

Krautkramer USPC 2100

Operating Manual
021-002-102



GE Inspection Technologies

USPC 2100 Operation and Features Guide

021-002-102

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Software Version

This helpfile supports the following version of USPC 2100 software:

User Interface (GUI)	3.3.661
DLL	2.3.6
VxD	3.66
Firmup	3.0.40
Firmware	ROM_081198.UPD

IMPORTANT NOTES

PLEASE READ. CALL US IF YOU HAVE ANY QUESTIONS.

USA 717-242-0327 Germany 02233 7010

Software

The USPC 2100 is a system designed for use in automatic ultrasonic testing installations, and must give accurate testing results. In order to achieve this level of performance, during a test the software operation must not be interrupted. Do not run other programs on the testing computer while the USPC 2100 is testing. This could result in erroneous readings or missed results.

Hardware

For the USPC 2100 software and ultrasonic instrumentation to function to specifications they must be installed in a GE Inspection Technologies supplied or approved computer. The importance of the computer type cannot be over stressed. Although the instrumentation and software may appear to function in other installations, adequate performance can only be assured in approved computers.

Help Guide

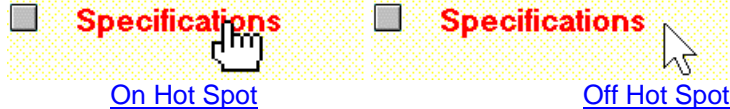
The quickest way to get help in the USPC 2100 is to place the cursor over the **TEXT** describing a control or indicator and to click on the right mouse button. This will give specific help on the appropriate subject and provide links to more detailed information if needed.

To search for help you can either click on the **Contents** button or tab at the top of a help screen to go to subjects in category order, or click on the **Index** or **Search** buttons to search for specific subjects or words.

The help program is designed as a basic "manual on a disk". The advantage of this medium is that you can easily navigate to the item that you need. As described above, there are different ways that you can use to access information. Chose the one that best suits your immediate needs.

Hot Spots

Within the help file system, the usual way to access information is through "hot spots" contained as text, or as parts of a picture. If you use the mouse to position your cursor over a hot spot, you will see the cursor change shape from an arrow to a pointing hand. Hot spot text is usually green and underlined.



Whenever the pointing hand is showing, this means that if you click the left mouse button then you will see information relative to that particular item. You can also use the "Tab" key: to successively move from hotspot to hotspot.

Menu Bar

At the top of each help window you will see a menu bar that gives other alternatives to access help information and navigate through the manual:



Contents

The contents button always takes you back to the main, or first page which lists the basic items in the HELP file.

Search

The search button will bring up a menu containing a list of keywords used in the manual. If you select a keyword then you will be taken directly to the help page containing information on the selected item.

Back

The back button will take you back through successive choices you made, so that you can easily back-track through your search.

History

The history button will show you the past 40 moves you made in the help file.

Done

Click on the done button to exit the help file



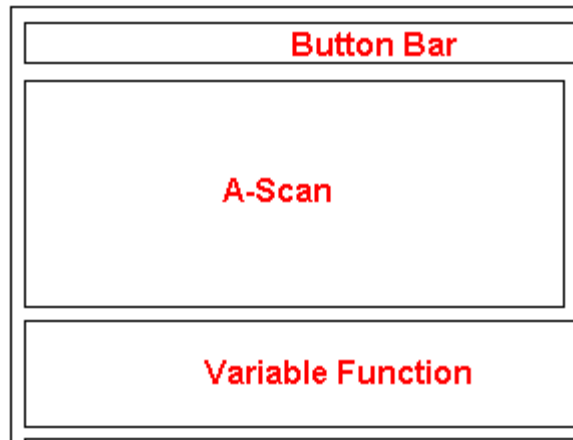
The above are browse buttons, shown active (left) and inactive(right).

These buttons are used to sequentially access groups of related information. If you are viewing a subject and you see that the buttons are active, then this means that you have easy access to other items related to the current topic.

Using the USPC 2100

This section describes the control types and menu structures used in the USPC 2100. It shows the basic methods to change parameters and steers the user through the operating system.

PC2100 Basic Screen Layout



The layout shown above is the basic layout for control panels used to setup and run the USPC 2100. Some other special display and configuration panels are used in the system, but the basic layout is as above. Use the << and >> arrows above to move between individual panel descriptions

Note that you can get help from any USPC 2100 function or control by clicking on the items text description with the right mouse button.

Button Bar	These buttons bring up the display of the main function control panels used in the system.
A-scan Panel	Is the basic display of the setup A-Scan and its associated controls. The A-scan shown in the display will be the A-scan for the currently selected channel.
Status Panel	Indicator panel shows currently selected channel number and indicator LED's which show if any channel has an alarm condition.
Variable Panel	Shows different groups of functions as selected on the button bar. Groups are arranged functionally such as receiver, gates, files, etc.
Gate Readout Panel	Displays gate readings from currently selected channel. Note that this panel will change appearance dependent on whether the current channel is set up as a FLAW channel or a THICKNESS channel.
Text Message Area	Displays system messages or warnings.
Config Buttons	Select system configuration menus. Note that these buttons will only be displayed if the system is started in configuration mode.

Control Types used in the USPC 2100

The following are the general control types used for selection of options and values in the USPC 2100

Push Buttons

Position cursor arrow on button and left click to actuate
Right click on button to get detailed help on the buttons' function.



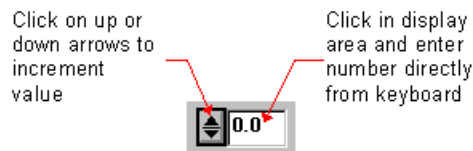
Slider Type Controls

Click on slider once to select.
Arrow keys move selected slider.



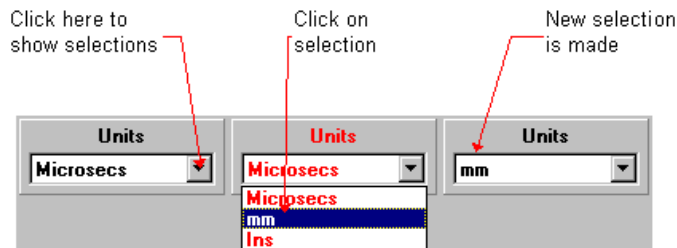
Increment/Decrement Controls

Click on control once to select.
Up/Down arrow keys will increment value.

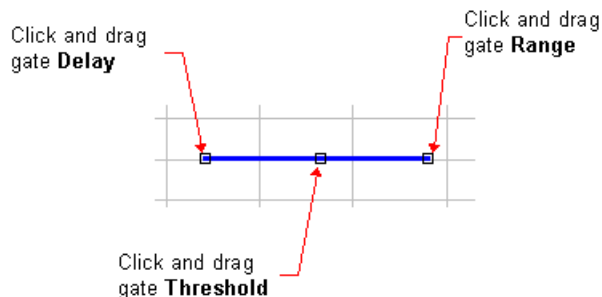


Selection Boxes

Click on slider once to select.
Up/Down Arrow keys change selection.



On Screen Gate Positioning



Channel Definition

In the USPC 2100 system a **Channel** is defined as a receiver channel. A **Channel** refers to a receiver channel and is fixed to one particular card. A **Channel** will refer to the: A-scan display, Amplifier, and Gating Evaluation from that card. Note that a receiver **Channel** does not necessarily have to use the pulser located on the same card. These assignments are selected in the **General Config** menu.

Warning Yellow Screen

This release of USPC 2100 software uses a debug feature to detect if all gate calculations are completed before the next pulser fire. This feature will be removed before final release. If you see the A-scan turn or flash yellow this means that the gate to PRF relationship is marginal and that the gate software has not been able to complete it's work before the next cycle. If you see this condition you should either reduce the PRF or reduce the gate width. Please note that this feature is global, so in multi channel systems if you see a yellow screen it may be due to a condition on another channel.

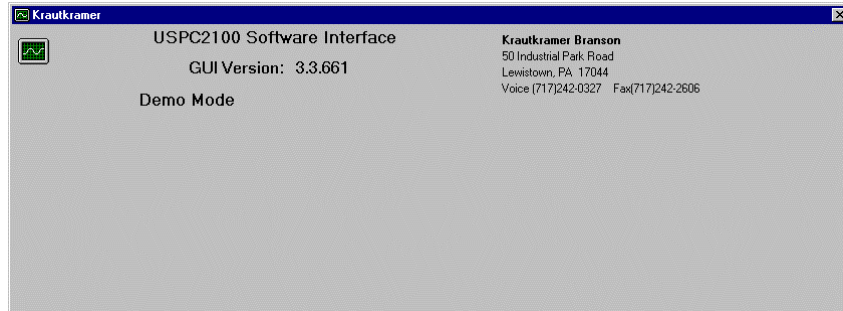
Control Panel Descriptions

This section describes each control panel used in the USPC 2100 and the controls and indicators found on that panel

The following panels are described:

*About Panel
A-scan Panel
Application Window
Configuration Buttons
Files
Gates Flaw
Gates Thickness
Menu Buttons
Measurement
PC Configuration
Pulser Receiver
Status
Strip Chart
System
Time Corrected Gain*

About Panel



The about panel shows all hardware and software versions currently installed in the system. This information is stored on each board and updated automatically if the software on that board is updated. The above picture shows information from a 1-channel system. If more channels are installed then information will be shown for all channels

Channel

Shows the channel number to which the following information applies

Hardware Version

Shows the hardware revision level for each board

Firmware

Shows the filename of the last firmware installation

Serial Number

Reads the serial number for the board installed in the selected channel

Software

BT Boot Software revision

OP Operating software revision for board processor

AQ Operating software for Acquisition DSP (A-scan)

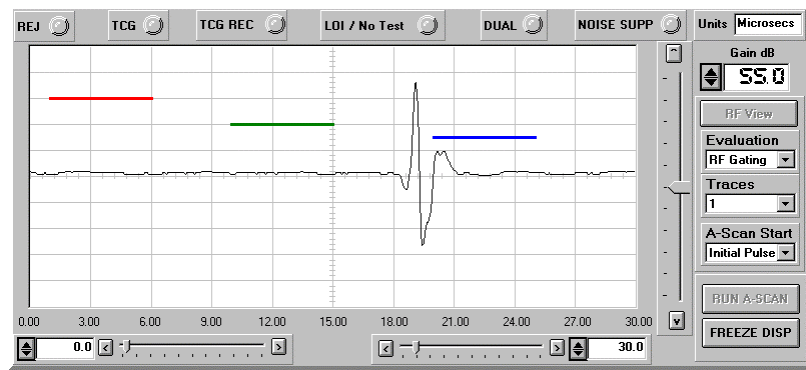
GA Software installed in the Gate A DSP

GB Software installed in the Gate B DSP

MN Main FPGA code (Field Programmable Gate Array)

AN Analog FPGA Code

A Scan Panel



A-Scan Panel Description

The **A-Scan Panel** is the main display window for setting up and calibrating the USPC 2100. It contains the A-scan display and controls, along with important indicators.

