

User's Manual

Varitronix Limited, Hong Kong



Technical Support Contact

Varitronix Limited
22 Chun Cheong Street
Tseung Kwan O Industrial Estate
Tseung Kwan O, Hong Kong
Tel: (852) 2197-6000
Fax: (852) 2343-9555

Trade Mark

Personal Response System and **PRS** are common law trademark of Varitronix Limited. It is based on the Free-forming One-way Network (patent pending).

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First Edition

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Activate your classroom with PRS!

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I. What is PRS?

PRS is for you if you teach and want

- your students to pay attention to what you say in class;
- 100% participation in question-and-answer sessions;
- immediate feedback and reinforcement;
- automatic attendance check;
- automatic recording of student answers;
- a lesson be reasonably understood before going to the next one;
- test or quiz results promptly with automatic grading;
- shy and disadvantaged students be proactive;
- students' opinions and preferences instantly;
- Continuous monitoring of students' progresses, both individually and as a group.

In short, **PRS** is a tool for active learning in the classroom.

PRS is also for you if you

- conduct a training session and want immediate feedback and reinforcement;
- convene a meeting to elect officers and want the results immediately;
- demonstrate a new product and want an on-the-spot measure of its impact;
- score a contest using the audience and want the results instantly.

In short, **PRS** is a tool for electioneering or voting with immediate results, and for instant polling or surveying of opinions or preferences.

PRS stands for Personal Response System. It literally means **privately responding** or **selecting**. It is based on a free-forming one-way network of wireless communication (patent pending). It is low cost, easy to use, portable, and a flexible network.

II. How does PRS work?

In a nutshell, each member of the audience responds privately to a question or prompt, all responses are collected, and the summary displayed for all to see.

Since nearly all questions can be cast in a multiple-choice format, the audience answer by pressing down on a numeric key on their pocket-size wireless Transmitter (T). The signals sent are intercepted by a portable Receiver (R) which in turn is connected to a central Display (D) via an electronic circuit or a PC. Every time a signal from a T is received, one of the boxes shown on D changes color. Since each T is encoded with a **sender** (student) ID number, which is tagged onto the signal sent, the flashing box on D shows the ID of the corresponding **sender**. The answer itself is not displayed. At the end of the question period, a statistical summary of the answers is shown on D as a histogram.

There are two modes of operation for **PRS** with which the **operator** (instructor) can select prior to the start of each session.

- In the *Anonymous* mode, only the statistical results are filed and no record is kept on the individual response.
- In the *Known* mode, each response (including the associated **sender ID**) is recorded on a data file in the sequence received. The cycle is repeated for each question until the end of the session, at which time an end-of-file is marked on the data file. The entire file is written on line onto the PC hard disk. [Note: If a special LED Display Panel is used instead of a on-line PC, the data file, which is recorded on a memory unit, can later be transferred off line to a PC.]

III. The special features of PRS

- It is affordable - the cost per user is no more than that of a typical paperback textbook.
- It can be installed and readied for use in minutes.
- It is easy to use - the **operator** and **senders** can gain familiarity with its operations in minutes.
- It is portable - the wireless transmitters and receiver are pocket-sized and, in an educational institution, students can be equipped with their own ID-coded transmitter to use in any classroom.
- It is scalable - adding new **senders** is easy and economical; the network can start with a small number of units and expand to cover the entire student population on campus by simply adding the corresponding numbers of transmitters and receivers.
- It is a learning tool - its simplicity makes it applicable to all levels of education from the primary to the tertiary.
- It has security - the ID in the transmitter can be changed only with the use of an ID changing adapter.
- It has two modes of operation - the *Known* mode in which all ID-tagged responses are recorded and the *Anonymous* mode in which these are not.
- It has two modes of display - the *full-screen* mode shows the largest image of the indicator boxes of signals received and for the histogram of the results, while the *half-screen* mode leaves the other half of the screen for displaying the question or instruction for responses.
- It is a teaching tool - it has provisions for creating a class seating chart on line, it facilitates the administration of quizzes, tests and polling, and permits the attachment of a confidence level (high, medium, and low) to the answer sent by the transmitters.

Extensive classroom testing and the use of well established IR technology have led to this simple functional system that is robust and sufficiently low cost to make it affordable for all students to have their personal transmitter to use in any classroom on campus. In sum, **PRS** could become a universal learning tool in the classroom.

IV. Parts list

A Standard Package comes with the following items:

- 50 Transmitters;
- 2 Receivers;
- 2 connecting cables;
- 1 9-V transformer;
- 1 ID Changer (for the Transmitters);
- 3 software programs: PRS, MARK and IDChg
- 1 User's Manual.

Please note that each Transmitter requires two (2) alkaline-type 1.5-V AAA batteries for power which the user must supply.

Multiple packages, special configurations or specific combinations can be ordered for campus-wide application. A rule of thumb is 2 Receivers per 50 Transmitters.

A School Package comes with 50 Transmitters and an integral Receiver-LED Display Panel with Memory (LED Panel for short). No PC is required to operate the LED Panel. An output port is provided so that the data stored in the LED Panel memory unit can be off loaded anytime after the end of each session. to a PC or PC Notebook.

V. Warranty

The manufacturer's warranty is limited to the repair or replacement at its option of any **PRS** product due to any defect in design, material and workmanship which arises within a period of one year from the date of delivery of such product. This warranty is subject to:

- the product not being used for any purpose other than the normal purpose for its applications; and
- the observance by the user of all operating instructions and recommendations issued by the manufacturer in relation thereto.

VI. Getting started with the Standard Package

A) What you need to have

- a PC or PC Notebook, with a minimum configuration of i486 chip and 8M RAM, which operates on Windows 3.1/95 (or a later version), and
- a projector or a TV monitor that can project your PC monitor screen for the entire audience to see.

B) What you need to do the first time

Instructions to the **Operator** (Instructor):

- Follow the instruction of the User's Guide to mount and connect the Receivers. The use of 1 Receiver per 25 Transmitters is recommended. Make sure the small glass window of each Receiver is visible to the audience.
- Supply power to the Receiver nearest the PC using the 9-V transformer provided.
- Connect the data output port of the nearest Receiver to the RS232C port of your PC using the signal cable provided.

Note: Four (4) Receivers will provide adequate coverage even for the largest lecture hall; if more than 4 Receivers are used, additional 9-V power source(s) will be required.

Skip the next paragraph if you plan to operate **PRS** entirely in the *Anonymous* mode.

Each Transmitter has been pre-loaded with an ID number (*ID*) at the factory. Before you hand out the Transmitters to the **senders** (students), you might want to change the factory set *IDs* to the student ID numbers. The *ID* can be any number from 0 to 999,999,999. Instructions for changing *IDs* can be found in the **PRS** ID-Changer User's Guide in the Appendix.

Instructions to the **senders** (students):

- When answering, make sure to aim the narrow end of your Transmitter at a Receiver.
- Watch the boxes on the display screen. Your *ID* will appear on one of these boxes and that box should change color for about 10 seconds when the signal you sent is received. This is a confirmation that the signal has been received and registered.
- The display screen also shows a box that indicates "live" the number of **senders** (students) that already have answered.
- The **Operator** (Instructor) will tell you ahead of time
 - 1) whether you can answer only once to a question or you can change your answer as many times as you wish within the time period allocated. In the latter case,
 - there is a built-in delay before the next answer can be sent out; and
 - only the last answer sent and received will be recorded.
 - 2) if a confidence level (CL) is required for your answer; press on
 - 'H' and then the 'Numeral' for certainty or high CL,
 - 'L' and then the 'Numeral' for uncertain or low CL, or
 - just the 'Numeral' for intelligent guessing or medium CL.

C) **PRS** Hardware

1) Transmitter

The Transmitter consists of a specially designed IR circuit and powered by two 1.5-V batteries (alkaline-type AAA). When the power button is pressed on, the LED is lighted and the unit is ready for sending signal. A signal is sent when any one of the ten 'numeric keys' is pressed momentarily. This signal corresponds to the numeral pressed and is tagged with an *ID*. In order to prevent traffic jam at the Receiver, the pushbuttons are deactivated for a brief duration following each send action.

A "Confidence Level" can be attached to the answer by first pressing 'H', 'L', or nothing before pressing the 'Numeric' key. 'H' means "High (certainty)" and the LED is "steady red". 'L' means "Low (uncertain)" and the LED is "steady yellow". The default of not pressing means "Medium (intelligent guessing)" and the LED remains in "steady green". The confidence level will revert to the default value of "Medium" after 15 seconds or after each power off/on sequence.

A continuously flashing or blinking of the LED indicates that the unit is malfunctioning. Try switching off the power and re-start the unit.

The batteries are expected to last at least a semester under normal usage. They will need replacement if the LED light is deemed or if it does not light up when the power switch is clicked on.

A **PRS** Transmitter User's Guide is appended to the end of this manual.

2) Receiver

The Receiver is an IR detector powered by a 9-V AC-to-DC converter. The red LED lamp should flash 3 times and be lit when the power is applied. This indicates that the unit is ready to receive signals. A signal cable is included for the connection between the RS-232C port of your PC and a Receiver. The signals are received sequentially, digitized, and passed on to the PC for analysis and recording.

If more than one Receiver is required for coverage, connect the signal output jack of the second unit to the signal input jack of the first unit and so on. No additional power source is required if a 9-V transformer is used and the total number of units in series is four or less.

A **PRS** Receiver User's Guide is appended to the end of this manual.

Warning: The IR detector may be damaged by exposure to intense light. Do not direct any part of the projector light cone on the Receiver.

D) PRS Software

1) The minimum PC configuration required

The package consists of three programs: PRS, IDChg and Mark. The PC running the PRS program will need a minimum configuration of i486 chip, 8M RAM, and Windows 3.1/95 (or later a version).

2) Installation on Windows 3.1/95

(The same procedures apply to installing the IDChg and Mark program).

All programs, libraries and data files are contained in the diskettes. These are installed with the default path C:\PRS and 3 megabytes of free disk space are required on your C Drive. No libraries will be installed on your Windows System Directory in order to avoid the mixing of different library versions.

a) On Windows 95

- ◇ Turn on the computer and start Windows.
- ◇ Insert PRS diskette marked "Disk 1" into you diskette drive.
- ◇ From the Windows Program Manager, click 'Start' and select 'Run'
- ◇ Type 'A:\Setup' (or 'B:\Setup' if the floppy disk is in the B Drive) and click 'OK'.

b) On Windows 3.1

- ◇ Start Windows
- ◇ Insert PRS diskette marked "Disk 1" into you diskette drive.
- ◇ From the Windows Program Manager menu bar, select 'File' and choose 'Run'.
- ◇ Type 'A:\Setup' (or 'B:\Setup' if the floppy disk is in the B Drive) and click 'OK'.

c) Installation

- ◇ On the welcome screen, close all other applications and click 'OK'.
- ◇ Click 'Install' to start copying files. The default path is C:\PRS.
- ◇ After all files have been copied, click 'OK' to complete this step.
- ◇ A PRS folder is created at the completion of the installation.

3) Changing the Transmitter's ID number

Instructions on the use of the *ID*-Changer unit and the IDChg software program can be found in User's Guide appended to the end of this manual.

4) Grading or marking the answers

The answers of each PRS session are recorded event-by-event on a data file stored in the folder C:\PRS\Session. These answers can be graded using the Mark software program. Detailed instruction can be found in the User's Guide in appendix.

