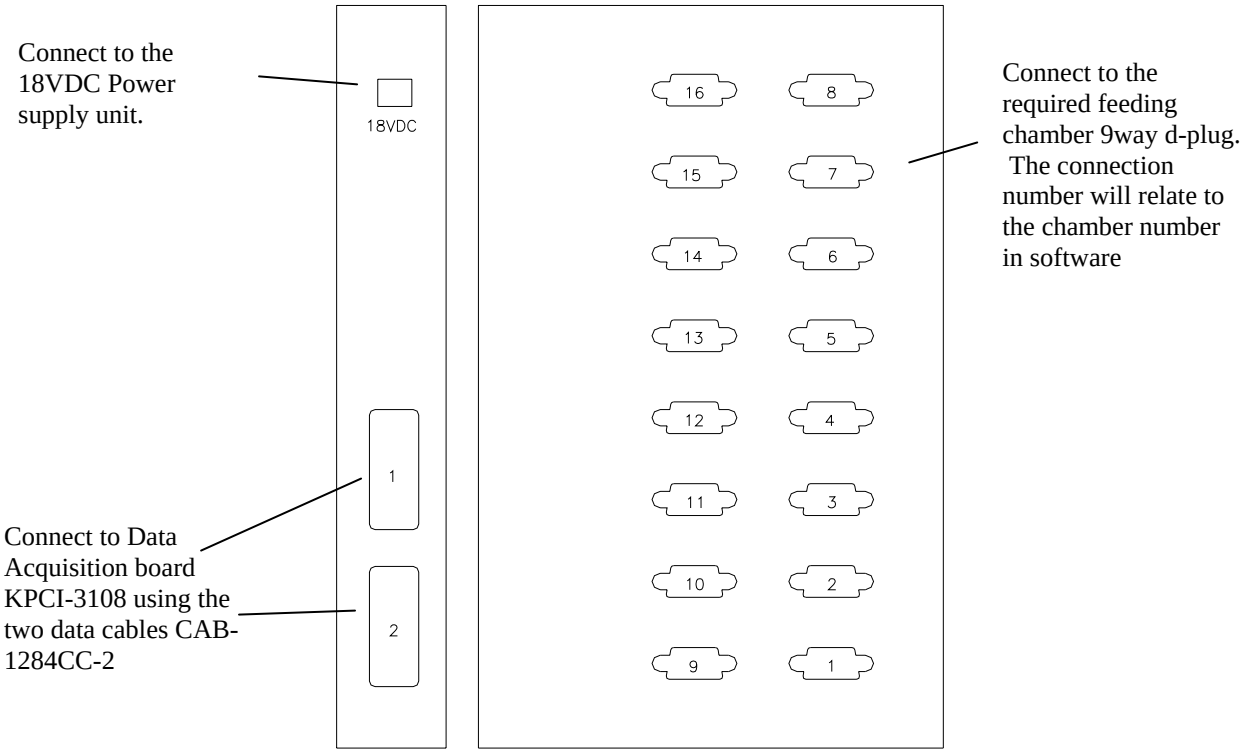

Figure 6. Interface Module.

6) Connect the individual chambers to the numbered 9 Way D-sockets on the interface unit. The socket number relates to the equivalent chamber number in the acquisition software.
7) Connect the 18VDC power supply to the power inlet on the interface unit.
8) Run the Feeding Monitor application software. The main screen will appear (Figure 8). This screen is divided to monitor the 16 or 32 chambers. The in beam indicator for the connected chambers should be off (gray). Placing an object between the IR beam in the chamber should illuminate (orange) the in beam indicator on the corresponding chamber screen. Check this is the case for all connected chambers.