LED Indicators The LEDs at the top of the display are indicators for important settings. Loss of interface is global and applies to all channels, while the others only apply to the channel currently active in the A-Scan display.

Indicator	Meaning	Global / Current channel
REJ	Reject is active	Current channel
TCG	TCG is active	Current channel
TCG REC	TCG is in TCG record mode	Current channel
LOI / No Test	Loss of interface	Global (Any Channel)
DUAL	Dual mode (separate transmit receive) is active	Current channel
NOISE SUPP	Noise suppression is active	Current channel

Units Shows the currently selected units in the General Config menu.

Gain dB Adjustment control for gain. Note that gain can also be adjusted using the slider control to the right of the A-scan.

RF View Shows RF display but does not turn gates to RF Gating mode.

Evaluation Sets mode for echo evaluation (not just display)

- Full Wave** Pos and Neg cycles evaluated
- Neg** Only negative cycles evaluated
- Pos** Only positive cycles evaluated
- RF** Pos and Neg cycles evaluated separately

Traces Selects how many channels are displayed on the A-scan display 1 to 4 channels can be displayed simultaneously, either at different screen levels or superimposed on the baseline (BASE). The currently selected channel will always be on the baseline with higher channels displayed above

- A-Scan Start** Selects trigger (zero) point for the displayed A-Scan
- Initial Pulse** Main bang (time when transducer is fired)
- Interface** Distance (time) at which interface gate threshold is broken
- Artificial** Start point of interface gate (usually used in set up process for Interface gate)

Run A-Scan When an A-scan has been frozen, then this button enables the current running A-scan to be superimposed over the frozen A-scan..Toggles between RUN A-SCAN and HIDE A-SCAN

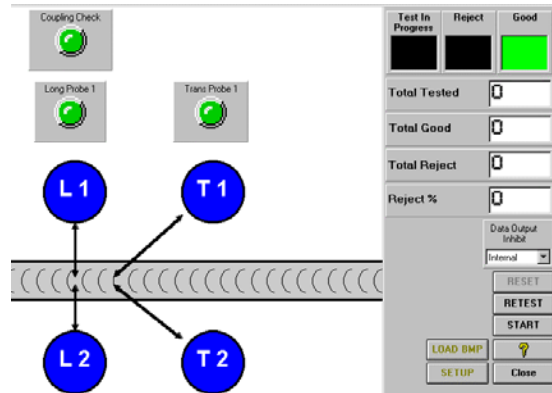
Freeze Disp Freezes the current A-scan display. The trace will turn to blue showing that it is frozen. See also RUN A-SCAN. The control toggles between FREEZE DISP and FREEZE OFF

Display Delay Sets the start point for the displayed A Scan

Display Range Sets the range for the displayed A-Scan

Note that the start and end point of the displayed A-Scan are shown in current units at the base of the display

Application Panel



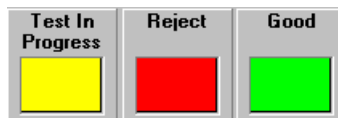
Application Window

The USPC 2100 includes an **Application Window (APP WIN)** which allows systems users to superimpose test results onto a component sketch, and to automatically count components tested, keeping a running total of accepts and rejects. These totals can be updated by hand or by a simple electrical input to the USPC 2100.

The **Application Window** simultaneously gives 2 important pieces of information to the user: An easy to interpret snapshot of all results of the current test, together with the testing history to date. The current test results can include thickness readings, amplitude readings, test alarms, or any combination for up to 8 test results per display window.

Testing

The start and completion of a test are determined by externally applied signals or by manually clicking on the **Start** and **Stop** buttons. During the test period, the **Test in Progress** light will be yellow, unless a reject alarm is given, then the **Good** light will stay green. If, at any time during the test a reject alarm is activated then the **Fail** light will be red and will stay red until the end of the test, and the **Good** light will go out. At the end of a test the accumulators will update with the results of the last test. If the test is being run in manual mode then the operator has the option of retesting by clicking the **Retest** button. This will restore the results accumulators to their values before the previous test. Clicking the **Reset** button will give a warning, and then zero all the results accumulators

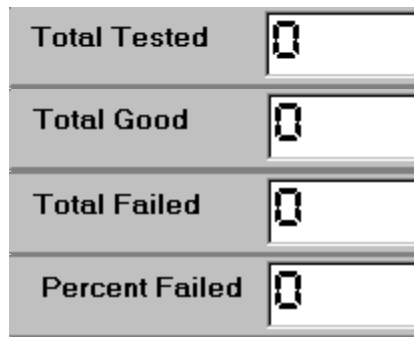


Shows the total number of tested components since the last reset

Shows the total number of good components since the last reset

Shows the total number of rejected components since the last reset

Shows the percentage of rejected components since the last reset



Please refer to the Application Panel Setup Instructions for more details.

Configuration Buttons



Configuration Buttons

The Panel Config Buttons are General Config, Outputs Config, and PC Config. These buttons are located at the bottom right of the screen, below the main control panels. The controls are only accessible, and will only appear on the display if the USPC 2100 is run in Config Mode. Config mode is selected as a software switch when the instrument is first run, to restrict access to the configuration menus if required by the user.

Important - The configuration buttons access menus that can set up or change basic USPC 2100 configuration and output connectors. Changes in these menus will affect the currently selected configurations, and could change the state of external devices controlled by the USPC 2100, such as mechanical outputs.

General Config

Shows general configuration menu to set up basic system settings such as Language, Units, Channel configuration and Firing order

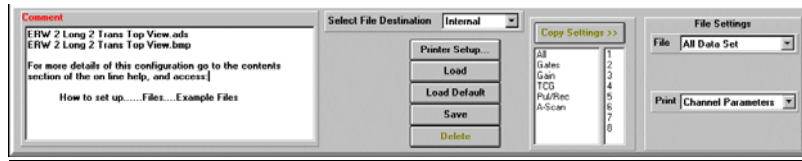
Outputs Config

Shows output configuration menu to set up USPC 2100 outputs, and to set up outputs used internally in the system by the **Strip** and **Application** Windows.

PC Config

Opens menu to enter default directories for file save and recall, and to set up RS232 port.

Files Panel



File Storage and Recall

Controls for file save and recall are in the **Files** panel accessed from the **FILES** button at the top of the screen. A comment window allows test comments to be saved with a data file.

Default directory destinations for file storage and retrieval are set up in the **PC Config** menu accessed from the config button at the bottom of the screen.

To save or recall a file:

- ◆ Select the file destination or source for the file from the **Select File Destination** Select Control.
- ◆ Select the Data Type from the **File Settings** Select Control.
- ◆ Click the appropriate option button to **Load, Save, or Delete** a file

Select File Destination

Internal Selected file type will be saved or recalled using the USPC 2100 hard disk

Floppy Selected file type will be saved or recalled using the USPC 2100 3.5-inch floppy drive

File Settings

Chan Data Set Will save a file containing all settings for the current channel. This will include an A-scan if it is frozen when the file is saved. Data set files can be recalled to restore the settings to the current channel at the time of recall. Note the Data Set files are in binary format and are not readable as a text file.

All Data Set As **Channel Data Set** but for all active channels

Chan Params Saves current channel parameters as a readable text file suitable for importing into a document as part of a report.

All Params As **Channel Parameters** but for all active channels

A-scan Saves current Frozen A-scan as a PCX format file suitable for importing into a document as part of a report.

Option Select Buttons

Printer Setup Opens standard Windows XP printer menu for currently installed printers.

Load Opens file selection window to select file to load.

Load Default Loads USPC 2100 default file.

Save Opens file selection window for entry of filename to save.

Delete Opens file selection window to select file to delete.

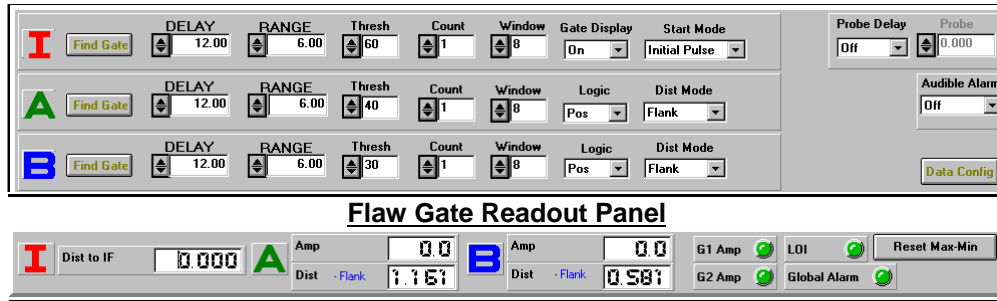
Error Messages

The area immediately below the main panels is used to display system messages to the user. These messages include notice of system errors and messages regarding actions the user tries to do which are "blocked" because of other system parameters (such as trying to set a gate out of PRF range, or a TCG point outside the instrument dynamic range).