VII. PRS Operation - a quick tour

The Default Settings - the Easiest to Use

- A) Click on the 'New Session' button just below the top pull-down menu bar.
- 1) A prompt appears which suggests a default filename of "MMddhhmm.csv" for storing your file at the conclusion of the current session (*MM* for the month, *dd* the day, *hh* the hour, and *mm* the minute; .csv means a comma-separated-values text file). Click on 'OK' unless you want to enter another filename.
 - 2) Inside the "session", there are the following "question options":
 - a) the question number "Qx" which can be changed by clicking on '+/- Question';
 - b) the time allotted to answer the question "mmss", with "mm" designating minutes and "ss" seconds, which can be changed by clicking on '+/- Time';. [You may want to give sufficient time for the Students to discuss with peers before answering.]
 - c) the display screen can be shrunk in half to free the lower half for displaying a question by first clicking on 'Screen' first, next on 'Half Screen', and then on either 'Black' to overlay a overhead transparency or 'Text' to type in the question;
 - d) setting the number of times a Student is permitted to answer a question by clicking on 'Chances' and select the desired number (Note that only the last entry received is recorded);
 - e) setting the number of choices in the multiple-choice question by clicking on 'Choices' and select the desired number; and
 - f) select whether to show the histogram of answers automatically or by menu control by clicking on 'Graph'
 - 3) Click on 'Start' to begin receiving the answers to the question.
 - a) Instruct the Students to commence pressing the key(s) on their Transmitter to answer, and to watch for the appearance of their *ID* in one of the display boxes for confirmation that their answer has been received.
 - b) Click on 'Pause' to stop the clock and on 'Resume' to continue.
 - c) Click on 'Stop' to terminate the question period.
 - d) The number of Students whose answer has been registered is shown on the right most box on top.
 - e) The '+/- Time' is functional during the question period.

- 4) The answering period concludes when the “clock” runs to zero or the ‘Stop’ button was hit. A summary of answers is displayed immediately as a histogram. Click on ‘Close’ to go on to the next question.
- B) To end the session, click on ‘End Session’ and the event-by-event records of your session (including the *IDs*) are stored on your hard disk as a comma-separated-values text file (.csv).
- C) To quit, click on ‘File’ and then on ‘Exit’.

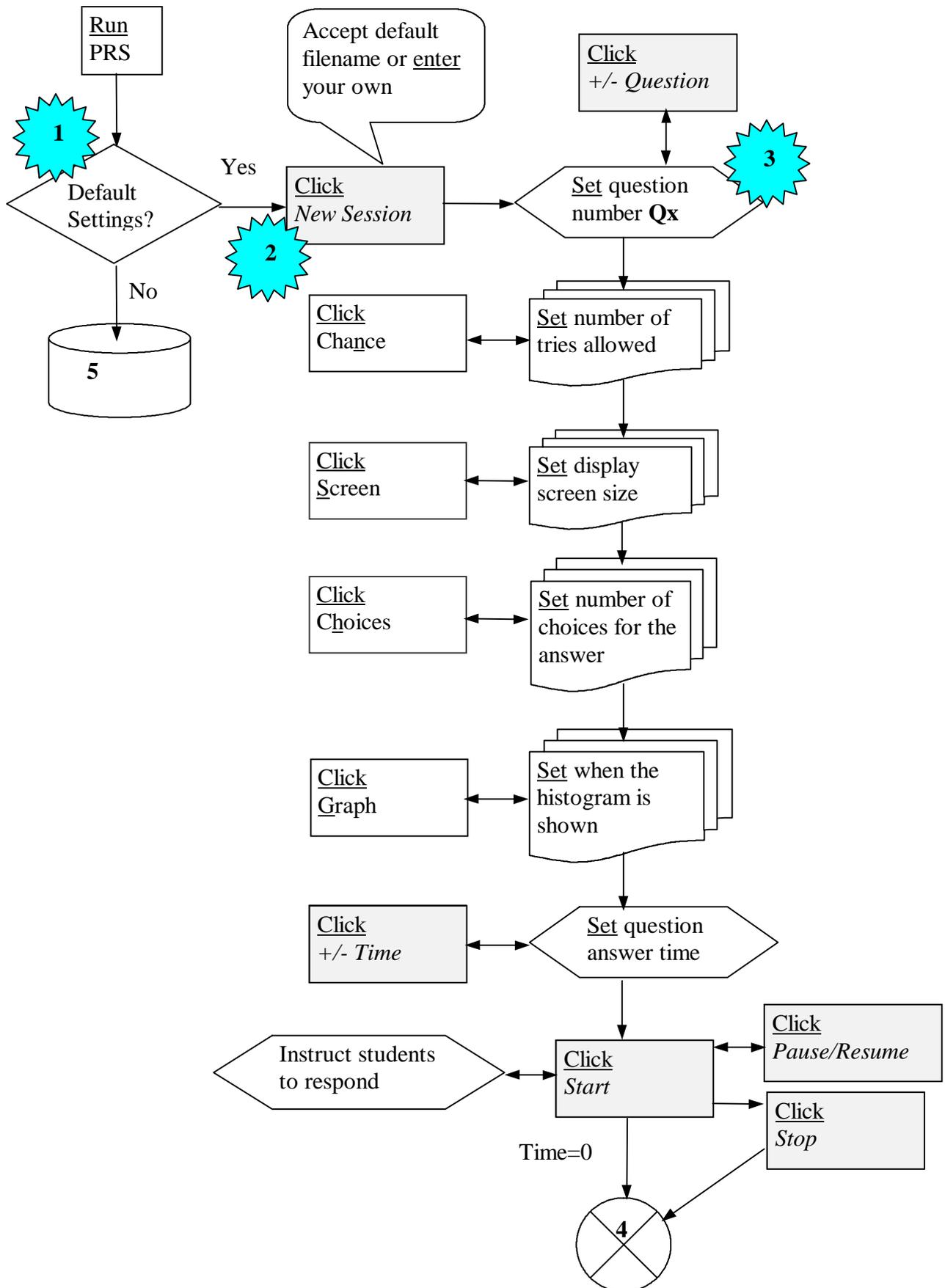
Other Settings

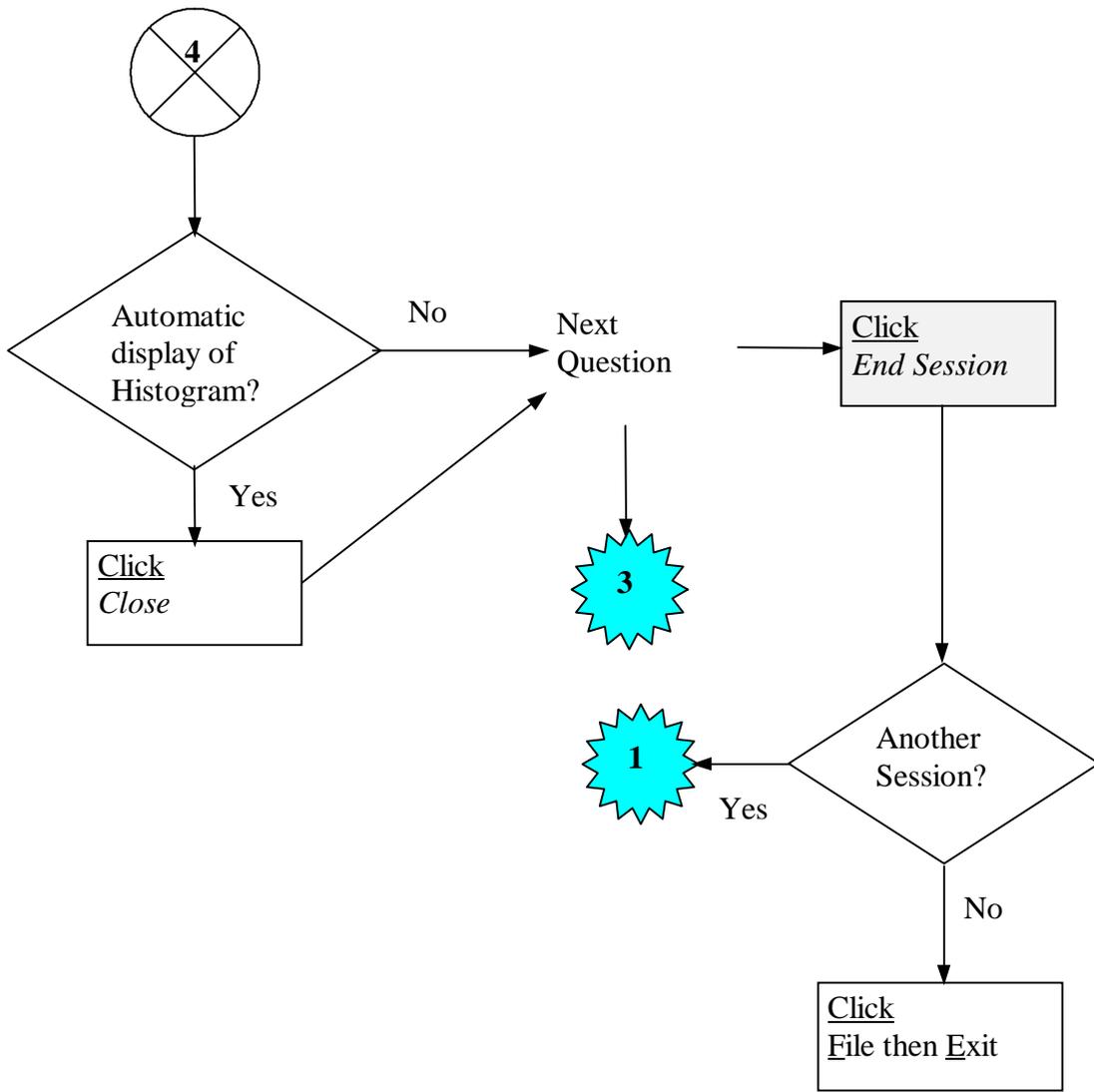
- A) Click on ‘File’ and then on
 - 1) ‘Open **N**ame File’ - to load a look-up table for replacing the numbers with names for all *IDs* on the “display boxes”.
 - 2) ‘Open **C**lass File’ - to retrieve a previously created “Class Seating Chart” (a .csv type) for use in the current session.
 - 3) ‘**N**o Class File’ - for not using a “Class Seating Chart”.
 - 4) ‘Open **S**ession File’ - to retrieve the histograms of a previous session for use in the current session.
 - 5) ‘**C**reate Class - Sequential’ - to create a “Class Seating Chart” by asking the Students to register in a sequence controlled by the Instructor.
 - a) Drag the ‘horizontal slider’ on the “dialogue box” to the desired “number of columns (seats per row)” and the ‘vertical slider’ to the “number of rows” and click on ‘next’.
 - b) A “Class Seating Chart” appears with the “seat” labeled by “rrcc” where “rr” refers to the “row number” and “cc” to the “column number”.
 - c) Make sure that you know the one-to-one correspondence between the “virtual” and “physical” seat.
 - d) Starting with “seat = 101 (row 1 - column 01)”, ask the student seating there to register by pressing any single ‘numeric key’. The “cursor” then moves to the adjacent “seat = 102” and the student there can be asked to register and so on and so forth; any empty seat will be skipped after 3 s.
 - e) Click on ‘end’ and then enter the filename to save the “Class Seating Chart” for the next session.
 - 5) ‘**C**reate Class - Random’ - to create a “Class Seating Chart” by asking the Students to register on a first-come-first-served basis. First follow steps 4-a) to c) above and then the steps below.
 - a) Ask each Student to transmit their “seat number” one digit at a time within 10 seconds. A ‘ticker-tape’ display above the top menu bar acknowledges the reception of each digit by showing the Student *ID* and the number string that has been received up to that moment. If their corresponding