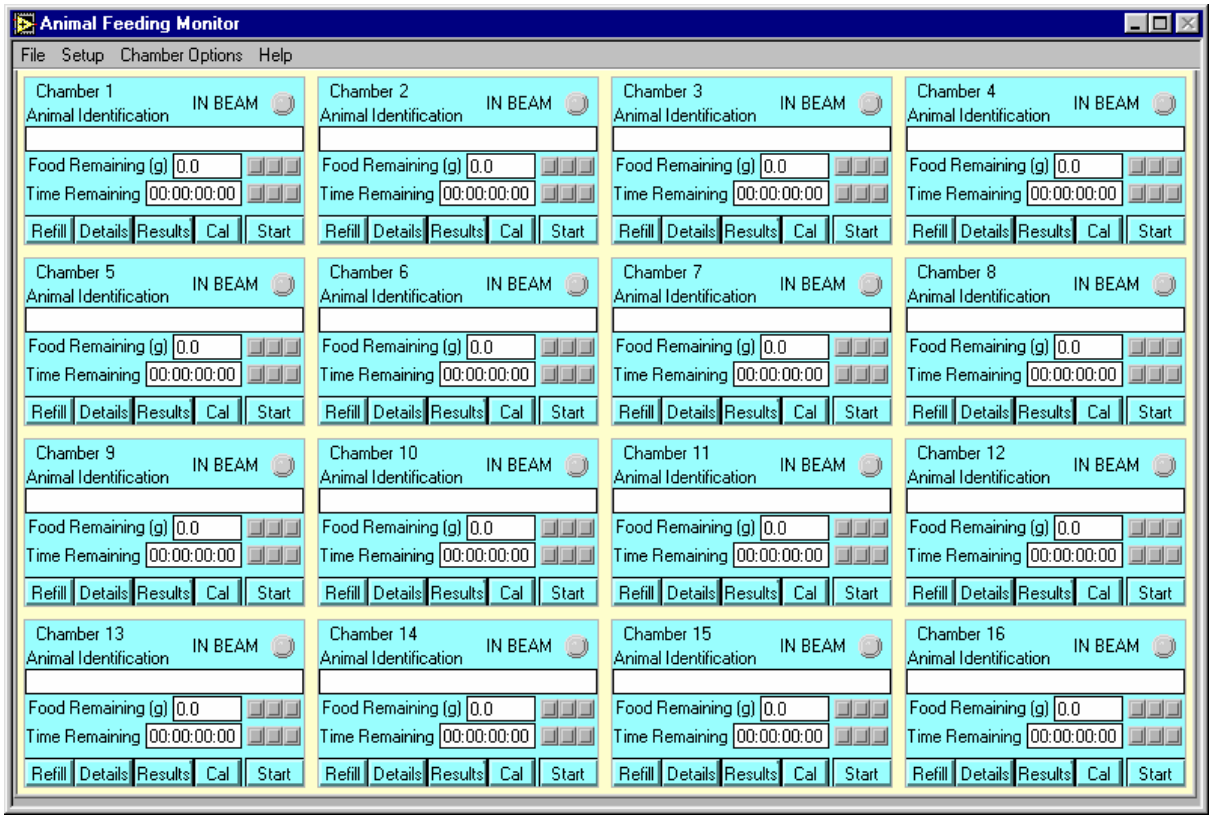

Figure 8. Main Screen.

9) To check the operation of each load cell. Click the calibrate button for the appropriate chamber. The calibrate screen will appear (Figure 9). The displayed voltage reading should vary if a small force is applied to the top of the load cell.
10) The feeding stations are now ready to calibrate.

Calibration of the Feeding Stations.

Locate the hoppers in the mounting trays on top of the load cells. And leave the units to settle for approximately 30 minutes.
To calibrate a feeding station, choose the corresponding calibrate screen (Figure 9). Click on the zero button with the empty hopper on the load cell. Carefully place the 50g calibration weight into the food hopper. Allow the load cell to settle for 5 minutes. Click on the 50g button. The chamber load cell is now calibrated. Moving the chamber to a different interface location, or using a different hopper will invalidate the calibration.

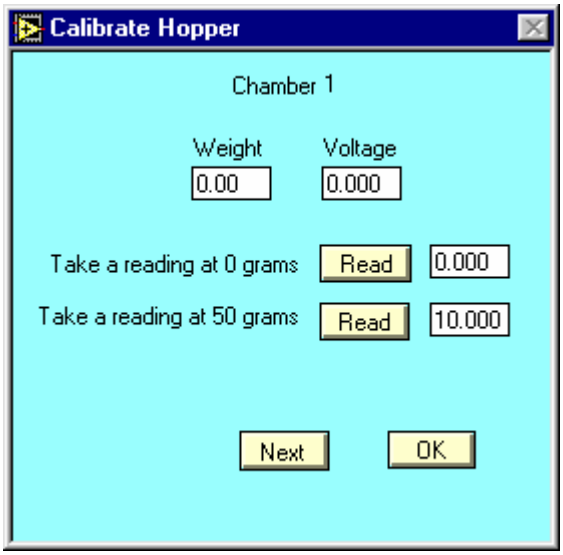

Figure 9. Calibration Screen.