id	Error Message	Comments
1	%% (%%).	
2	Directory (%%) does not exist. Please try again	You are trying to save to a non existent directory. Either retype the directory name or create a new directory
3	Error Handler received Unknown Action Type	
4	Attempt made to make too many interface connections for %%	
5	%%: Could not find interface connection to disconnect!	
6	Soft Limit Exceeded - Channel %%%: %% limited to %%	You have entered a value outside its range
7	Soft Limit Exceeded - Channel %%%: %% limited to %%	You have entered a value outside its range
8	Hard Limit Exceeded - Channel %%%: %% limited to %%	You have entered a value outside its range
9	Hard Limit Exceeded - Channel %%%: %% limited to %%	You have entered a value outside its range
10	Recalculation for %% not understood	
11	Action for %% not understood	
12	Spare Message	
13	RS232 Error: %%	
14	Remote (RS232) Command '%%' not for this instrument	
15	Remote (RS232) Command '%%' requesting unavailable channel	
16	Remote (RS232) Command (%%) not understood - What Parameter to Change?	
17	Remote (RS232) Command (%%) not understood - Could not understand %%	
18	Remote (RS232) Command '%%' not understood - expecting '='	
19	Remote (RS232) Command '%%' not understood - What Parameter is being Requested?	
20	Remote (RS232) Command '%%' not understood - Could not understand '%%'	
21	RS232 Error: %%	
22	%%: Cannot create temp database for reporting purposes.	
23	%%	
24	%%. Error in printing report.	
25	%%	
26	Error in Read Channel Parameters: %%	
27	Error in Save Parameters: %%	

- 28 Error in Read Channel Parameters: %%
- 29 Error in Open File: %%
- 30 A-Scan Save Error: %%
- 31 A-Scan Read Error: %%
- 32 Error in Save Defaults: %%
- 33 Error in Read Defaults: %%
- 34 %%
- 35 Auto Adjust
- 36 %: Automatically Change Sign to Positive?
- 37 Warning! You are about to reset the Good /
Bad accumulators to Zero. Do you really want
to do this?
- 38 Start Recording
- 39 Warning: Recording a new TCG table will
destroy the current one.
- 40 Demo Mode
- 41 Unable to set Parameter %% for channel %%
- 42 Automatically switching Gating Mode to RF for
channel %.
- 43 Switching Interface Velocity will force gates to
move within PRF
- 44 GE Inspection Technologies
- 45 50 Industrial Park Road
- 46 Lewistown, PA 17044
- 47 Voice (717) 242-0327 Fax (717) 242-2606
- 48 TCG Entry Error in Point Number %%
- 49 Gain entry must be between 0 and 120 dB.
- 50 Maximum range in Gain Values must be less
than 35 dB.
- 51 Distance (time) must be > 80 nsecs and <
5,242,900 nsecs.
- 52 TCG Curve slope must be between -12
dB/usec and 12 dB/usec
- 53 Entering RF Evaluation Mode Forces A SCAN
Reject to Zero!
- 54 USPC 2100
- 55 The new sequence table would invalidate the
currently selected Main PRF. Hit OK to
continue and have the Main PRF adjusted
automatically, or CANCEL to return to the
sequence configuration.
- 56 The gate reading is invalid. Either the distance
or amplitude or both are zero. Reposition the
gate and try again.
- 57 Error in TCG Record
- 58 The Evaluation Mode (Flaw/Thickness) is
different on channel %% than on the current
channel. Press OK to change mode on %% or
CANCEL to skip copy to that channel.

Flaw Gate Panel



Flaw Gate Panel

See the following sections for gate setup and positioning

Basic Gates for an overview and diagrams of USPC 2100 gate positioning and evaluation

Gates Setup for details of all gate controls (flaw and thickness gates)

Gate Start Modes for an overview and diagrams of the gate start mode options

Thickness Gate Setup describes how to position gates for thickness measurement

Thickness Gate Measurement Modes gives details of thickness measurement options using the USPC 2100

Flaw Panel Readout Panel

Dist to IF

Currently measured distance to the signal breaking the interface gate (updated instantly to outputs and evaluation, updated at approx 60 Hz to the display)

Amp

The current amplitude reading from Gates A and Gate B

Dist

The current distance reading from Gates A and Gate B

GA and GB Amp

Simulated LED indicators, which will show an alarmed condition if the respective gate evaluation conditions are exceeded.

LOI

A simulated LED indicator which will show an alarmed (red) condition if the instrument is set up in Interface Start mode and no echo triggers the gate.

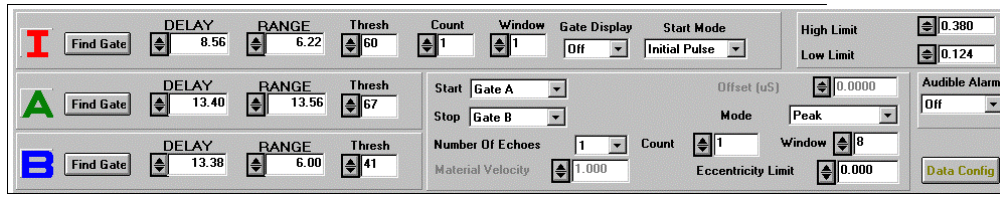
Global Alarm

A simulated LED which will show an alarmed condition if **any** gate in **any** channel is violated

Reset Min Max

Manually resets min and max readings as defined in the Data Config Panel accessed from the Flaw Gate Panel

Thickness Gate Panel



Thickness Gate Readout Panel



Thickness Gate Panel

See the following sections for gate setup and positioning

Basic Gates for an overview and diagrams of USPC 2100 gate positioning and evaluation

Gates Setup for details of all gate controls (flaw and thickness gates)

Gate Start Modes for an overview and diagrams of the gate start mode options

Thickness Gate Setup describes how to position gates for thickness measurement

Thickness Gate Measurement Modes gives details of thickness measurement options using the USPC 2100

Thickness Panel Readout Panel

Thick

Current thickness reading (updated instantly to outputs and evaluation, updated at approx 60 Hz to the display)

Max

The maximum reading measured according to the settings in the Data Config panel accessed from the Data Config button on the Thickness Gates Panel

Min

The minimum reading measured according to the settings in the Data Config panel accessed from the Data Config button on the Thickness Gates Panel

Avg

The average reading measured according to the settings in the Data Config panel accessed from the Data Config button on the Thickness Gates Panel

Ecc

The current eccentricity according to the settings in the Data Config panel accessed from the Data Config button on the Thickness Gates Panel.

Reset Min Max

Manually resets min and max readings

High Limit

Currently set High tolerance limit set in the Thickness Gates Panel

Low Limit

Currently set Low tolerance limit set in the Thickness Gates Panel

Panel General Config

General Configurations

Language: English

Units: Ins

Synchronization: Internal

Slave Mode: Master

Sequence Table

Rec / Trace	Pul	Cycle	Name	Mode
1	1	1	Long Probe 1	Flaw
2	2	2	Long Probe 2	Thickness
3	1	1	Coupling Check	Flaw
4	4	3	Trans Probe 1	Flaw
5	5	4	Trans Probe 2	Flaw
6	6			Flaw
7	7			Flaw
8	8			Flaw

2 | 2 | None | Long Probe 2 | Thickness

Reset Variables

OK Cancel ?

This panel is used to setup the basic USPC 2100 system.

Language

Select the language for the USPC 2100. The selected language will be used for all interface controls.

The following languages are currently available

English, German, French and Italian.

Help is available in English only at this time.

Units

Selects the unit for operation

Inches, millimeters, microseconds

Synchronization

Selects if the USPC 2100 system uses its internal clock for timing, or uses an externally supplied signal.

Slave Mode

Used when multiple USPC 2100s are operated together, to insure synchronization and minimum ultrasonic cross talk problems. One USPC 2100 system should be selected as **Master** and other systems as **Slave**

Sequence Table

This table is used to setup and configure the USPC 2100 system. It is used to set up the firing order of channels, to select if a channel is configured in flaw or thickness mode, and to assign a name to a particular channel.

Full details of the setup of this table are found in the How to ... Setup Channels section of the manual

Panel Outputs Config

USPC2100 Outputs

Assign Analog Outputs							Assign TTL Outputs			
OP-Pin	Ch	Option	Offset	Range	LOI / no Test	Timed Hold	OP-Pin	Ch	Option	LOI / no Test
1 - A18	1	Off					1 - A19	1	Off	
2 - A17	1	Off					2 - A16	1	Off	
1 - A12	2	Off					1 - A13	2	Off	
2 - A11	2	Off					2 - A10	2	Off	
1 - A6	3	Off					1 - A7	3	Off	
2 - A5	3	Off					2 - A4	3	Off	
1 - A37	4	Off					1 - A1	4	Off	
2 - A36	4	Off					2 - A35	4	Off	
1 - B18	5	Off					1 - B19	5	Off	
2 - B17	5	Off					2 - B16	5	Off	
1 - B12	6	Off					1 - B13	6	Off	
2 - B11	6	Off					2 - B10	6	Off	
1 - B6	7	Off					1 - B7	7	Off	
2 - B5	7	Off					2 - B4	7	Off	
1 - B37	8	Off					1 - B1	8	Off	
2 - B36	8	Off					2 - B35	8	Off	

1 - A18 | 1 | Off | 0.000 | 0.00 | Last Reading | Max

1 - A19 | 1 | Off | Alarm

Reset Variables
Reset Variables
Reset Variables

Data Output Inhibit: Internal

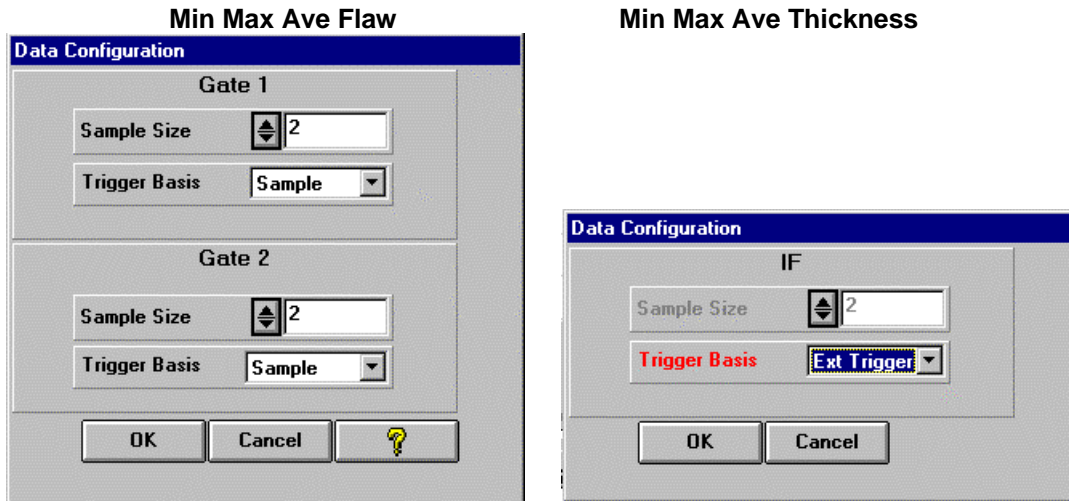
TTL Alarm Level: Alarm High (5V)

TTL Hold Time: Inst

Analog Full Scale: 10 Volts

OK Cancel ?