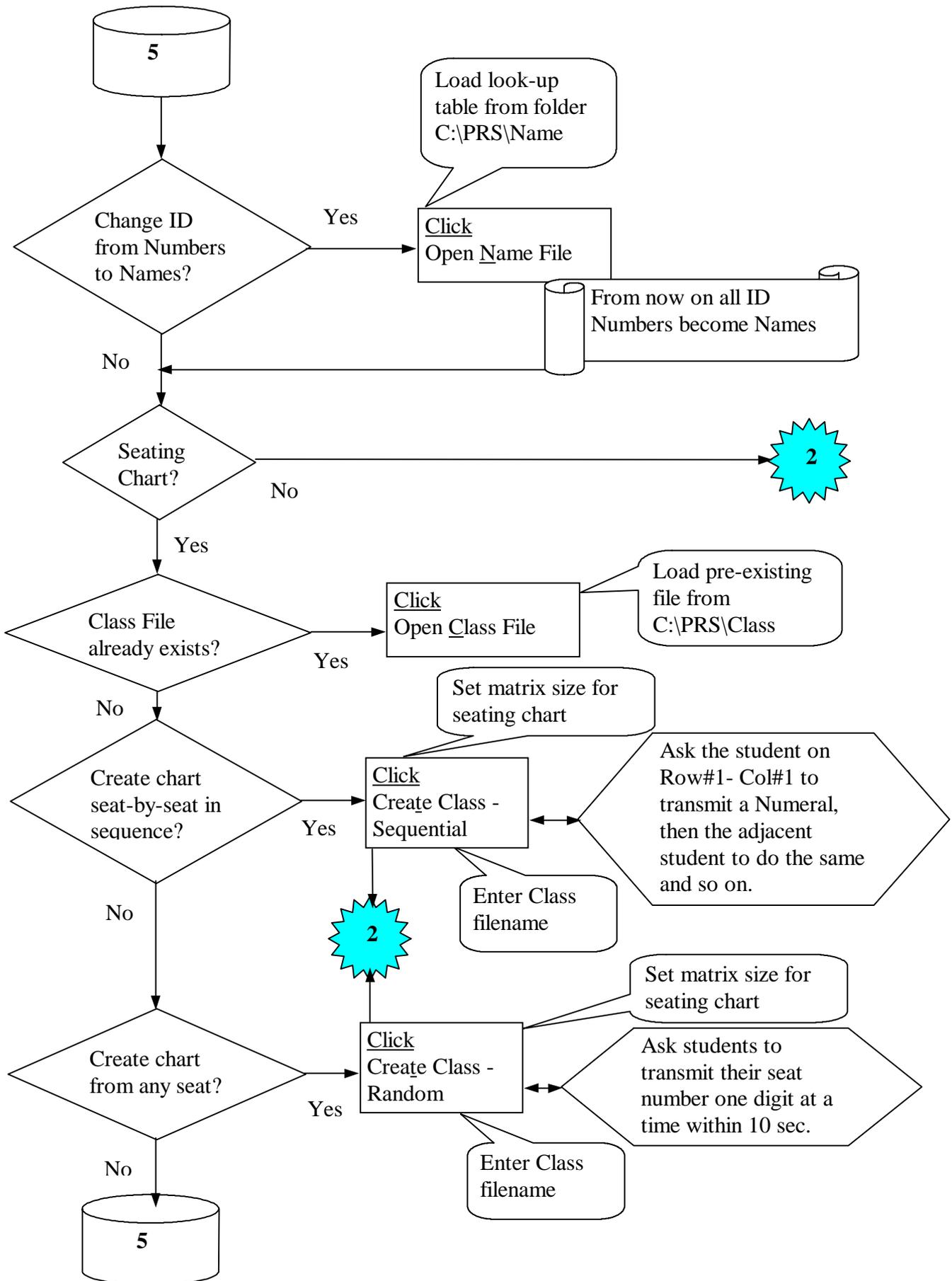
seat on the display box does not show their *ID* as acknowledgement, wait 10 seconds and re-transmit the whole “seat number”.

- b) Terminate the registration process by clicking on ‘end’ and then enter the filename for the “Class Seating Chart “.
- 6) ‘COM’ - for designating which communication port, ‘COM1’ or ‘COM2’, to connect the Receiver(s).
- 7) ‘**A**bout’ - for important reminders,
- 8) ‘**E**xit’ - to quit PRS.
- B) Click on ‘Audience’ to select the option of:
 - a) ‘**K**nown’ in which all recorded answers will be tagged with the Student *IDs* (for answers which will be marked or graded later) or
 - b) ‘**A**nonymous’ in which there will be no *ID* tag on the recorded answers (for polling or surveying).
- C) Click on ‘Chances’ to select the limit on the number of times that a Student is permitted to answer a question (Note that only the last entry is recorded).
- D) Click on ‘Screen’ to select either ‘**F**ull Screen’ which gives the largest display area or ‘**H**alf Screen’ which frees the lower half for displaying a question with:
 - a) ‘**B**lack’ giving a dark background to overlay, for example, an overhead viewgraph, or
 - b) ‘**T**ext’ for typing in a question or, by double clicking on the white area, for loading or saving a text file
- E) Click on ‘Boxes’ to select the number of display boxes to show the *IDs* of the most recent responses received.
- F) Click on ‘Choices’ to select the number of choices in the current question.
- G) Click on ‘Graph’ to select whether to show the histogram of answers automatically or via menu control.

IX. PRS Operation – a flow chart







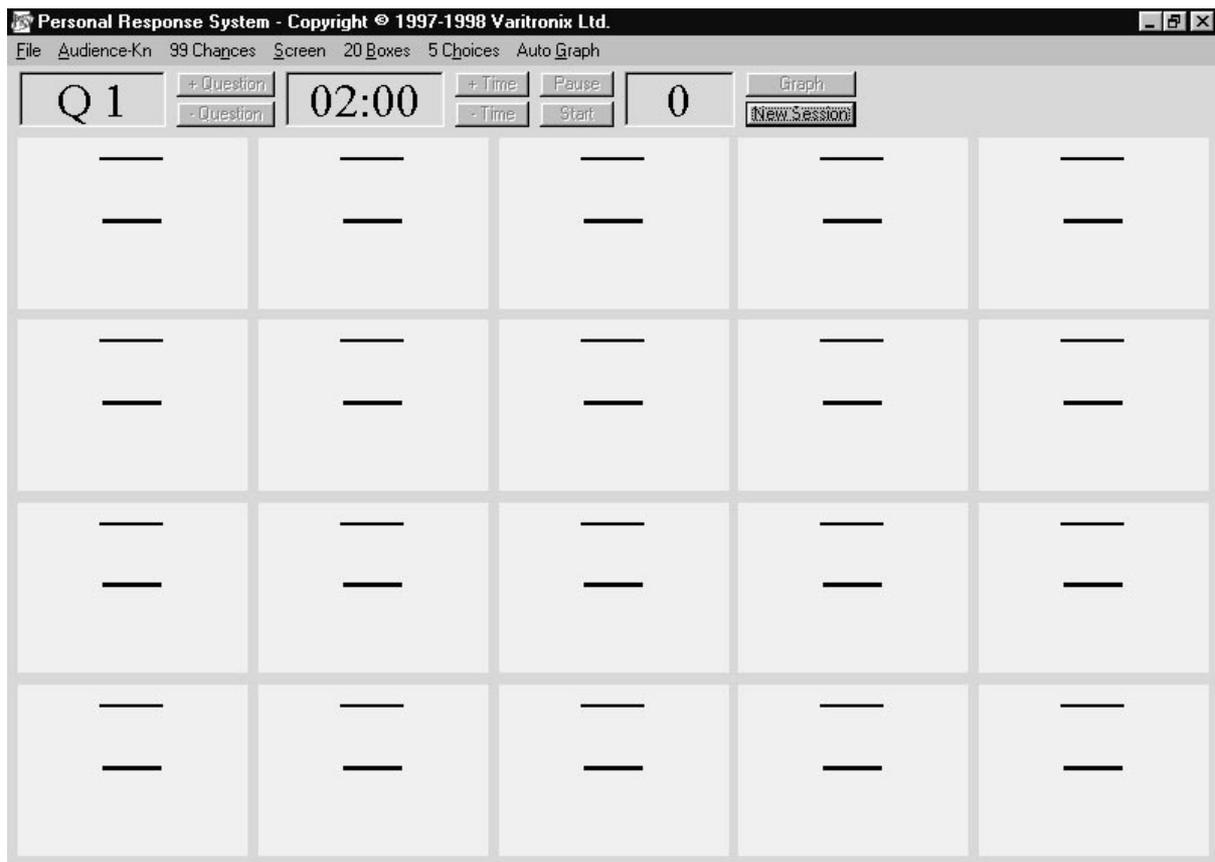
IX. PRS Operation - a detailed guide

The folder C:\PRS should contain several file folders for data input and output. The names of these folders are shown below..

Name	Size	Type	Modified
Answer		File Folder	18/8/98 16:37
Class		File Folder	18/8/98 16:37
Mark		File Folder	18/8/98 16:37
Name		File Folder	18/8/98 16:37
Question		File Folder	18/8/98 16:37
Session		File Folder	18/8/98 16:37
Ding	12KB	Wave Sound	29/7/98 15:23
Mark	26KB	Application	21/8/98 14:49
PRS	99KB	Application	21/8/98 15:16

A) Starting

Run the PRS program and the “Main Display” appears on the PC screen as shown below.



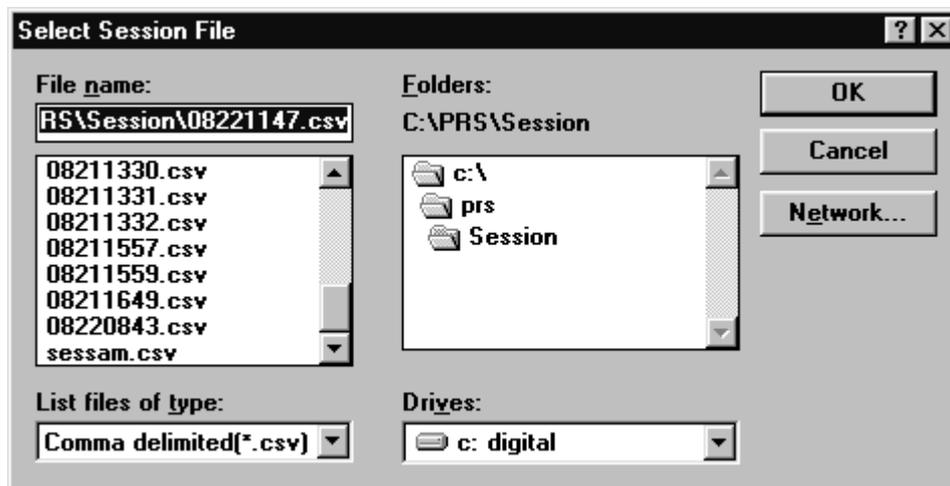
The colored “boxes” serve the important function of confirming that the signal sent by a member of the audience is received and registered. That is, upon the reception and registry of the first signal, the top left most “box” will change color and show the

ID number of the corresponding **Sender**. The second signal registered will change the color of the “box” immediately on the right and so forth.

All “session options” are controlled by clicking on one of the buttons on the “top pull-down menu bar”. The default “options” are set to allow you to start using PRS for questions and answers (Q&A) immediately. The “session control keys” are the “highlighted boxes” immediately below the “top pull-down menu bar”.

B) A question and answer session

To start a Q&A session using the default “options”, click on “New Session” and a “dialogue box” appears as shown below. A comma-separated-values text file is opened on the C Drive with a default filename of “C:\PRS\Session\MMddhhmm.csv”, where MM stands for the month, dd the day, hh the hour and mm the minutes; as shown in the illustration below.