Operation.

Once each chamber has been calibrated with the certified weight provided. The next step is too fill the feeding hoppers. The system is designed for use with powdered diet of P2.5 grades (granule size) available from BioServe or Charles River. The maximum weight of food allowed in the hopper is 50g.

Loading the hoppers can be done either by removing them and then carefully replacing them when full or by carefully filling them *in situ* through a funnel or similar.
It is important that the weighing element is not overloaded during this process. If the hopper is overfilled or if the loaded hopper is dropped onto the weighing element this is most likely to result in damage that would require return to Campden Instruments for repair that would be costly.
Spillage of the powdered chow must be avoided as this could, in time, solidify and affect the sensitivity of the weighing element.
Ensure the feeding entrance is adjusted so as no to allow the animal to escape from the chamber into the hopper enclosure. If this occurs, damage to the weighing element is possible.
Ensure the small spillage tray is in place below the feeding entrance. Any food spilt during the meal will be caught in this and may be weighed at the end of the experiment.
The next step is to open the software set up to run the experiment and choose the required parameters. As follows: -
1/. Enter the administrative details and identities of all animals. The experiment duration must be entered for the experiment to run.
2/. In the 'PREFERENCES' menu. Select the minimum feed weight and minimum feed time.
3/. In the 'PREFERENCES' menu. Select the data fields that are required to be output to spreadsheet.

The final step is to load the animals.
This is best achieved by two operatives working together one at the PC and the other handling the animals.
The following procedure will minimize latencies and disturbances.
1/. Open the door on each chamber and have the animals close by and easily accessible.

2/. One operative takes the first animal and placing it in the first chamber calls a confirmation to the operative by the PC who can them duly press the 'START' button at the correct moment. Please note that an experiment time and animal identification must have been entered for the experiment to commence.
3/. This is repeated with each animal and chamber in turn so that the latency between the animal entering the cage and taking its first meal is accurately recorded.

Guide to Software.

Feeding Monitor Main Screen (Figure 8)

This screen displays all of the experiments in limited detail and provides access to all other functions. It provides simple monitoring of running experiments.
The screen is split into 16 or 32 chambers (depending on version). The 32 chambers are accessed via the vertical scroll bar. Functions displayed for each chamber are:

In Beam – This indicator is illuminated when the animal is feeding (IR sensing beams broken). It is active at all times so the beams can be checked prior to operation.

Animal Identification – Identifies the animal in the chamber. This data is entered via the experiment details screen.

Food Remaining – Indicates the food remaining in the hopper. To the left of this, there is an alarm function, which allows the user to detect at a glance if food levels are becoming low. The alarm levels are set in the preferences screen.

Time Remaining – Indicates how long the experiment has left to run. The duration is set via the experiment details screen. To the left of this, there is an alarm function, which allows the user to detect at a glance if the experiment time is running low. The alarm levels are set in the preferences screen.

Refill – This allows the food hopper to be refilled during longer experiments. When selected the experiment is halted. Once the refill is complete, the experiment is restarted and a marker entered in the log file showing before and after weights and times.

Details – Provides access to the experiment details screen (Figure 11).

Results – Provides access to the last 20 result entries (Figure 12).

Calibrate – Provides access to the load cell calibration screen.

Start – Starts or stops the experiment. Pressing the start button will start the experiment running, first checking the log file name and path, and then saving the header information. Data will then be saved to file as it is acquired. The experiment will stop, either when time runs out or the stop button is pressed again. Note once the experiment is started, stopping the experiment will end the results file. Therefore pressing start again will start a new

experiment.
When start is pressed the user will be asked to enter the results log filename before the experiment commences.

Preferences.