Min Max Average Calculations



Min Max and Average Function Description (flaw and thickness gate data config panel)

The **Min**, **Max**, and **Average** functions are provided to capture and reduce the amount of data recorded and displayed. Typical uses include minimum and maximum thickness readings over a part, or outputs based on a fixed sample size, such as one complete revolution of tube, or every inch of a plate. The sample over which the readings are calculated can be a fixed sample size, or based on externally supplied signals.

The **Min**, **Max**, and **Average** functions give statistical information of **Amplitudes**, and **Distances** from Gate A and Gate B in **Flaw Mode**, or **Thickness Measurements**, if used with a channel configured to **Thickness Mode**. The results are shown on the user interface and are also available as analog outputs, or they can also be displayed in the Application or **Strip Chart** windows

The **Min** and **Max** readings are taken either over the sample size as entered in the **Sample** control (2 - 2,000 samples), or over the period of time between 2 external TTL signals applied to the **TDR** pin on the input / output connector.

The **Average** reading is only available using the fixed sample size.

Min, Max, and Average are available as selection options in both the Config Outputs menu and the Strip Chart Config menu. When statistic options are selected as outputs, then these outputs will be updated either at the end of the Sample period, or when the Input is received.

Menu Select Buttons



Exit

Saves current settings and closes USPC 2100

System

Opens **System** Panel

Pul/Red

Opens **Pulser Receiver** panel

Gates

Opens **Gate Panel**. Note this will be the **Flaw** Gates Panel or the **Thickness** Gates Panel depending on the current assignment in the **General Config** settings

TCG

Opens Time Corrected Gain Panel

Files

Opens Files Panel to allow saving of files, printing or copying settings between channels

Strip

Opens the Strip Chart Panel

App Win

Opens the Application Window

Meas

Opens the Measurement Panel to display readings from all channels

Print

Activates the print command currently set in the Files Panel

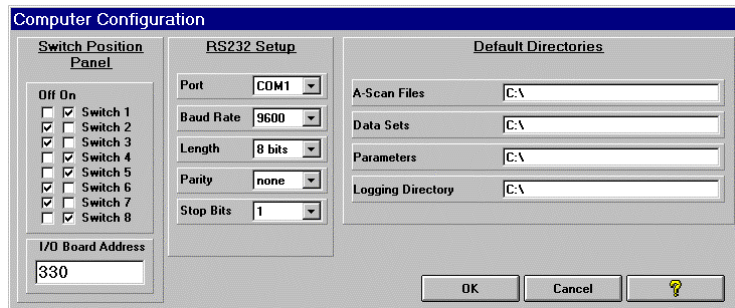
Reset ALR

Resets alarms when they are set in latched mode

About

Show current information about the system and software and hardware revisions

PC Config Panel



This panel is used to set up Output Card base address, RS232 interface parameters, and default directories for file saving and retrieving.

A-Scan Files

Selects default directory for A-scan files

Data Sets

Selects default directory for Data sets (binary files to store USPC 2100 setups)

Parameter Sets

Selects default directory for Parameter sets (text files to store USPC 2100 setups)

User Directory

Default user directory

See Setup PC Configuration for information on base address and RS232.

Pulser Receiver Panel



Pulser Receiver Panel Description

The Pulser Receiver panel is used to set up the current Receiver Channel, and the Pulser Channel assigned to it during Configuration.

Note the Pulser assigned to this channel may be from another channel and necessitate some external probe wiring changes.

Receiver Settings

Reject 0 - 80 %
Frequency 1, 2.25, 5, 10, Broad Band
Test Mode Single, Dual

Pulser Settings

Damping 50, 75, 500 Ohms
Voltage 400V into 100 Ohms, 100V into 100 Ohms
Energy 330 pfarads, 1330 pfarads

Status Panel



Status Panel Description

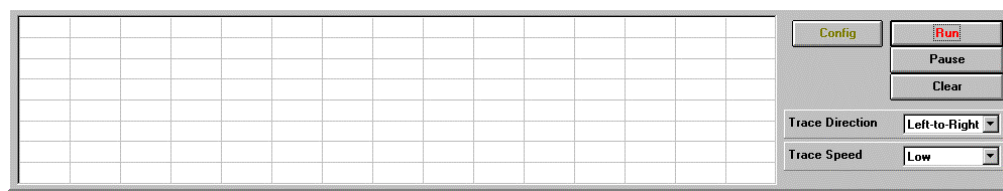
The status panel is an indicator of current channel settings, and of Global alarms.

Text Window The text window at the top of the panel will show the name of the displayed channel if a name for the channel has been entered in the **General Config** menu.

Rec /Pulser Show the currently displayed Receiver Channel and its assigned Pulser channel from the **General Config** menu. For more information on Channel configuration see the Setup Channels section of the help file.

Chan Alarms Give a summary of the alarm states for all channels installed and running in the system. This function will show up to 8 Channel alarms for an 8-channel system

Strip Chart Panel



For information on this panel please refer to the **Strip Chart Setup** instructions (Page 36).

System Panel

The screenshot shows a software interface for system parameters. It includes several input fields and dropdown menus. On the left, there are three velocity controls: 'Material Velocity' (0.2223 Ins/microsec), 'Delay Velocity' (0.0583 Ins/microsec), and 'Interface Velocity' (set to 'Material Velocity'). In the center, there are two dropdown menus: 'Mat. Velocity Table' (set to 'Steel_mild') and 'Delay Velocity Table' (set to 'Water'). On the right, a 'System Parameters' box contains 'Main PRF' (500 Hz) and 'Channel PRF' (25 Hz).

System Panel Description

The system panel has both system controls (apply to all channels) and controls for the current channel.

System Panel Controls

Main PRF This control sets the system **Pulse Repetition Frequency**. This is the base "clock" for all testing. Its setting interacts with the settings in the General Config menu. For instance, if all Channels are set to run in parallel, then all channels will fire at the System PRF. However, if channels are set to fire sequentially, then the individual channel PRF will run at a sub multiple of the System PRF. See also Channel Setup.

Channel PRF This is a read only value that shows the PRF for the current channel. Note that this control is also active when the USPC 2100 is slaved from a master clock, when it will indicate the current channel PRF.

Channel Controls

Matl Vel Used to set the velocity used to calculate Distance and Thickness measurements and settings.

Note that Velocity controls are inactive when the instrument is set in Time (microsecs) mode in the General Config setup panel.

Del Vel Sets the Velocity used to calculate and measure Distances and settings from the Interface Gate. For immersion testing, if this value is set to the velocity of water, then water path readings will be output from the **Interface Gate**. Note that this mode is only active if the **Interface Velocity** control below is set to **Delay Velocity**.

Int Vel Setting to determine if **Delay Velocity** or **Material Velocity** is used for the **Interface Gate** and its readings.

Velocity Table Look up table of common material velocities.

Time Corrected Gain Panel



See also the TCG Setup section

TCG Start Mode

The start point (zero distance point) for the gates and their distance measurements is selectable to suit different measurement techniques. This selection is made from the Start Mode Selection Control, of the Interface gate. Note that Start Mode selections are not available if Probe Delay is turned on (this control is described later in this section).

Initial Pulse All measurements from all gates are made from the initial pulse of the transducer.

Interface *Interface mode is typically used with immersion or other water gap techniques to automatically adjust the start (zero) point for the measurement gates. With Interface Start Mode active, variations in water gap are automatically compensated.*

The measurement in the interface gate (Dist to IF) is taken from the Initial Pulse to the position where the Interface Gate Threshold is broken. Distances (for gate measurements and gate position) for the 2 measurement gates are taken from the end of the Interface gate measurement.

Artificial The measurement in the interface gate (Dist to IF) is taken from the Initial Pulse to the position where the Interface Gate Threshold is broken. Distances (for gate measurements and gate position) for the 2 measurement gates are taken from the end of the Interface Gate.

TCG Offset

Use this control to add or subtract gain from the current TCG curve. Typically used when calibrating at a lower sensitivity than the final testing sensitivity.

TCG Gate Delay

Sets the start point for the TCG record gate.

TCG Gate Range

Sets the range for the TCG record gate

TCG Record Buttons

SELECT ECHO

Start Rec

Used to capture successive TCG points to create TCG table

Show TCG Table

Displays current TCG table to show or edit entries

TCG Offset

Adds or subtracts fixed amount of gain to each point in current TCG table

Material Attenuation

Use this control to add a linear attenuation value to the current TCG curve.

Typically used when calibrating with a low attenuation material and testing a higher attenuation material.

TCG Display

A curve showing the relative TCG corrections can be displayed on the A-scan display.

Off No curve is displayed

Baseline The curve is displayed on the display baseline

Mid Screen The curve is displayed at 50% screen height.

TCG

Turns the TCG On or Off. When activated (On) the TCG light at the top of the display will be **red**.

How to set up.....

How to set up.....

This section describes features of the USPC 2100 and gives setup instruction on each feature.

Application Window

Strip Chart

Files

Saving and Recalling

Example Files

File Types

Default Settings

Gates

Basic Gate Positioning and Measurements

Gate Start Modes

Thickness Gating

Zero Crossing

Min, Max and Average

Gating Reference

Time Corrected Gain

Print Reports

Outputs

Setup Outputs

Setup Output Card

Setup Output Pins

Add On Devices

Channels and Configuration

Application Window

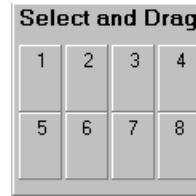
The USPC 2100 includes an **Application Window (APP WIN)** which allows systems users to superimpose test results onto a component sketch, and to automatically count components tested, keeping a running total of accepts and rejects. These totals can be updated by hand or by a simple electrical input to the USPC 2100.