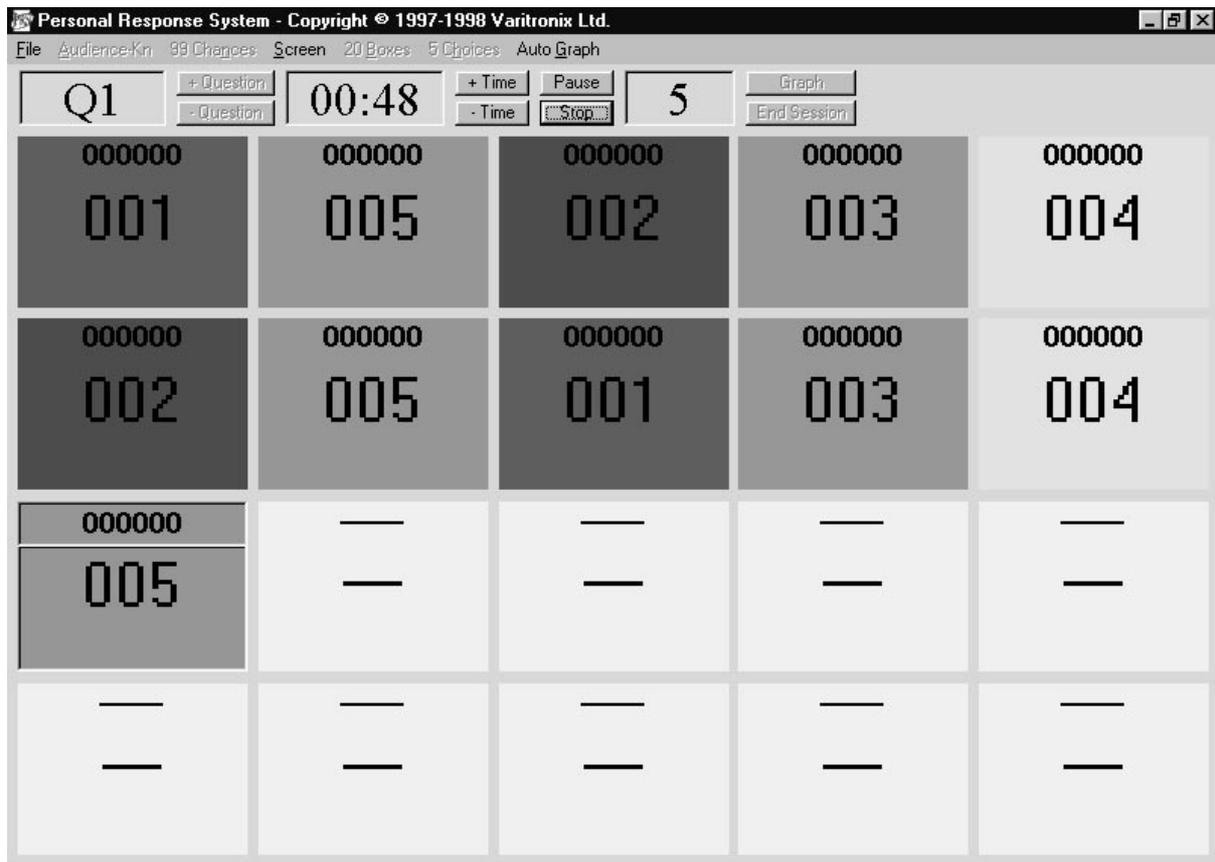


1) Click on ‘OK’ unless you want to enter a different filename. Different “session control keys” will be highlighted as shown below.



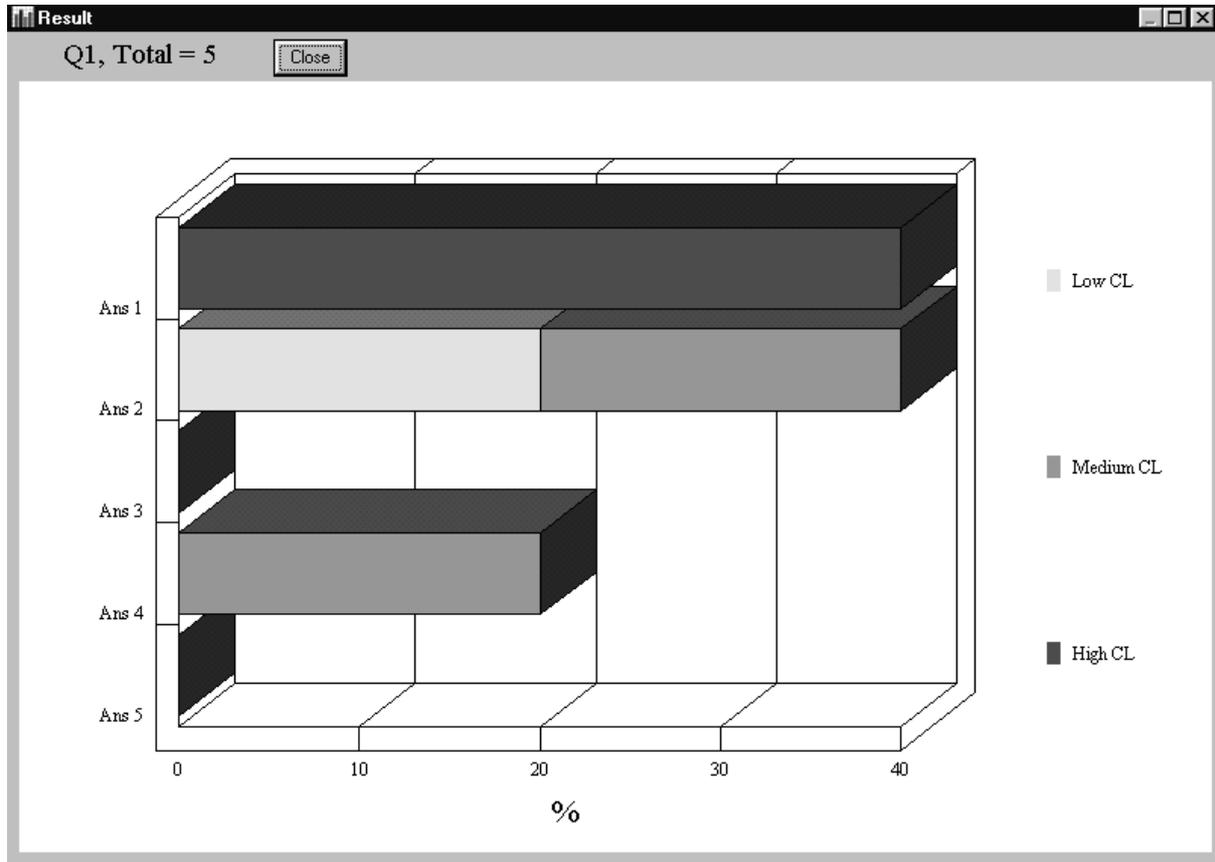
2) The beginning question number is “Q1”. Click on ‘+/- Question” to change the number. (Note that a default value of 5 has been set for the number of selections in the multiple-choice question. Click on ‘Choice’ on the top menu bar to change this number.)

- 3) The time allotted to answer the question is shown in the box immediately on the right as “*mmss*” with “*mm*” for minutes and “*ss*” for seconds. Click on ‘+/- Time’ to change the allotment in increment of 30 seconds.
 - a) You may want to allot sufficient time for the Students to discuss with peers before answering.
 - b) If you want a “Confidence Level” to be tagged to their answers, ask the Students to press on their Transmitter ‘H’ followed by the ‘Numeral’ for “very confident (certain)”, ‘L’ plus the ‘Numeral’ for “not confident (pure guessing)”, and just the ‘Numeral’ for “moderately confident (intelligent guessing)”.
- 4) Click on ‘Start’ to begin receiving answers to the question. Students can commence pressing the key(s) on their Transmitter to answer.
 - a) Click on ‘Pause’ to stop the clock and on ‘Resume’ to continue.
 - b) Click on ‘Stop’ to terminate the question period before the clock time reaches zero.
 - c) The number of Students whose answer has been registered is shown on the right most box on top.
 - d) The illustration below shows a total of 11 signals were received from 5 Students: 3 from “*ID* = 000000005 and 2 each from the remaining 4. Note that i) the color of the box is associated with the last digit of the *ID*, and ii) only the last signal received from each Student is registered.



- 5) The answering period concludes when the “clock” reads zero, and a summary of answers is displayed immediately as a histogram as illustrated below.

- a) Of the 5 students, 2 answered “1”, 2 answered “2”, and 1 answered “4”.
- b) Since the Students were asked to attach a “confidence level (CL)” to their answer, the CL results are reflected by the colors of the bars. There were two “CL = Hi (Red)” for answer “1”, one each of “CL = Lo (Yellow)” and “CL = Med (Green)” for answer “2”, and one “CL = Med (Green)” for answer “4”. [If no “confidence level” was required, all bars would be green.]
- c) Click on ‘Close’ to go on to the next question.

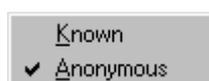


7) To end the session, click on ‘End Session’ and the event-by-event records of the session, including the *IDs*, will be stored automatically on your hard disk as a comma-separated-values text file (.csv).

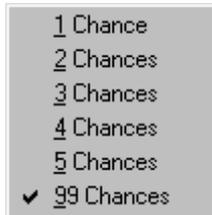
8) If you do not want to start another “session”, quit by clicking on ‘File’ and then on ‘Exit’.

C) Options other than the default ones

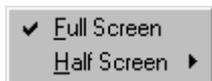
1) A common option would be “polling” or “opinion sampling” in which no *ID* information will be recorded. In this case, one simply click on ‘Audience’ and then on ‘Anonymous’. Follow all the steps in B) above. The *IDs* will still be shown on the “display boxes” for acknowledging the receptions of signals. But the output file will have no *ID* information.



- 2) For pedagogical reasons, there might a need to allow the Students to answer only once or a few times. This limit can be imposed by clicking on 'Chances' and select the limit. [Note that, for each Student, only the last answer to the question received is recorded.]