The preferences screen (Figure 10.) is accessed from the setup menu. The screen is split into four sections:

1) Acquisition Constants

There are three acquisition constants that affect the quality of data acquisition.
Load cell filter constant – The load cell data acquisition is filtered in software using an averaging filter. This filter helps to remove mechanical and electrical noise from the system. The value of the filter constant represents the number of samples taken per load cell reading. Higher values will be more demanding on the processor and will slow the acquisition rate but will improve the noise rejection of the system. The default value is 50.
Values between 20 and 200 are acceptable.
Load cell Acquisition Rate – This value represent the time taken to update the load cell reading in milliseconds. A faster update rate will be more demanding on the PCs processor. The default value is 500. Values between 1 and 1000 are acceptable.
IR Beam Acquisition Rate – This value represent the time taken to update the reading from the IR Beam in milliseconds. A faster update rate will be more demanding on the PCs processor. The default value is 200. Values between 1 and 1000 are acceptable.

2) Experiment Preferences.

Minimum Meal Length (seconds) – This is the minimum length of time feeding, which will be classed as a meal. The default value is 2 seconds.
Minimum Meal Weight (grams) – This is the minimum amount of food consumed to be classed as a meal. The default value is 2 grams.
Same meal if within (seconds) – This value serves two purposes. Firstly, it is the amount of time after a meal before the weight is measured. i.e. it is a settle time for the load cell. A settle time of 5 seconds is recommended. Secondly, if the animal returns to feed within this time it is classed as the same meal and the returns field will be incremented. The default value is 5.

3) Record Results in the following Fields.

Experiment results will be recorded to the data log files in any of the fields selected below.

Date – The actual date the meal was recorded. (DD:MM:YY).
Start Meal Time (actual) – The actual start time of the meal (HH:MM:SS).
Finish Meal Time (actual) – The actual finish time of the meal (HH:MM:SS).

Start Meal Time (experiment) – The time into the experiment the meal started (HH:MM:SS).
Finish Meal Time (experiment) – The time into the experiment the meal finished (HH:MM:SS).
Meal Time – The duration of the meal. Recorded in seconds.
Start Meal Weight – The weight of food in the hopper before the meal began. Recorded in grams.
Finish Meal Weight – The weight of food in the hopper after the meal has finished. Recorded in grams.
Meal Size – Amount of food eaten during the meal. Recorded in grams.
Feed rate – Meal size / Meal time. Recorded in grams per second.
Interval time – This is the time elapsed between meals. Recorded in seconds. The entry for the first meal is the latency from the beginning of the experiment.
Returns to Meal – The number of returns made to the meal before the load cell end of meal weight is recorded.

4) Alarms

There are two experiment alarms that can be set, food remaining and time remaining. Each alarm has there statues; Green, Amber and Red. Times or weights for the amber and red alarm levels can be entered here.