The **Application Window** simultaneously gives 2 important pieces of information to the user: An easy to interpret snapshot of all results of the current test, together with the testing history to date. The current test results can include thickness readings, amplitude readings, test alarms, or any combination for up to 8 test results per display window.

There are 2 major steps to setting up an **App Win**, first load the picture of the test component, then configure and position the test indicators around the component. Pressing the Load Bitmap button, which will open a file select window, accesses pictures. From this window select the file to be loaded, and press the **OK** button on the file select window. The USPC 2100 uses Windows Bitmap format pictures, 690 pixels high x 780 pixels wide (in Velocity mode, 525 by 725), These images can be supplied by your local GE Inspection Technologies representative or can be drawn with your own drawing program.

To configure and position the indicators on the picture first click the **Setup** button to open the **Select and Drag** panel and the **Static Setup** panel (click the **Setup** button again to remove these menus).

Now click on one of the 8 indicators in the **Select and Drag** panel and, while holding the left mouse button down, drag the indicator and roughly position it on the picture. Continue until all indicators are positioned (don't worry about fine tuning the positioning, this is best done from the Static Setup panel.)



Next, configure the reading to appear on the indicators. This is done in the **Static Setup** window. This window has a fixed column for the indicators and 5 columns for the variables assigned to each indicator. Changes/entries are made on the edit row at the bottom of the table.

Static Setup													
Ind	Chan	Function	X-Pos	Y-Pos	Name								
1	1	G1 Alarm	267	500	Flaw Alarm								
2	1	G1 Amp	409	500	Flaw Amplitude								
3	2	G2 TOF	267	344	G2 Distance								
4	4	G1 Avg.	420	344	G1 Average								
5	1	Off	0	0									
6	1	Off	0	0									
7	1	Off	0	0									
8	1	Off	0	0									
<table border="0"> <tr> <td></td> <td>1</td> <td>G1 Alarm</td> <td></td> <td>267</td> <td></td> <td>500</td> <td>Flaw Alarm</td> </tr> </table>							1	G1 Alarm		267		500	Flaw Alarm
	1	G1 Alarm		267		500	Flaw Alarm						

Selections for Indicators

Ind Number of indicator to be edited

Chan Channel select

Note: In Velocity mode, all indicators' associated with a velocity measurement will match the indicator assigned to "Velocity."

Function (Flaw Channel)

Off

GA & GB Amplitude Current Amp value for gates 1 or 2

GA & GB TOF Current Time of Flight (distance) value from gates 1 or 2
GA & GB Min Minimum value from gates 1 or 2 **
GA & GB Max Maximum value from gates 1 or 2 **
GA & GB Avg Average value from gates 1 or 2 **
GA & GB Alarm LED alarm from gates 1 or 2
IF TOF Current distance readout from Interface Gate
LOI Alarm Loss of Interface Alarm

Function (Thickness Channel)

Off
Min Thick Minimum Thickness measurement **
Max Thick Maximum Thickness measurement **
Avg Thick Average Thickness measurement **
Min Alarm Triggered when velocity reads outside limits set by the Minimum and Maximum Velocity controls (in Gates panel).
Max Alarm Triggered when thickness reads outside limits set by the Minimum and Maximum Thickness controls (in Gates panel).
LOI (NO test) Loss of Interface Alarm
IF TOF Current distance readout from Interface Gate
Eccentricity Current Eccentricity measurement (subject to offset and range controls)
Eccentricity Alarm Signal will be output if the measurement rises above the max eccentricity set in the Thickness Gates panel.

Function (Velocity Channel)

Off
Velocity Current velocity measurement **
Velocity Min Minimum Velocity measurement **
Velocity Max Maximum Velocity measurement **
Velocity Avg Average Velocity measurement **
Velocity Alarm Triggered when velocity reads outside limits set by the Minimum and Maximum Velocity controls (in Gates panel).
Thickness Alarm Triggered when thickness reads outside limits set by the Minimum and Maximum Thickness controls (in Gates panel).

X-Pos Position of indicator from left side of screen

Y-Pos Position of indicator from top of screen

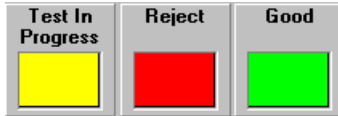
Name Name to appear above indicator

** Note: These calculated statistical measurements are setup in the **Flaw** and **Thickness Data Config** menus and also controlled by the **Data Output Inhibit** input signals.

Use "BACK" button to return to this menu

Testing (Thickness mode)

The start and completion of a test are determined by externally applied signals or by manually clicking on the **Start** and **Stop** buttons. During the test period, the **No Test** light will be yellow, during the test, unless a reject alarm is given, then the **Good** light will stay green. If, at any time during the test a reject alarm is activated then the **Fail** light will be red and will stay red until the end of the test, and the **Good** light will go out. At the end of a test the accumulators will update with the results of the last test. If the test is being run in manual mode then the operator has the option of retesting by clicking the **Retest** button. This will restore the results accumulators to their values before the previous test. Clicking the **Reset** button will give a warning, then zero all the results accumulators



Testing (Velocity)

The start and completion of a test are determined by the detection of a part in the water path while "Load Part" is lit. The data logger On/Off control activates the storage of test results. During the test period, the **No Test** light will be yellow, during the test, unless a reject alarm is given, then the **Accept** light will stay green. If, at any time during the test a reject alarm is activated then the **Fail** light will be red and will stay red until the end of the test, and the **Accept** light will go out. At the end of a test the accumulators will update with the results of the last test. If the test is being run in manual mode then the operator has the option of retesting by clicking the **Re-test** button. This will restore the results accumulators to their values before the previous test. Clicking the **Clear** button will give a warning, then zero all the results accumulators.



Shows the total number of tested components since the last reset

Shows the total number of good components since the last reset

Shows the total number of times the USPC was unable to take a reading

Shows the total number of rejected components since the last reset

Shows the percentage of rejected components since the last reset

Total Tested	0
Total Good	0
Total No Test	0
Total Failed	0
Percent Failed	0

Trend Chart (Velocity only)



Displays the Velocity readings from the last 100 components tested. The position of the points is scaled based on the minimum and maximum velocity limits. The top of the chart is 125% of the maximum limit and the bottom is 75% of the minimum limit. The solid red lines represent the limits.

If a component is RETESTED, the last charted point will be deleted from the chart. A NO TEST will be displayed as a break (blank area) in the chart.

The MAX and MIN velocity controls are duplicates of the ones in the Gates panel.

Strip Chart

The USPC 2100 has an in built strip chart display to show some history of a test. The user can select up to 8 traces to display and can select from over 15 functions to display, including thickness, amplitude and alarm conditions. The chart can be set to scroll at three different speeds to allow for different test conditions.

The Strip Chart window is opened using the **STRIP** button at the top of the screen, and configured using the menu accessed through the **Config** button on the Strip chart panel.

Important note: As the strip chart speed is slow relative to typical pulse repetition rates, a result cannot be displayed from each individual pulse. To overcome this issue, the USP`C 2100 strip chart can be set to record either the maximum or minimum value of all pulses occurring between strip chart update cycles. Typically, for flaw detection you will want the strip chart to display the maximum amplitude value from pulses so that you can be sure that all defects are recorded, whereas for thickness you may want to show the minimum values. To insure that min's or max's are displayed, you should select

Panel Controls

Run Button	Starts the strip chart running. The chart will continue to run until the Pause, or Clear buttons are used. If you temporarily close the Strip window, it will continue to be active in the background, and will be seen updated when the chart is re-opened.
Pause Button	Causes chart to pause temporarily into; the run button is pressed.
Clear Button	Clears all values currently displayed on the chart.
Trace Dir.	Selects if the chart scrolls Left to Right or Right to Left .
Trace Speed	Selects chart speed, Low , Medium , or High .
Config	Opens the Strip Chart configuration menu.

Configuration Options

Options are selected in the config window. The left column is predefined as Trace numbers, with each trace having a predefined color. Selections are made in the select row at the bottom of the table. The second row is used to select a channel, and the third row to select the value to be displayed. The **Analog** options are those set up in the **Outputs Config** window. Data displayed on the strip chart is also controlled by the settings of the Data Output Inhibit control and input signals.

Flaw Channel Options

Off	Trace is turned off
Gate A&B Min	Minimum Amplitude according to settings in Gates Data Config
Gate A&B Max	Maximum Amplitude according to settings in Gates Data Config
Gate A&B Ave	Average Amplitude according to settings in Gates Data Config
Gate A&B TOF	Current Distance measurement in Gates 1 or 2
IF TOF	Current Distance to interface signal
Gate A Alarm	Shows step if alarm is exceeded
Gate B Alarm	Shows step if alarm is exceeded
LOI Alarm	Shows step if the instrument is set up in Interface Start mode and no echo triggers the gate.

Thickness and Velocity Channel Options

Off	Trace is turned off
Thick Min	The minimum reading measured according to the settings in the Data Config panel accessed from the Data Config button on the Thickness Gates Panel
Thick Max	The maximum reading measured
Thick Avg	The average reading measured

Min Alarm	Shows step if alarm is exceeded
Max Alarm	Shows step if alarm is exceeded
LOI Alarm	Shows step if instrument is set to Interface Start mode and no echo violates the gate.
Eccentricity	Current measured reading.
Ecc. Alarm	Shows step if maximum set in Gates panel is exceeded.

Offset and Range Column Choices

Flaw Channel

Offset shifts the analog trace up or down by adding the specified amplitude.

Range is inoperative in Flaw mode. The max range, which represents 100% screen amplitude, is the voltage selected in the **Analog Range** control.

With an offset of 10%, and the output connected to a chart recorder, then the recorder will only rise above the baseline when gated signal amplitude rises above 10%. In this mode the Offset acts similarly to a reject control applied to the outputs.