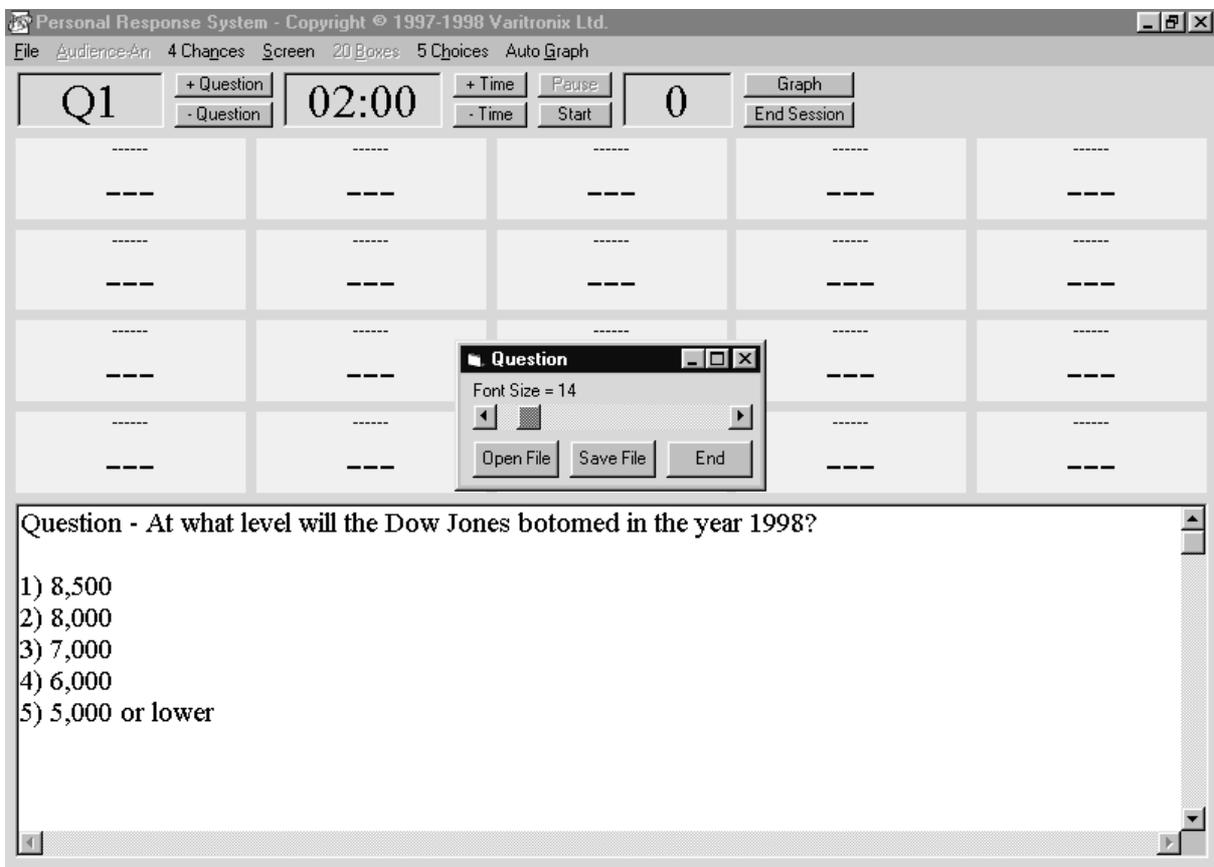
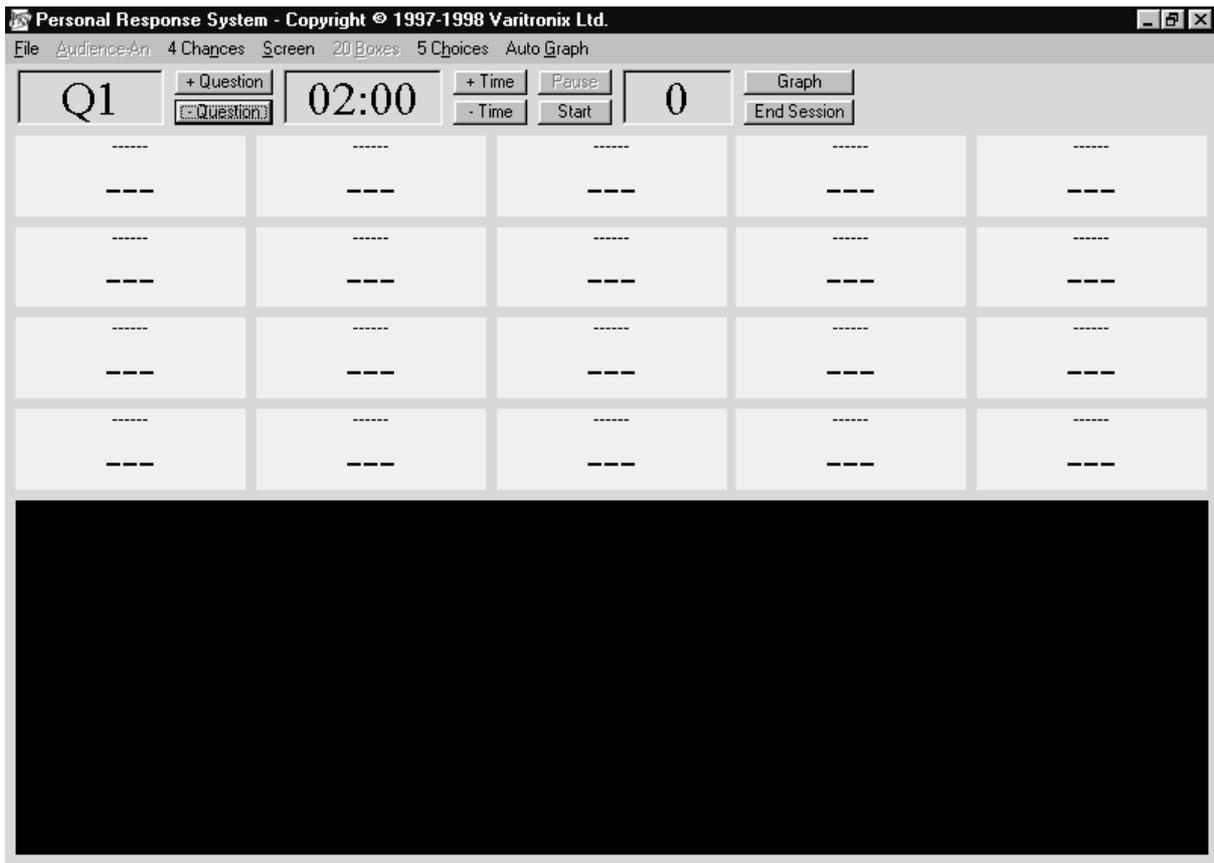


- 3) It is convenient to have 2 screens or white areas for projecting information - one for the PRS main display and the other for showing the question to be answered for all to see. If only one screen or projection area is available, click on 'Screen' and select '**H**alf Screen' which frees the lower half for displaying a question.

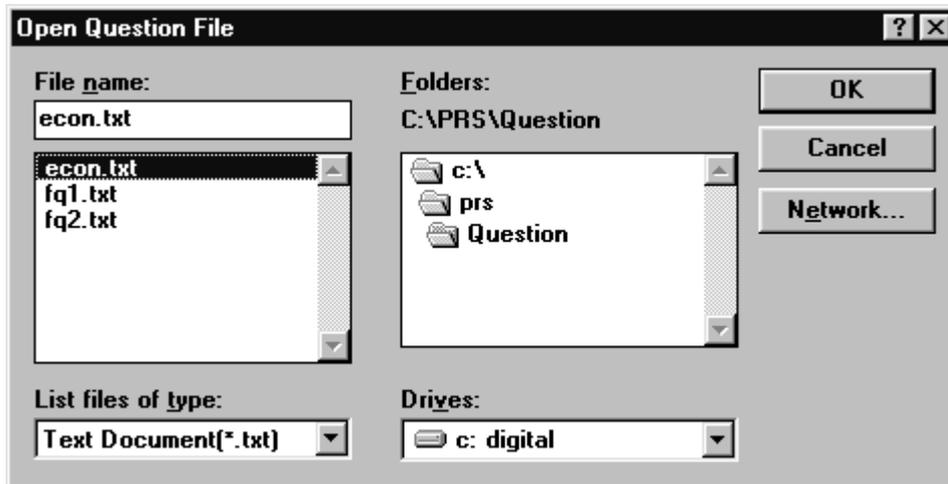


There are two options under '**H**alf Screen'.

- a) '**B**lack' giving a dark background to overlay, for example, an overhead viewgraph.
- b) '**T**ext' for typing in a question directly on the white area. The typed question can be saved by double clicking on the white area and then click 'Save File' on the "dialogue box".



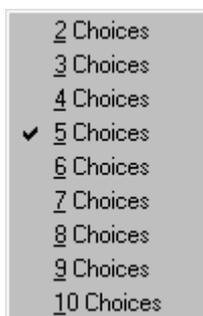
If you have a question that is pre-loaded as a text file stored in the folder C:\PRS\Question, you could click 'Open File' on the "dialogue box" and select that question (econ.txt in the example below).



- 4) An alternative to using the 'Half Screen' option is by adjusting the Windows frame on the PC monitor screen such that the lower half is available for showing a question from the file in Notepad, WordPad or MS Word program.
- 5) Sometimes showing more "display boxes" could be helpful. Click on 'Boxes' to select the number desired. [Also see below on "Using Names instead of Numbers for IDs" and "Class Seating Chart"]



- 6) For each question asked, the number of available choices for the Students to answer must equal or be larger than the actual number of multiple choices in the question. Click on Choices and the appropriate number to satisfy the requirement.



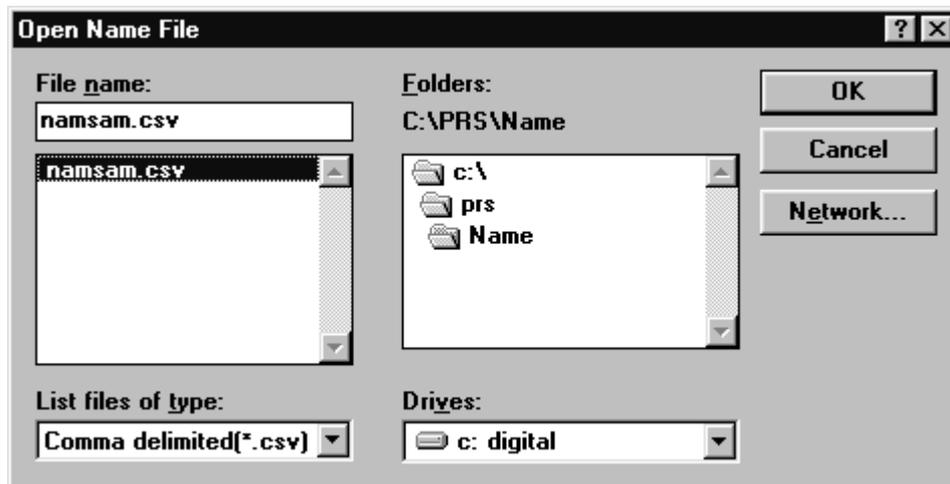
- 7) Click on 'Graph' to select whether to show the histogram of answers automatically or by menu control. In the latter mode, viewing the histogram of the

just concluded Q&A exercise requires two steps: clicking ‘- Question’ and then ‘Graph’.



X. Using Names instead of Numbers for IDs

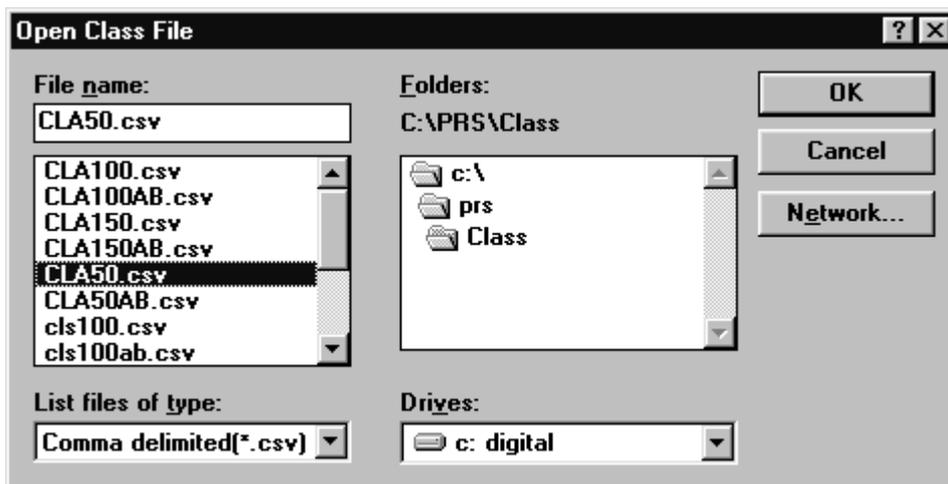
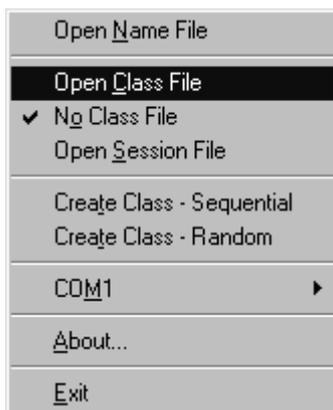
The option of using Names instead of Numbers for *IDs* has been provided. To do this, create a look-up table for names versus numbers. An example to follow is the file C:\PRS\Name\name.csv. You should of course have your own file. Click on ‘File’, then on ‘Open Name File’ and load the look up file. From this action onward, the “display boxes” will show names throughout the session.





XI. Class seating chart

A Class Seating Chart is referred to as “Class File” for short. Its creation can be made ahead of time or on-line at the beginning of a class. Click on ‘File’ and then on ‘Open Class File’ if there is already a pre-existing class file to load.



- A) Off-line creation - In the applications where the Students are assigned seats, a class seating chart can be created ahead of time. In this case, it may be simpler to use "Transmitter Number" for "Student ID Number". Several examples are included in the folder C:\PRS\Class.
- 1) One Transmitter per seat - In "the dialogue box" shown above, the file "CLA50.csv" has been highlighted for selection. The first few lines of the data inside it are shown below. The 1st and 2nd line is the "number of rows" and "number of seats per row", respectively. Beginning from the 3rd line, the 1st entry is the "Seat Number", 2nd is "Transmitter Number", and last is a descriptor for the number of seats per Transmitter (A=1, A/B=2). Note that in this case the "display boxes" will show the "Seat Number" as illustrated below. The corresponding "Transmitter Number" can be revealed by 'double clicking' on the box.

```

5
10
1,1,A
2,2,A
3,3,A
4,4,A
5,5,A
6,6,A
7,7,A
8,8,A

```

Personal Response System - Copyright © 1997-1998 Varitronix Ltd.