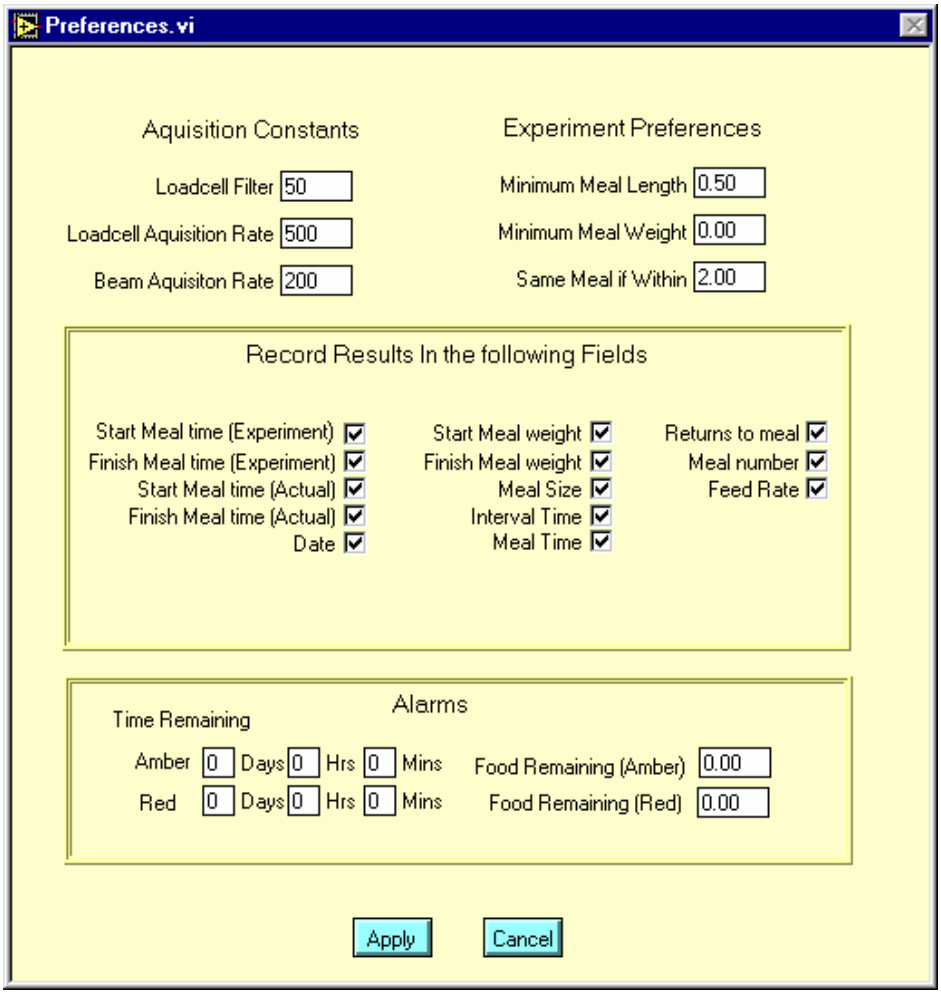

Figure 10. Preferences Screen.

Experiment Details.

The experiment details screen (Figure 11) is accessed from the main screen via the chamber menu or the individual chamber button. When in this screen, use the previous and next buttons to switch between chamber details.