Thickness Channel

Offset sets the thickness reading, which will register at zero voltage.

Range sets the thickness range, which will be displayed between 0 and max voltage.

With an offset of 1 inch and range of 2 inches, a 0-10 volt analog output will represent a range from 1 to 2 inches.

File Storage and Recall

Controls for file save and recall are in the **Files** panel accessed from the **FILES** button at the top of the screen. A comment window allows test comments to be saved with a data file. Note that the basic Data Sets also include all configuration settings including firing assignments, output assignments, current application window settings and any associated drawings. This means that outputs can be reassigned by loading another different data set with different configurations.

Default directory destinations for file storage and retrieval are set up in the **PC Config** menu accessed from the config button at the bottom of the screen.

To save or recall a file:

- ◆ Select the file destination or source for the file from the **Select File Destination** Select Control.
- ◆ Select the Data Type from the **File Settings** Select Control.
- ◆ Click the appropriate option button to **Load, Save, or Delete** a file

Select File Destination

Internal	Selected file type will be saved or recalled using the USPC 2100 hard disk. Note that the default file directories are selected from the PC Configuration Panel accessed through the PC Config button.
Floppy	Selected file type will be saved or recalled using the USPC 2100 3.5-inch floppy drive

File Settings

Chan Data Set	Will save a file containing all settings for the current channel. This will include an A-scan if it is frozen when the file is saved. Data set files can be recalled to restore the settings to the current channel at the time of recall. Note the Data Set files are in binary format and are not readable as a text file. Also note that all configuration and output settings are saved and recalled along with the Channel settings.
All Data Set	As Channel Data Set but for multi channel systems will save all active channels. Includes all configuration and output settings.
Chan Params	Saves current channel parameters as a readable text file suitable for importing into a document as part of a report.
All Params	As Channel Parameters but for all active channels
A-scan	Saves current Frozen A-scan as a PCX format file suitable for importing into a document as part of a report.

Notes on Using Files between Systems with different numbers of channels

If a file is loaded onto a system having more channels than the one on which it was originally saved, then channels will be loaded up to the original number on the originally saved file. For example if a file was saved on a 2 channel system and is recalled on a 4 channel system, then only channels 1 and 2 will be programmed with the 2 channel system settings. Channels 3 and 4 will retain their settings before the file load.

System configuration settings from the **General Config** and **Outputs Config** will be taken from the loaded file for channels up to the max in the loaded file. Factory Default settings will be

loaded for channels higher than those in the file.

If a file is loaded onto a system having less channels than the one on which the file was saved, then only the number of channels on the second machine will be loaded, other channels in the file will be ignored. For example, if a file is saved on a 4 channel system then recalled on a 2 channel system then channels 1 and 2 of the 2 channel system will be programmed to the same values as channels 1 and 2 from the 4 channel file.

System configuration and output settings will be taken from the loaded file.

After loading files between systems having different channels, you should carefully check all system and output configurations before using the USPC 2100 system.

Option Select Buttons

Printer Setup Opens standard Windows XP printer menu for currently installed printers.

Load Opens file selection window to select file to load.

Load Default Loads USPC 2100 default file.

Save Opens file selection window for entry of filename to save.

Delete Opens file selection window to select file to delete.

USPC 2100 File Types

The following is a list of files used to operate the USPC 2100. There are 2 sections, **System Files** that are the basic files used in the operation of the USPC 2100, and **User Files**, which are created by the user to save and recall data.

System Files located in main USPC 2100 directory (default c:\USPC 2100)

Firmup.exe	Firmware upgrade program called from the Firmup icon. This program is used to load new operating software onto USPC 2100 cards, for local computer, DSP and FPGA devices
Formloading.exe	Displays GE Inspection Technologies "K" symbol and "please wait... loading" while main program loads. This program runs for 30 secs, so if the main program loads faster then you may see the icon also for a short time after shutdown.
PC30.exe	Main operating program of the USPC 2100. (PC30 is the original code name for the USPC 2100)
defaults.bin	Defaults file loaded from the Load Default button in the Files Panel
Pc30_sys.bin	Temporary file into which current USPC 2100 settings are stored at normal shutdown.
parameters.rpt	Support file for main PC30.exe program
St4unst.log	Install log. Created when the USPC 2100 programs were first installed on the computer. This file is used as a reference for uninstalling the USPC 2100, and keeps a record of all files and their locations and the registry.
Pc30.mdb	Microsoft Access Database file. All text labels and messages are referenced from this file, which has all USPC 2100-text information in all languages supported.
Ascan.txt	Default "a-scan" displayed in demo modes of operation.
Rom_XXXX.upd	Firmware update used by the firmup.exe program. XXXX represents the month and date of the version.
Pc2000.hlp	Main help file used for context sensitive help. This file will also function as a freestanding training tool for the USPC 2100.
Pc2000.cnt	Contents and index file accessed by the main help file.

TECHNOLOG Y.hlp	Technology overview section of the help files. (This file is automatically accessed by the main help file)
TECHNOLOG Y.cnt	Contents and index file accessed by the technology help file.
INTRODUCTI ON.hlp	Introduction section of the main help file. (This file is automatically accessed by the main help file)
INTRODUCTI ON.cnt	Contents and index file accessed by the introduction help file.

User Files located in user-defined directories (default c:\)

<i>nnnnnnnn..ads</i>	.ads is the default file type for an All Data Sets, which is used to store the complete settings for all channels of a USPC 2100 in binary format used in the save and recall routines..
<i>nnnnnnnn..cds</i>	.cds is the default file type for a Channel Data Set, which is used to store the settings of a single USPC 2100 channel.
<i>nnnnnnnn..ap</i>	.ap is the default file type for an All Parameters, which is used to store the complete settings for all channels of a USPC 2100 in ASCII text format.
<i>nnnnnnnn..cp</i>	.cp is the default file type for a Channel Parameter, which is used to store the settings of a single USPC 2100 channel in ASCII text format..
<i>nnnnnnnn..scn</i>	.scn is the default file type for an a-scan file.
<i>nnnnnnnn..bmp</i>	.bmp (Microsoft bitmap file) is the format for files used in the USPC 2100 Application Window to display drawings of components or test techniques.

Reset and Default Settings

There are 3 basic types of reset for the USPC 2100.

1. Starting the USPC 2100 from the RESET icon

When the USPC 2100 is started using the reset icon, then all channels are set to a fixed value. These values are factory defaults (hard coded) and cannot be changed by the user. (However, please see the Load **Default** section below for a user option.

2. Reset Variables

This push button control is found on the **Output Configs Panel** for **Analog Outputs, TTL Outputs, and Output Controls**, and on the **General Config Panel** for the **Sequence Table**. The control will reset all variables to a set of predefined values. These values are as follows and cannot be changed by the user:

Analog Outputs	All variables will be reset to the OFF position. ie all outputs will be disabled.	
TTL Outputs	All variables will be reset to the OFF position. ie all outputs will be disabled	
Output Controls	Data Output Inhibit	-Internal
	TTL Alarm Level	Alarm High (5V)
	TTL Hold Time	Instant
	Analog Full Scale	10 V
Sequence Table	All available channels will be set to Flaw mode; Receiver 1 will be assigned to Pulser 1 to fire on Cycle 1, Receiver 2, Pulser 2, Cycle 2 etc up to the maximum number of channels installed	

The above settings are the same, which are loaded automatically when you start the USPC 2100 using the **RESET** icon

3. Load Default

This push button is located on the **Files Panel** and will automatically load a file named default.bin, which is located in the USPC 2100 directory. This file is initially factory set to the same fixed values, which are loaded when the USPC 2100 is **RESET**.

However, it is possible for a user with some PC knowledge to program this file with his custom settings using the following procedure.

NOTE: IF YOU DO NOT FULLY UNDERSTAND THE FOLLOWING THEN PLEASE DO NOT ATTEMPT THE PROCEDURE.

1. Configure the USPC 2100 exactly as you need for your default setting.
2. Shut down the USPC 2100 using the EXIT button. (When the USPC 2100 is shut down normally, all current settings are saved in a file named "**PC30_sys.bin**", which is reloaded when you next start the USPC 2100)
3. Go to the directory where you installed the USPC 2100 program (default is C:\USPC 2100)
4. Locate the file "default.bin".
5. Rename "default.bin" "defaultold.bin"
6. Locate the file "PC30_sys.bin".
7. Create a copy of "PC30_sys.bin" in the same directory (Win XP will create a new file named "copy of PC30_sys.bin")
8. Rename "copy of PC30_sys.bin" as "default.bin"

Basic Gate Positioning and Measurements

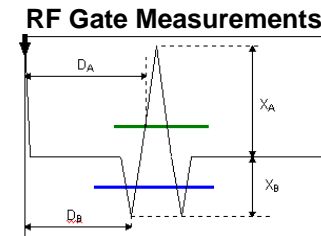
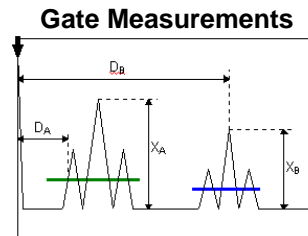
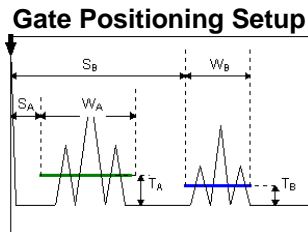
This topic gives a basic overview of gate terminology and setup on the USPC 2100. In addition you might also want to refer to Gate Start Modes and Gate Thickness Measurement

Key:

SA = Start of Gate A **WA** = Width of Gate A **TA** = Threshold of Gate A **DA** = Distance Measurement Gate A **XA** = Amplitude Measurement Gate A
SB = Start of Gate B **WB** = Width of Gate B **TB** = Threshold of Gate B **DB** = Distance Measurement Gate B **XB** = Amplitude Measurement Gate B



= Reference point (Start point) for measurements and distances. **Note** that this will depend on the Gate Start Mode.



Basic gate positioning

Gates **A** and **B** are positioned using Gate Start, Gate Width and Threshold controls on the Gate setup panel.