File Audience-Kn 99 Chances Screen 20 Boxes 5 Choices Auto Graph

Q 1 + Question - Question 02:00 + Time - Time Pause Start 0 Graph New Session

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

- 2) One Transmitter per two seats - One advantage of attaching the Transmitters to seats is that two adjacent students can share the unit if we limit the multiple choices in a question to no more than 5. This option is activated automatically if in the "Class File" the descriptors for the number of seats per Transmitter have both A and B. An example of a file that would activate this mode is C:\PRS\Class\CLA50AB. Its contents are shown below as well as the main display that would ensue after the file is loaded. The student with descriptor A would use the key set 1 to 5 while the one with descriptor B uses 6 to 0. In the latter case "6" means 1, "7" means 2...."0" means 5.

```

10
10
001A,1,A
001B,1,B
002A,2,A
002B,2,B
003A,3,A
003B,3,B
004A,4,A
004B,4,B

```

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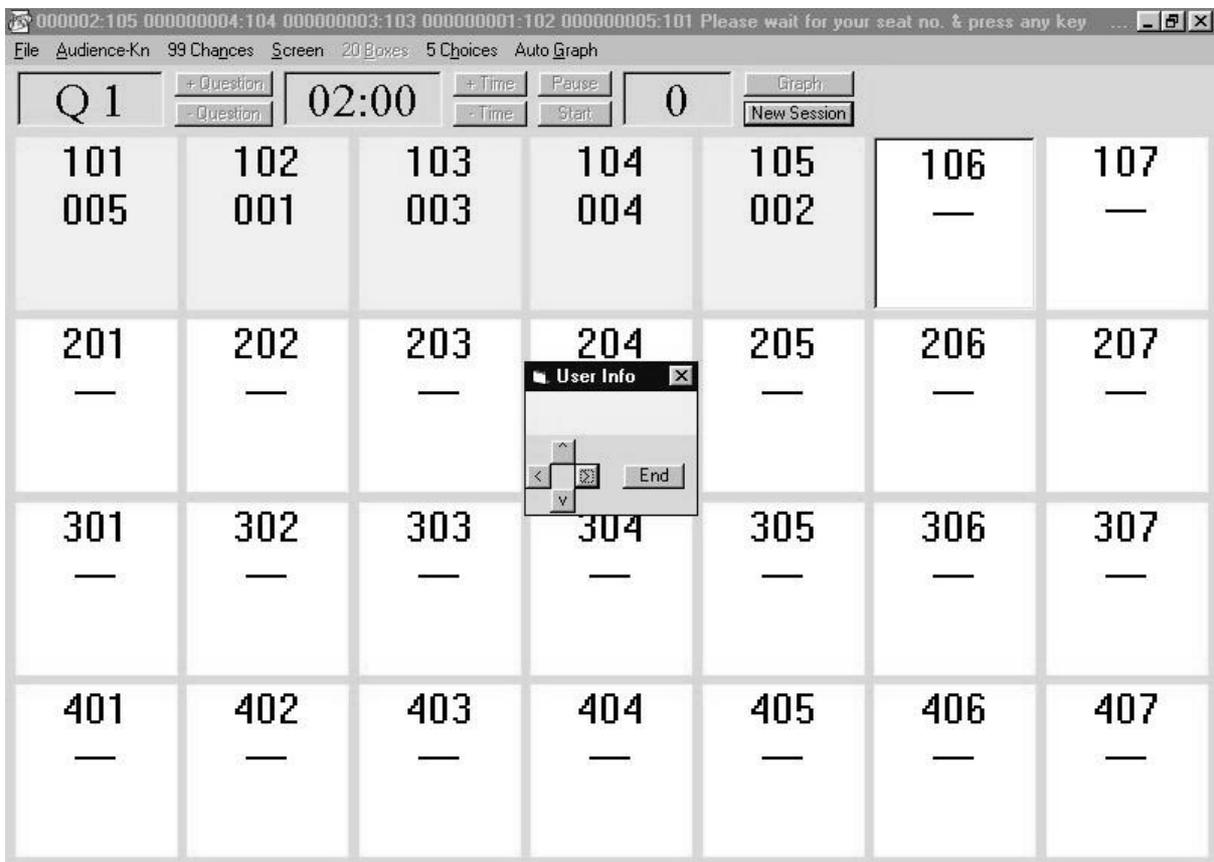
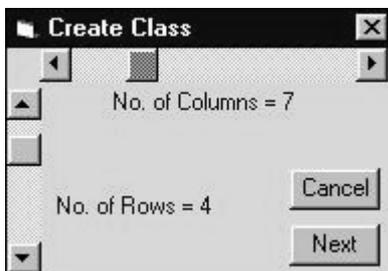
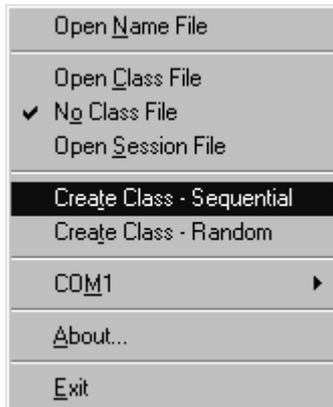
File Audience-Kn 99 Chances Screen 20 Boxes 5 Choices Auto Graph

Q 1 + Question 02:00 + Time Pause 0 Graph
 - Question - Time Start New Session

001A	001B	002A	002B	003A	003B	004A	004B	005A	005B
006A	006B	007A	007B	008A	008B	009A	009B	010A	010B
011A	011B	012A	012B	013A	013B	014A	014B	015A	015B
016A	016B	017A	017B	018A	018B	019A	019B	020A	020B
021A	021B	022A	022B	023A	023B	024A	024B	025A	025B
026A	026B	027A	027B	028A	028B	029A	029B	030A	030B
031A	031B	032A	032B	033A	033B	034A	034B	035A	035B
036A	036B	037A	037B	038A	038B	039A	039B	040A	040B
041A	041B	042A	042B	043A	043B	044A	044B	045A	045B
046A	046B	047A	047B	048A	048B	049A	049B	050A	050B

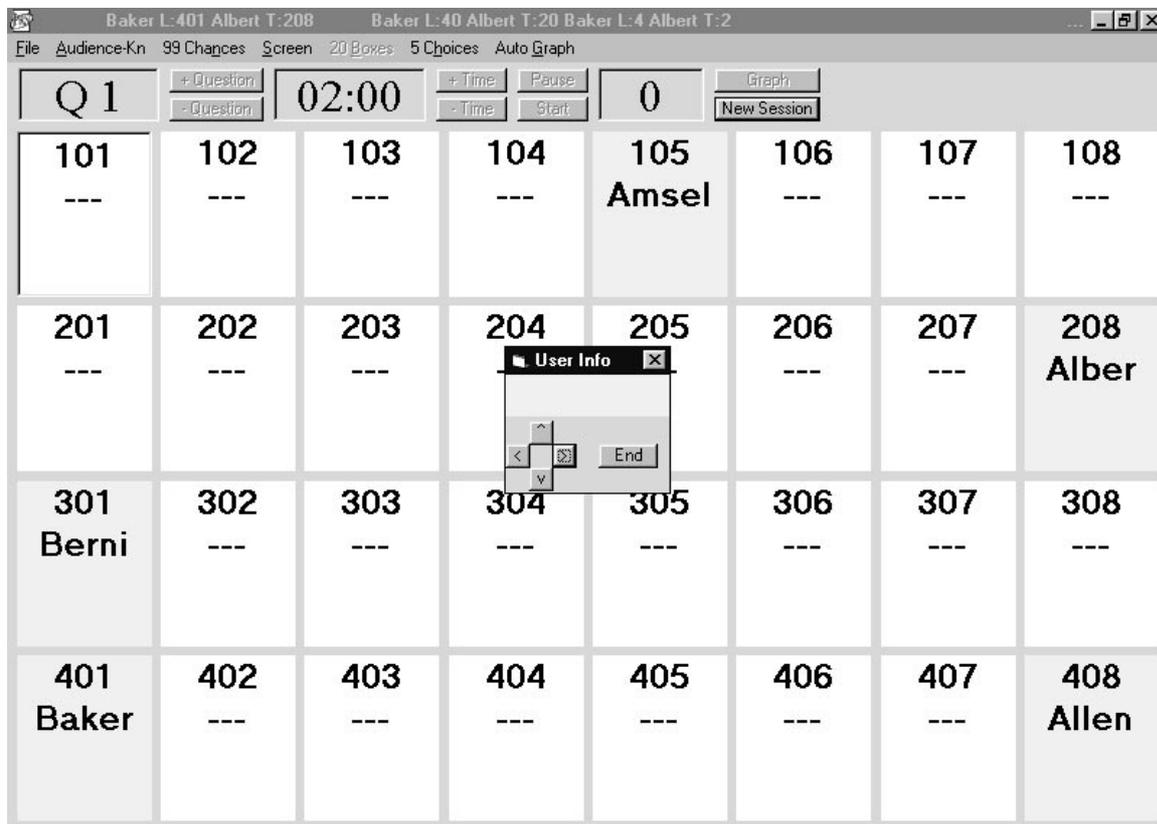
- B) On-line sequentially - If the students have their own Transmitters, a seating chart can be created after the Students have settled on their seats. One at a time and in sequence, the Students can register by transmitting any single "Numeral".

Start by clicking on 'File' and then on 'Create Class - Sequential'. A "dialogue box" appears with sliders for adjusting the "virtual seat matrix" for your class. Make sure that this overlays the physical seat matrix.



The process starts with the cursor set at seat number 101 (1st row-1st column) on the main display. This serves to prompt the occupant there to register by pressing on any “Numeral” within 3 s. The cursor then moves to seat 102 for the occupant there to register within 3 s and so on and so forth. An empty seat or inattentive occupant will be by-passed after 3 s. Seat-by-seat movement of the cursor cycles through repeatedly until the ‘End’ button in the “dialogue box” is hit. Clicking on the 4-way arrows will move the cursor from one seat to another. The snapshot above shows the situation when the first 5 Students have registered. Immediately below the “Seat Number” is the “Student *ID* Number”. Note that a separate acknowledgement of the signal received can be found on the “ticker-tape” on top of the top menu bar. Click on ‘End’ on the “dialogue box” to end the registration process. Another “dialogue box” appears for you to save the seating chart as a “Class File” for future sessions.

- C) On-line randomly - This option allows the Students to register immediately when seated without having to wait for the others to arrive. But the Student will have to transmit their seat number one digit at a time within 10 seconds. The procedures are analogous to the sequential method just described above. A ‘ticker-tape’ display above the top menu bar will acknowledge the reception of each digit by showing the Student *ID* and the string of numbers that has been received up till that instant. Start by clicking on ‘File’ and then on ‘Create Class - Random’. Select the appropriate “virtual seat matrix” for your class. Make sure that this overlays the physical seat matrix. The snapshot below shows the situation when 5 students have registered and the “ticker tape” still showing the acknowledgements. The Student “Names” appeared instead of “ID Numbers” because a “Name File” has been loaded previously.