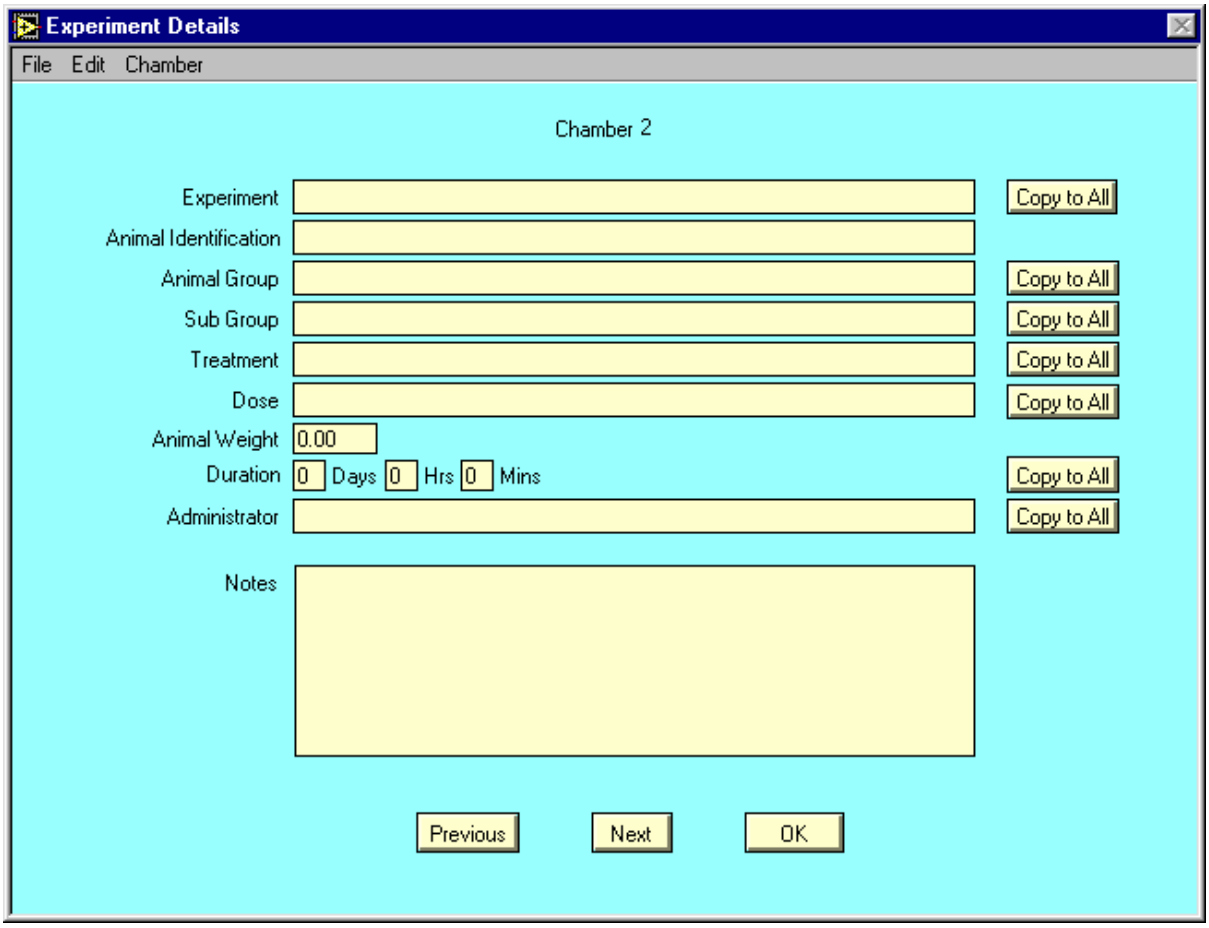

Figure 11. Experiment Details Screen.

Enter the data into this screen before starting the experiment. The information will be stored as a header on the experiment log file. The default log file name is made up of entries in Experiment and Animal Identification, followed by the date.
The duration time must be entered for the experiment to run.
Copy to all – pressing the copy to all buttons will copy the respective data to all chambers.

Experiment Results.

The experiment results screen (figure 12) is accessed from the main screen via the chamber menu or the individual chamber button. When in this screen, use the previous and next buttons to switch between chamber results.
The screen displays the last 17 results acquired in the fields selected in preferences. Also displayed are the start and finish times of the experiment.

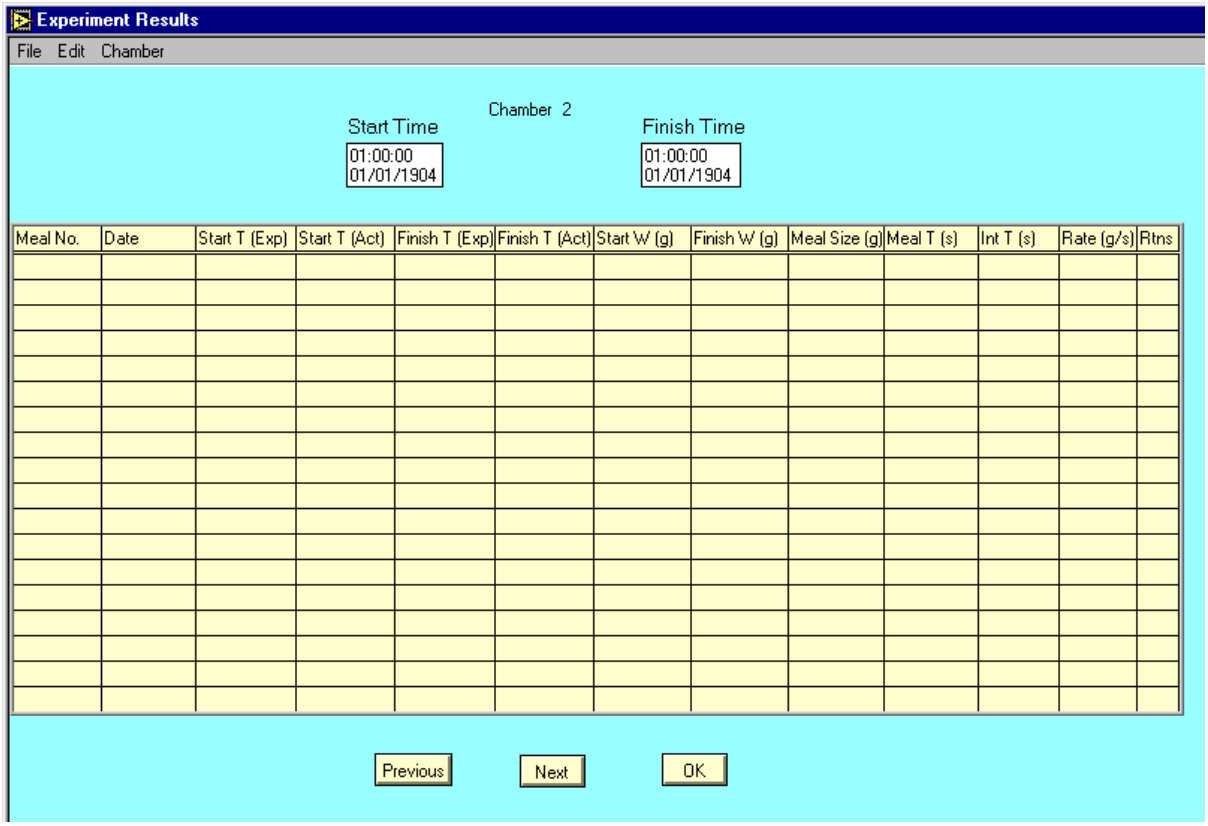

Figure 12. Experiment Results Screen.