- ◆ **Gate Start Sab** sets the start point of the gated area. This will also be influenced by the Gate Start Mode. This setting will be in current units, based on the current velocity.
- ◆ **Gate Width Wab** sets the width of the gated area based on the current velocity.
- ◆ **Gate Threshold Tab** (in % screen height) sets the trigger point for alarms. Note that threshold has no effect on amplitude readings, which will be based on the maximum amplitude in the gate.

Gate Measurements

On each instrument shot, measurements are made of the amplitude of the largest echo in each gate, and the distance to either the first echo to cross the gate threshold, or the distance to the largest echo in the gate. This setting can be made independently for each gate and is set up in the Gate Panel.

- ◆ **Gate A** shows readings for distance readings in Flank mode. In this configuration, DA will be to the first point where the gate threshold is crossed, and XA (amplitude) will be to the largest echo in the gate. **Note** that these 2 measurements can be from different echos.
- ◆ **Gate B** shows readings for Peak distance readings. In this case both the amplitude and the distance are from the same echo.

RF Gate Measurements

With USPC 2100 the gates can also be used with the RF display, in which case they will act independently on the positive or negative cycles of an ultrasonic pulse. This feature can be used for tests where pulse phase reversal is a feature of the evaluation such as for bondline inspection.

- ◆ **Gate A** is shown as a positive gate in Flank mode. The threshold setting for Gate A will be a positive value.
- ◆ **Gate B** is shown as a negative gate in Peak mode. The threshold setting will be shown as a negative value in **red** in the Gates menu.

Gate and Display (A-Scan) Start and Measurement Modes

You should already be familiar with basic gate positioning before referring to this section.

In the USPC 2100 there are three start modes used for gate positioning, basic gate measurements, and for the start of the A-Scan. These start modes apply for Flaw, Thickness, and Velocity measurements, although you should note that in Thickness and Velocity Measurement Modes, Interface Start can be used independently as a trigger point from which the measurement gates are started and for the measured values. (see thickness gating modes or velocity gating modes)

The three modes are shown in the following diagrams

Key

SI=Start Distance for the Interface Gate **SA**=Start Distance for Gate A **DI** =Measured Distance in the Interface Gate **DA** =Measured Distance in the Gate A

IP =Initial Pulse

IF =Interface Echo

E1 = Echo 1

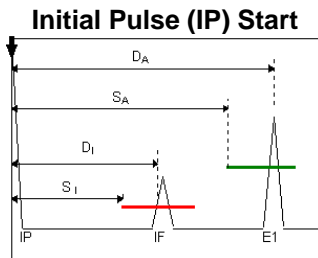


= Fixed start point determined by start mode



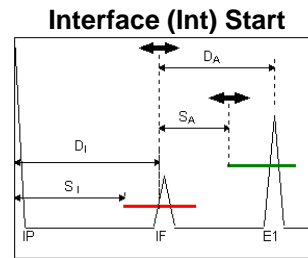
= Variable start point determined by start mode

Note: **SI** and **DI** will be either in units calculated using delay velocity or using material velocity depending on the selection made in the ??? menu



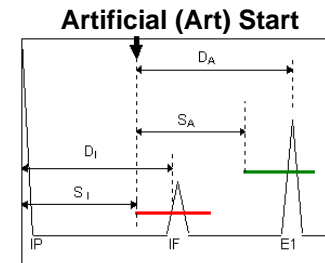
In Initial Pulse start mode (Gates and A-scan)

- ◆ All distances and measurements are made from the Initial pulse. This is the main trigger point for the pulser. These readings will be offset by the **Probe Delay** value if selected



In Interface start mode (Gates and A-scan)

- ◆ Interface gate start and measurement will be from the initial pulse
- ◆ Gate(s) positions and measurements will be from the point where an echo crossed the threshold in the interface gate



In Artificial start mode (Gates and A-scan)

- ◆ Interface gate start and measurement will be from the initial pulse
- ◆ Gate(s) positions and measurements will be from the start point of the interface gate

Thickness Gate Setup and Measurement Modes

Before beginning this topic you should already be familiar with Basic Gate Setup and with Gate Start Modes.

This topic outlines the configuration of gates for thickness measurements. Note that to setup gates for thickness measurement you should already have the USPC 2100 channel configured as a thickness channel.

Note that this section can be complex if you are not fully familiar with ultrasonic testing. Please don't hesitate to call GE INSPECTION TECHNOLOGIES or local representative for help, or leave a message on our bulletin board. We will get back to you within 24 hours.

The following diagrams outline the thickness measurement gate setup variations. Not all gate combinations are illustrated, but the diagrams show the major options.

Key

M = Measured Value



= Fixed start point determined by start mode

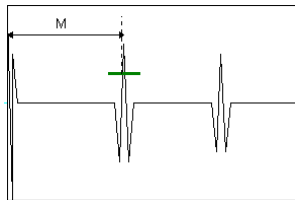
SA = Start distance for Gate **A**



= Variable start point determined by start mode

SAB = Start distances for Gates **A** and **B**

Initial Pulse to 1st Echo



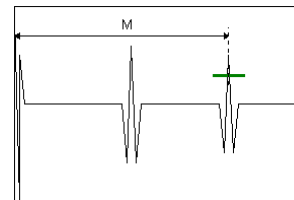
Measurement from Initial Pulse to first echo in gate.

- ◆ **Thickness Start Mode** = Initial Pulse
- ◆ **Thickness Stop Mode** = Gate **A**
- ◆ **No of Echos** = 1

This method will give a simple reading from the Initial Pulse to the first echo in the selected gate.

The measured value will be offset (reduced) by the value entered by the **Offset** control

Initial Pulse to 2nd Echo



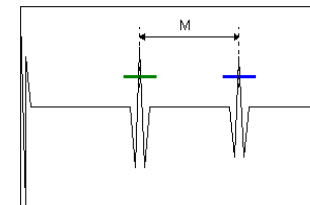
Measurement from Initial Pulse to second echo.

- ◆ **Thickness Start Mode** = Initial Pulse
- ◆ **Thickness Stop Mode** = Gate **A**
- ◆ **No of Echos** = 2

Note that in this mode the measurement **M** will be divided by the selected number of echos (2) to give a displayed and evaluated value of **M/2**

Although the number of echos mode is not shown in all these examples, it is available in all thickness modes.

Echo to Echo



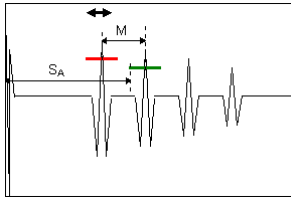
Measurement from echo to echo (gate to gate)

- ◆ **Thickness Start Mode** = Gate **A**
- ◆ **Thickness Stop Mode** = Gate **B**
- ◆ **No of Echos** = 1

This setup will measure the distance from the trigger echo in Gate **A** to the trigger echo in Gate **B**.

Note that the precise measurement point will be determined by the Measurement mode **Threshold** or **Zero Crossing** as set in the Gate menu

Interface to Echo

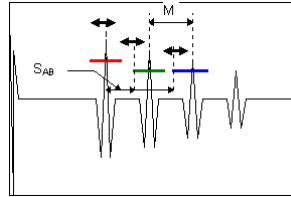


Measurement from the interface to the selected echo in the gate, using fixed gates.

- ◆ **Thickness Start Mode** = Interface
- ◆ **Thickness Stop Mode** = Gate **A**
- ◆ **Gate Start Mode** = Initial Pulse

Note that the start point for the measurement gate is the Initial Pulse. This means that the gate position will remain static

Echo to Echo - Interface Start Gates

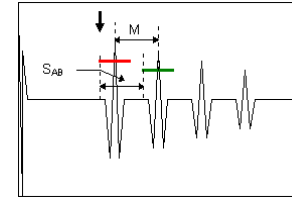


Measurement from the interface to the selected echo in the gate, using gates which will track the interface..

- ◆ **Thickness Start Mode** = Gate **A**
- ◆ **Thickness Stop Mode** = Gate **B**
- ◆ **Gate Start Mode** = Interface Start

Note that the start point for the measurement gates is the Interface. With this setup the gate positions will track the interface.

Interface to Echo - Artificial Start Gates



Measurement from the interface to the selected echo in the gate, using fixed gates.

- ◆ **Thickness Start Mode** = Interface
- ◆ **Thickness Stop Mode** = Gate **A**
- ◆ **Gate Start Mode** = Artificial

Note that the start point for the measurement gate is the Artificial. This means that the gate position will remain static.

Measurement Modes for Thickness Gating

There are 2 modes, which are available for thickness measurements, Zero Crossing, and Flank Crossing. Note that in thickness mode gating is always on the RF signal and gates can be Positive or Negative to suit the test situation. Note that a channel must be setup in thickness mode for thickness measurements.

In **Zero Crossing Mode** the measurement point for thickness readings is the point **after** the threshold where the selected echo crosses the zero line. This is the preferred thickness-measuring mode as it is the most immune from signal amplitude variations and allows a measurement on the steepest part of echo, which gives more accuracy.

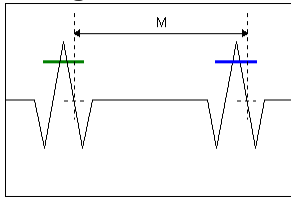
In **Flank Crossing Mode** Measurements are taken at the point where an echo first breaks a gate threshold.

In **Peak to Peak** mode, the measurement will be triggered by the highest echo within two microseconds (gates A and B) or 140 ns (Interface gate) after the first echo breaking threshold within the start and stop gates. Note that because the instrument finds the echoes to be used by looking for the flank crossing point, no peak-to-peak measurement can be taken if a flank crossing is not detectable.

The diagrams below show the basic principals based on gate-to-gate measurements. However the same modes apply to all thickness modes.