XII. Retrieving data files

The results of each PRS session are stored as a "Session File" in a comma-separated-value text file (.csv) inside the folder C:\PRS\Session. This file can be read with Notepad and any spreadsheet software. The contents of a session file named "0824165.csv" are shown below as read with Notepad and Microsoft Excel 97.

```

Session ended on Monday, Aug 24 1998 04:57:13
Question,Time,Attempt,Seat,ID,AB(B=Shared),Answer,CL
1,00:31,2,,3,A,2,L
1,00:17,1,,1,A,3,M
1,00:13,1,,4,A,2,M
1,00:37,2,,5,A,1,H
1,00:41,2,,2,A,1,H
2,00:20,2,,3,A,2,M
2,00:16,2,,1,A,1,M
2,00:13,1,,4,A,4,M
2,00:22,2,,5,A,2,M
2,00:05,1,,2,A,2,M
Question,Answer,All,Low CL,Medium CL,High CL,%,%L,%M,%H
1,1,2,0,0,2,40.0,0.0,0.0,40.0
1,2,2,1,1,0,40.0,20.0,20.0,0.0
1,3,1,0,1,0,20.0,0.0,20.0,0.0
1,4,0,0,0,0,0.0,0.0,0.0,0.0
2,1,1,0,1,0,20.0,0.0,20.0,0.0
2,2,3,0,3,0,60.0,0.0,60.0,0.0
2,3,0,0,0,0,0.0,0.0,0.0,0.0
2,4,1,0,1,0,20.0,0.0,20.0,0.0

```

08241655											
	A	B	C	D	E	F	G	H	I	J	K
1	Session ended on Monday, Aug 24 1998 04:57:13										
2	Question	Time	Attempt	Seat	ID	AB(B=Sha	Answer	CL			
3	1	00:31	2			3 A	2	L			
4	1	00:17	1			1 A	3	M			
5	1	00:13	1			4 A	2	M			
6	1	00:37	2			5 A	1	H			
7	1	00:41	2			2 A	1	H			
8	2	00:20	2			3 A	2	M			
9	2	00:16	2			1 A	1	M			
10	2	00:13	1			4 A	4	M			
11	2	00:22	2			5 A	2	M			
12	2	00:05	1			2 A	2	M			
13	Question	Answer	All	Low CL	Medium CL	High CL	%	%L	%M	%H	
14	1	1	2	0	0	2	40	0	0	40	
15	1	2	2	1	1	0	40	20	20	0	
16	1	3	1	0	1	0	20	0	20	0	
17	1	4	0	0	0	0	0	0	0	0	
18	2	1	1	0	1	0	20	0	20	0	
19	2	2	3	0	3	0	60	0	60	0	
20	2	3	0	0	0	0	0	0	0	0	
21	2	4	1	0	1	0	20	0	20	0	
22											

There are two main parts in the file. The first part is the event-by-event records of the answers received for all the questions asked in the session. The second part is the corresponding statistical summaries. Line-by-line descriptions are given below.

Line 1 - The date and time the file was created.

Line 2 - The headings of the respective columns.

Line 3 to 12 - The record of the 10 events corresponding to 2 questions each answered by 5 students; for each event,

Column 1 - Question number.

Column 2 - Elapsed time when the last answer attempt was received.

Column 3 - Number of answer attempts.

Column 4 - Label on the "display boxes" (blank since no "Class File" was used).

Column 5 - *ID* number of the Transmitter.

Column 6 - Code for one or two users per Transmitter (one user for this example).

Column 7 - Answer recorded.

Column 8 - Confidence level attached to the answer.

Line 13 - The headings of the respective columns.

Line 14 to 23 - The statistical summaries of the answer choices per question for the 2 questions each with 4 multiple choices.

Column 1 - Question number.

Column 2 - Choice of answer

Column 3 - Number of students selected this choice regardless of the confidence level (CL).

Column 4 - Number of students selected this choice with a low CL.

Column 5 - Number of students selected this choice with a medium CL.

Column 6 - Number of students selected this choice with a high CL.

Column 7 to 10 - Entries in Column 4 to 6 in percent.

A session file taken under exactly the same conditions as the example above except that the 'Audience' was set for 'Anonymous' (poll mode) is shown below. ID information is clearly absent. Only the statistical summaries are recorded.

```

Session ended on Monday, Aug 24 1998 04:59:07
Question,Answer,All,Low CL,Medium CL,High CL,%,%L,%M,%H
1,1,0,0,0,0,0.0,0.0,0.0,0.0
1,2,1,0,1,0,20.0,0.0,20.0,0.0
1,3,4,1,2,1,80.0,20.0,40.0,20.0
1,4,0,0,0,0,0.0,0.0,0.0,0.0
2,1,2,0,2,0,40.0,0.0,40.0,0.0
2,2,2,0,2,0,40.0,0.0,40.0,0.0
2,3,1,0,1,0,20.0,0.0,20.0,0.0
2,4,0,0,0,0,0.0,0.0,0.0,0.0

```

XIII. Application notes

A. Active learning in the classroom

PRS is a tool for effecting electronically immediate feedback and reinforcement (IFR) for active learning by all students in the classroom. Surveys of student users indicate that a majority of them consider the following features as valuable:

- answering in private;
- discussion with peers before answering; and
- knowing how their peers responded.

The faculty users consider the following as very useful:

- immediate assessment of students comprehension;
- automatic attendance check;
- automatic recording of students answers; and
- a polling option for surveying views and opinions.

In a comprehensive article published in the *American Journal of Physics* [Vol.66 (1998) pp.64-74], Richard R. Hake showed unequivocally that *the use of Interactive Engagement (IE) strategies in the classroom can increase mechanics-course effectiveness well beyond that obtained with Traditional (T) methods*. The study was based on a survey of pre/post test data of about 6000 students in high schools, colleges, and universities using the Halloun-Hastenes Mechanics Diagnostic test (MD) or Force Concept Inventory (FCI). Defining the average normalized gain $\langle g \rangle$ as the ratio of the actual average gain ($\langle \text{post}\% \rangle - \langle \text{pre}\% \rangle$) to the maximum possible average gain ($100 - \langle \text{pre}\% \rangle$), Hake found $\langle g \rangle_{T\text{-ave}} = 0.23 \pm 0.04$ and $\langle g \rangle_{IE\text{-ave}} = 0.48 \pm 0.14$. The effectiveness of IE approaches over those of T is more than a factor of 2 according to this measure!

The IE methods are those *designed at least in part to promote conceptual understanding through interactive engagement of students to heads-on (always) and hands-on (usually) activities which yield immediate feedback through discussion with peers and/or instructors*. For the practitioners of Traditional lecture method, the approach of immediate feedback and reinforcement (IFR) using electronic devices is, perhaps, the easiest IE approach to adopt. The **PRS** is, perhaps, the easiest, lowest cost, and most flexible of the electronic tools for conducting the IFR approach in the classroom.

Recent literatures on the use of the EFR approach include:

- Robert J. Dufresne, William J. Gerace, William J. Leonard, Jose P. Mestre and Laura Wenk, "*Classtalk: A Classroom Communication System for Active Learning*" in *Journal of Computing in Higher Education*, **7**, 3-47, (1996). (or see http://www-perg.phast.umass.edu/UMPERG/papers/CT_Paper/CT_Paper.html).
- Eric Mazur, "*PEER INSTRUCTION - A Users Manual*", 1997 (Prentice Hall). (or see <http://galileo.harvard.edu/galileo/lgm/pi/details.html>).

The '*Known*' or "class" mode of operation in which a record is kept on the answer of every student to every question permits a continuous monitoring of the progress made by each and every student in class. Some faculty have used these records as a part of the course grade. Some even assigned relative scores to an answer; for

example, 5/2/0 for Correct/Wrong/No-Submission. On the other hand, other faculty prefer the use of informal assessments via the 'Anonymous' or "poll" mode in which no individualized records are kept.

B. The choices for **Sender-IDs** in the Transmitters

Note first that the **Sender-ID** must be a numeral between 0 and 999999999.

In applications where only the 'Anonymous' mode is used exclusively, it may be convenient to change the **Sender-IDs** to a number sequence starting from 1.

In applications where the **Senders** (students) are assigned a permanent seat in a classroom throughout the day, it may be convenient to use the seat numbers as the **Sender-IDs**.

For applications where the **Senders** (students) bring their own Transmitter to use in many different classrooms or lecture halls, the **Sender-IDs** naturally would be either the student ID numbers, or social security numbers or other similar individualized set of numbers. The choice will depend on what numbers the institution uses for record keeping.

C. Campus-wide usage

With individualized, pocket-size, wireless Transmitters, a portable Receiver and a Windows-based simple-to-use software, it is practical and convenient for a) the students to bring their own Transmitter to class and b) for the instructors to effect active learning for all in any classroom or lecture hall on campus.

The entire student body could be equipped with their own Transmitter all at the same time or gradually by starting from one Standard Package and acquiring additional ones as the needs demand or resources permit. There is also an optional PRS Barcode Reader that could be ordered to facilitate the entering of the Student *IDs* into the Transmitters.

D. Non-academic applications of **PRS**

There are many other applications of **PRS**. The following are a few examples.

- Training classes in language and other technical skills - use **PRS** to ensure that a lesson is understood before proceeding to the next one and for monitoring the learning progress of trainees.
- In a convention or meeting to elect officers or vote on resolution - use **PRS** to record votes and tabulating the results immediately.
- In marketing - use **PRS** to obtain on-the-spot reactions of your audience to your product demonstration.
- In a contest to be judged by the audience - use **PRS** to facilitate the scoring by the audience and to tabulate the results immediately.



PRS Transmitter User's Guide

Specification:

Size:	107mm x 56mm x 25mm
Weight:	Approx. 50g (without battery)
Power:	Two AAA (1.5V) Alkaline Batteries
Signal:	Infrared
Effective Distance:	Not less than 30 meters

Operation:

- ❑ Press power key to ON.
- ❑ Locate the Receiver and point the Transmitter towards it.
- ❑ Make your decision, press the corresponding NUMERIC key, and the LED will be flashing.
- ❑ Power will shut OFF when the unit is not use for 15 minutes.

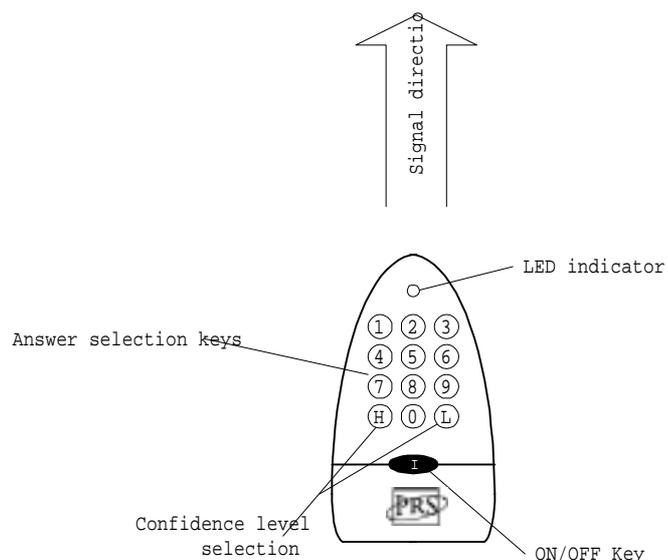
Confidence level (CL):

- ❑ A confidence level will attached to your answer if you first press H, L, or nothing before pressing the NUMERIC key.
- ❑ "H" means High, "L" means Low, and the default of no pre-pressing means Medium.
- ❑ The confidence level will revert to the default value of Medium after 15 seconds or on each power off/on sequence.

LED indicator

- ❑ Green: Medium CL
- ❑ Red: High CL
- ❑ Yellow: Low CL
- ❑ Flashing: Transmission in progress

* Replace batteries when the LED becomes dim.