Calibrate Load Cell.

The Load Cell Calibration screen (figure 9) is accessed from the main screen via the chamber menu or the individual chamber button. When in this screen, use the previous and next buttons to switch between chambers calibrate screens.
All load cells are hardware calibrated at the factory. The Load cells also require software calibration. Place the empty hopper onto the load cell. Press the Zero button. Carefully place the 50g calibration weight in the hopper. Press the 50g button. The chamber load cell is now calibrated.

Log File Output.

A folder called ‘data’ will be created in the same folder as the program software. The log files will be stored here. Access the files using Microsoft Excel. Note the log files are not of Microsoft Excel type so when opening, follow the Excel instructions for changing file type. The log file default name is made up of the date and information entered in the experiment details as follows – (Experiment details-Animal identification–dd-mm-yy).

Specifications.

PC Requirements
IBM compatible PC with 2Ghz Pentium 4 processor one free PCI slot; 500MB free hard disk space for the application and minimum 126MB RAM. The system is compatable with Windows 98/2000/NT/XP

Interface.
The PC interface module consists of:

Data acquisition PCI Board –
Keithley KPCI-3107 – 16 channel 16bit Analogue input; Max sample rate 100ksamples/s; 32 digital I/O lines.

Interface box -
Interfaces up to 16 Chambers with the data acquisition board and also supplies power for the chamber weighing stations.
Connection to Keithley KPCI-3107 via two data cables – Keithley CAB-1284CC-2 2M.
Connection to chamber via 16 9-Pin D connectors.
Power Supply –
ASTEC SA45-3109 – Input Voltage, 90-264Vac 47-63Hz; Input connector, 3 Pin IEC320; Power, 45W; Output, 18Vdc 2.5A.

Chambers.

Small Chamber: for animals up to 400g
240mm (front to back) x 240 (width) x 200mm (height from grid floor) in Stainless Steel with clear Polycarbonate front hinging door.
Floor is a grid of 5mm diameter bars with a 14mm pitch.
Large Chamber: for animals up to 1000g
430mm (front to back) x 235 (width) x 400mm (height from grid floor) in Stainless Steel with clear Polycarbonate top lid and front.
Top lid is removable (not hinged but secured to prevent animal escape) in order to place and remove the animal.
Floor is a grid of 5mm diameter bars with a 14mm pitch (across the width) with cross supports of 35mm pitch (along the length).
General Chamber Features
Separate catch tray extends 25mm into the cage under the grid floor in order to catch any spillage when the animal withdraws from the feeding hole.
Litter tray under floor is removable from the front for cleaning. (E.g. filling with sawdust for removal of animal's excrement.)
Back wall with food hopper and sensitive weighing element and electronic amplifiers is free standing on the bench to allow rest of chamber to be separated for cleaning by pressure washing or autoclaving.
Feeding hole in rear wall is minimum 35mm and incorporates a vertical-sliding panel so that

the hole can be elongated to accommodate cannulated animals.

Weighing Station.

Maximum allowable food weight – 50g.
The weighing station uses a load-cell weighing device along with a signal conditioning amplifier to measure the food content of the food hopper. The food hopper is mounted upon the load cell and has a feeding hole open to the animal enclosure. Two IR light beams detect the presence of the animal's head in the feeding hole of the hopper allowing meal times to be monitored.
The weighing station is accurate to +/- 0.1g assuming a deviation in room temperature of less than 2°C. If the temperature deviation is greater than 2°C the system accuracy over extended time periods will be compromised due to drift with time/temperature. Individual feeding bouts will not be affected by this and the system will remain accurate to +/- 0.1g. However, at the end of the experimental period some discrepancy may occur between the sum of all feeding bouts and the total measure over the duration.