PRS Receiver User's Guide

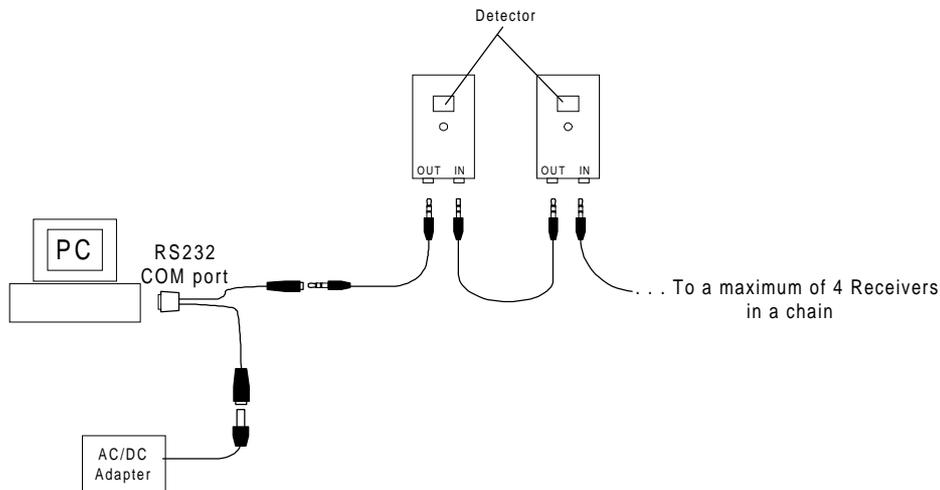
Specification:

Dimension:	Approx. 122mm x 60mm x 43mm
Weight:	Approx. 130 grams
Power:	9VDC (via signal cable)
Receiving half angle:	Approx. 45 degrees

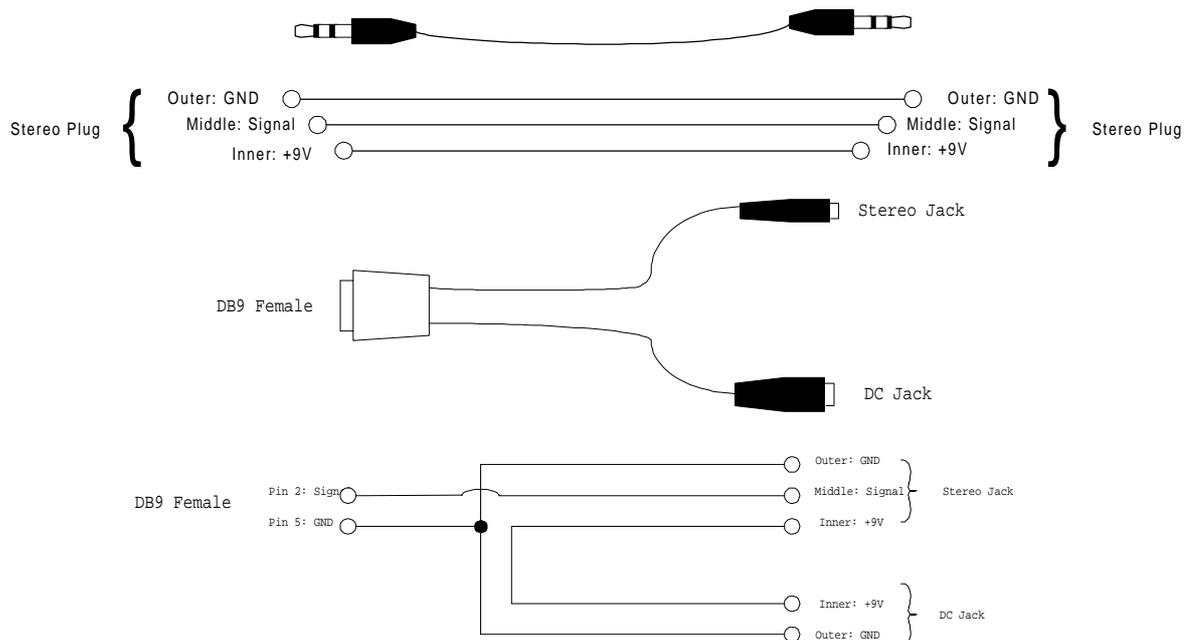
Mounting:

- ⊙ The use of 1 receiver for every 25 transmitters is suggested.
- ⊙ If two receivers are used, mount them on the corners in front of the classroom, and make sure the sensitive part (glass) of each unit faces the diagonal corner.

Hardware connection:



Cable configuration:



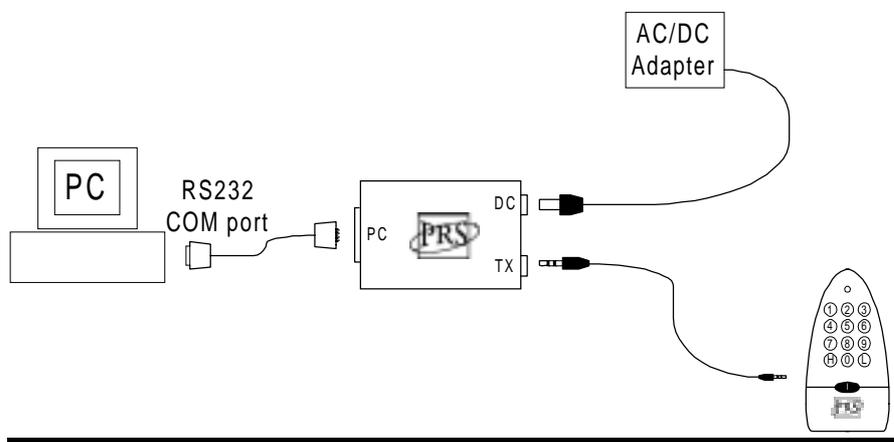


PRS ID Changer User's Guide

Specification:

Dimension:	90mm x 50mm x 32mm
Power:	9V DC
Weight:	Approx 70 grams
Hardware requirement:	* IBM PC compatible * 80386 system or above * Win 3.1, Win95 or above * 1 free COM port * 10Mb Harddisk space

Hardware Connection:



Customizing ID:

The PRS **ID-Changer** unit enables the user to customize a 9-digit ID number into the transmitter. The procedure is as follow:

1. Start the PRS **IDChg** Software.
2. Connect the transmitter to be programmed to the **ID-Changer**.
3. Click on the button "Customize ID".
4. Following the prompt, key in the ID number and press ENTER.
5. Simultaneously press on the keys "H" and "L" on the transmitter to write the ID number into the transmitter.

Verifying ID:

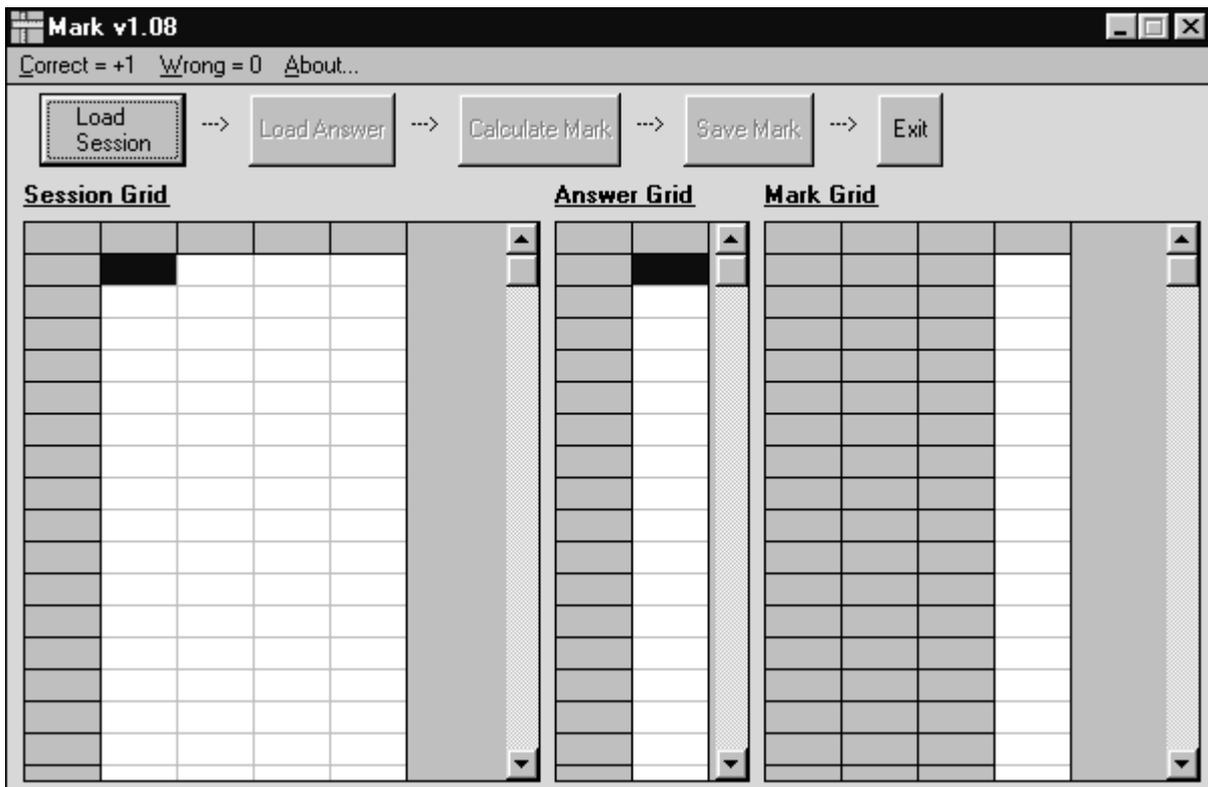
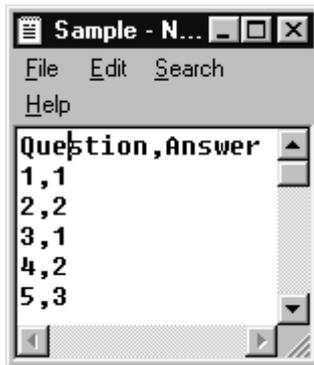
To verify the ID number stored in the transmitter:

1. Start the PRS **IDChg** Software
2. Connect the transmitter to the **ID-Changer**.
3. Click on the button "Read ID".
4. Simultaneously press the keys "H" and "L" on the transmitter.
5. The ID will be read from the transmitter and be displayed on the screen.



Mark Program User's Guide

The Mark program marks or grades the answers contained in a "session file" if there is a corresponding "answer file" available. Details on the "session file" can be found in Section X on PRS operation - a detailed guide. An example of "answer file" is shown below. This was opened via Notepad by clicking on C:\PRS\Answer\Sample.csv. The 1st entry is the question number and the 2nd is the corresponding answer



Load the PRS Mark program into same file folder where your PRS program resides. Run the Mark program and the main display will appear as illustrated above.

- 1) The weighting factors are shown on the top pull down menu bar. The defaults settings are "+1" for "Correct" and "0" for "Wrong". Click on the appropriate buttons to change to the desired weightings.
- 2) Click on 'Load Session' to get the desired session file which normally resides in the folder C:\PRS\Session. Below is an example in which the session consisted of 2 questions each with 4 choices and answered by 5 students.
- 3) Click on 'Load Answer' to get the pre-existing file that contains the correct answers for the set of questions.
- 4) Click on 'Calculate Mark' and the session score of each student is shown on the column labeled Mark. The statistical summaries are also computed and shown. Note that in the example below, the weightings are Correct =+5 and Wrong =+2 with zero for not participating.
- 5) Click on 'Save Mark' to save the results.
- 6) Click on 'Exit' to quit.

The screenshot shows the 'Mark v1.08' application window. At the top, the status bar indicates 'Correct = +5 Wrong = +2 About...'. Below this are five buttons: 'Load Session', 'Load Answer', 'Calculate Mark', 'Save Mark', and 'Exit', each with a right-pointing arrow between them. The main area is divided into three sections: 'Session Grid', 'Answer Grid', and 'Mark Grid'. A 'Result' dialog box is open in the bottom right corner.

Session Grid

Que	Seat	ID	AB(B=C)	Ans
1		3	A	2
1		1	A	3
1		4	A	2
1		5	A	1
1		2	A	1
2		3	A	2
2		1	A	1
2		4	A	4
2		5	A	2
2		2	A	2

Answer Grid

Que	Ans
1	1
2	2
3	1
4	2
5	3
6	4
7	5
8	4
9	3
10	2
11	2
12	3
13	2
14	3
15	1
16	3

Mark Grid

Seat	ID	AB(B=C)	Mark
	2	A	10
	5	A	10
	3	A	7
	1	A	4
	4	A	4

Result Dialog Box

```

Result
-----
N = 5
Mean = 7
SD = 2.683282
Min = 4
Max = 10
OK
  
```