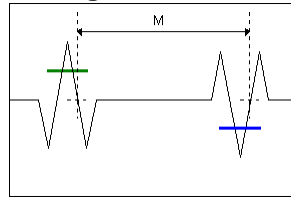
M = Measured Value

Zero Crossing Mode - 2 Positive Gates



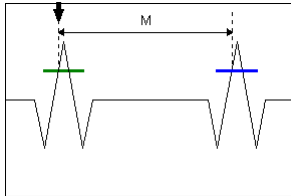
◆ **Mode = Zero Crossing**

Zero Crossing Mode - Pos and Gates



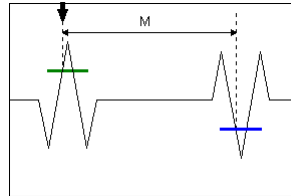
◆ **Mode = Zero Crossing**

Flank Mode - 2 Positive Gates



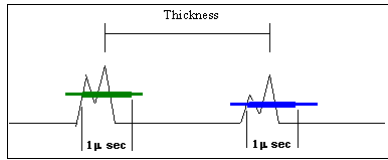
◆ **Mode = Flank Crossing**

Flank Mode - Pos and Gates



◆ **Mode = Flank Crossing**

Peak Mode - 2 Positive Gates



◆ **Mode = Peak to Peak**

Gating Reference

Gates are defined areas of an A-scan, which monitor events and take measurements. In the USPC 2100 gates are displayed as bars superimposed on the A-scan, with each gate displayed by a different color bar. Gates do not have to be displayed on screen to be active. There are 4 menus where gates are used: Flaw Mode gating, Thickness Mode gating, Velocity Mode gating TCG setup.

The basics to set up the gates are as follows. Full details of each feature are shown in the sections below

- ◆ Determine the **Start** mode best suited for the application. (TIP if the application needs interface start, you can use **artificial** mode to position the gates, without the need for an interface echo. Also in Interface start, you can set the **Interface Velocity** and **Delay Velocity** controls in the System menu, so that the probe water path can be read out directly)
- ◆ Position the gate(s) over the search area
- ◆ Set up the evaluation controls for the test
 - Gate Logic
 - Count Controls
 - Distance Measurement Mode

Gate Positioning (Flaw, Thickness, and Velocity Modes)

Gates can be positioned horizontally (distance) using the Delay and Range UpDown Control or by moving the mouse pointer onto the A-scan area and dragging the gate using the box shaped handles at the ends of the gate bar. Use the Find Gate button to return the gate to the center of the display. The current position of a gate can be seen in the Delay and Range numeric displays.

Gates can be positioned vertically (amplitude) using the threshold UpDown Control or by moving the mouse pointer onto the A-scan area and dragging the gate using the box shaped handle in the middle of the gate bar. Note that in RF Gating mode (selected on the A-scan panel), and in Thickness and Velocity Modes, gates can be positioned above or below the mid screen center line. When a gate is positioned on the negative side of the centerline then its threshold will appear as a negative number in threshold numeric display.

Start Modes (Flaw, Thickness and Velocity Modes)

The start point (zero distance point) for the gate starts and for their distance or thickness measurements is selectable to suit different measurement techniques. This selection is made from the Start Mode Selection Control. of the Interface gate. Note that Start Mode selections are not available if Probe Delay is turned on (this control is described later in this section). The same basic start modes also apply to the A-Scan and are independently set using the A-Scan start mode.

Initial Pulse All measurements from all gates, and the delay start for the measurement gates are made from the initial pulse.

Interface *Interface mode is usually used with immersion or other water gap techniques to automatically adjust the start (zero) point for the measurement gates. With Interface Start Mode active, variations in water gap are automatically compensated.*

The measurement in the interface gate (Dist to IF) is taken from the

Initial Pulse to the position where the Interface Gate Threshold is broken. Distances (for gate measurements and gate start position) for the 2 measurement gates are taken from the position where the Interface Gate Threshold is broken.

Artificial Distances (for gate measurements and gate start position) for the 2 measurement gates are taken from the start of the Interface Gate.

Probe Delay Mode (Flaw Mode)

Probe Delay Mode allows for the entry of a known fixed value (delay), which will automatically be subtracted from any distance or thickness measurements. This function can be used as an offset to compensate for the delay material in delay line transducers, and for transducer wear soles.

This mode is activated using the **Probe Delay** Selection Control and the **Probe** UpDown Control.

Use the Selection Box to turn Probe Delay mode on, and enter the delay value (in microseconds) in the Probe

Measurement Gate Evaluation (Flaw Mode)

Count / Window Controls

The **Count** and **Window** Controls work together and are used to set up a combination of alarm conditions that must be true before the LED indicators on the display and the TTL outputs are activated. The Window control is used to set the number of successive pulse (1-16), which will be monitored. This set number of pulses can be regarded as a moving "window" which is scrolled through the test. The Count control sets the number of alarmed pulses, which must be present in the window before an alarm is given both on the panel and on the output connector. For example, if **Count** is set to 2 and Window is set to 8, then the alarm will be activated if 2 alarm "hits" are seen in any 8 pulses. The alarm will remain active for as long as the **Count** number of alarms are in the scrolling **Window**.

This feature can be used to filter out the effects of extraneous noise such as electrical spikes or water bubbles in an immersion test.

Use the Count and Window UpDown Control to set up the values required, or set both to a value of "1" for instantaneous alarms on any alarm.

Logic

This control sets the logic for the LED and TTL output alarms. There are 2 options:

Pos Activates LED and TTL alarms if a signal exceeds the gate threshold.
Typically, this feature is used to monitor for flaw echoes.

Neg Activates LED and TTL alarms if a signal drops below the gate threshold.
Typically, this feature is used to monitor back wall or front surface echoes to indicate coupling losses or a high material attenuation.

Dist Mode

This control sets the method of measuring distance to an echo in each gate. This measurement will appear in the gate measurement panel (Dist) at the bottom of the screen. in the Meas panel, and is available as an analog output. There are 2 options:

- Peak** The distance measured will be to the peak of the largest (highest) echo displayed in the gate. If the gate covers saturated (off screen) echoes then the measurement will be taken to the first instance where an echo exceeds 127% full screen.
- Flank** The distance measured will be to the point where the first echo exceeds the gate threshold.

The currently selected Dist Mode will be shown in Blue (**Peak** or **Flank**) adjacent to the Dist label in the gate measurement panel

Audible Alarm

Turns the PC audible alarm on or off, in the event of gate alarm conditions.

Data Config Button (flaw mode) (See also Data Config for Thick. Mode)

Click on the **Data Config** button to access the Data Config setup menu. This menu is used to set up the method of calculation for the USPC 2100 amplitude and distance statistical calculations **Max**, **Min** and **Average**.

Data Config Menu Selections (flaw mode)

Gate A

Sample Size 2 - 2000 pulses

Trigger Basis

Sample No of samples as entered above

Ext Trigger Max and Min will be accumulated between signals from an external trigger. Note that average is not available in Ext Trigger mode

Gate B

Sample Size 2 - 2,000 pulses

Trigger Basis

Sample No of samples as entered above

Ext Trigger Max and Min will be accumulated between signals from an external trigger. Note that average is not available in Ext Trigger mode

Note that Gate A and Gate B can be set independently so that Gate A could accumulate data on a sample basis (say every inch, or every revolution), and Gate B could accumulate data for output after a complete component or length of product.

Measurement Gate Evaluation (Thickness and Velocity Modes)

When a channel is configured as a Thickness or Velocity Channel, the USPC 2100 uses different gating evaluation and setup techniques than those used for Flaw Mode. You should note the following:

- ◆ The system automatically switches to RF display and gating mode
- ◆ Only the gates used according to the **Start** and **Stop** settings will be displayed
- ◆ High and Low thickness/velocity limits are available
- ◆ The Analog Outputs can be scaled so that a given thickness range can be output.
- ◆ Selection choices for Start point, Stop point, and method of measurement will be available in the Gate setup panel
- ◆ A different gate measurement panel will be displayed, showing Current (**Thick/Velocity**), **Max**, **Min**, and **Average** thickness/velocity readings, and the current settings of the thick/velocity **High** and **Low Limits**.

Start Measurement

The **Start** configuration determines the zero point for the thickness/velocity measurement. The

configuration consists of a **Start** selection, and the measurement **Mode**. The **Stop** configuration determines the end point for the thickness/velocity measurement. The configuration consists of a **Start** selection, and the measurement **Mode**.

Note that thickness modes use RF gating, so gates can be set on either the positive or negative portions of an echo and can also operate in zero crossing mode to give greater measurement accuracy and less susceptibility to amplitude variations

Start Choices

- IP Offset** Measurement will start from the time the pulser fires the transducer less the microsecond value entered into **offset**
- Interface** Measurement will start from the point where an echo first crossed the interface gate. (IF gate is always in flank mode)
- Gate A** Measurement will start from an echo Gate A according to the selected start Mode

Start Modes (Gate A only)

- Zero Cross** **Pos or Neg Thresh** The measurement will be from the first zero point on the echo waveform BEFORE the threshold is crossed.
- Flank** **Pos or Neg Thresh** The measurement will be from the first point to break the set threshold.
- Peak** The measurement will be from the highest peak of the waveform that violates the set threshold.

Stop Choices

- Gate A** Measurement will end at an echo Gate A according to the selected stop Mode
- Gate B** Measurement will end at an echo Gate B according to the selected stop Mode

Stop Modes (gates A or B)

- Zero Cross** **Pos or Neg Thresh** The measurement will be from the first zero point on the echo waveform BEFORE the threshold is crossed.
- Flank** **Pos or Neg Thresh** The measurement will be from the first point to break the set threshold.
- Peak** The measurement will be from the highest peak of the waveform that violates the set threshold.

Number of Echoes

This control is used if measurements are taken over multiple echoes (repeat echoes). The calculated measurement as determined above will be divided by the number entered in this control. Thus if the measured distance over 4 echoes is 4 inches, and the Number Of Echoes is set to 4, then the displayed and evaluated thickness will be 1 inch.

Offset microsecs

This control is active when IP Offset is selected as the start mode for measurement. It is for use to offset a constant value from the thickness reading. Typical uses are to compensate for probe wear shoe thickness or for delay lines.

Count / Window Controls

The **Count** and **Window** Controls work together and are used to set up a combination of alarm conditions which must be true before the LED indicators on the display and the TTL outputs are activated. The Window control is used to set the number of successive pulse (1-16), which will be monitored. This set number of pulses can be regarded as a moving "window" which is scrolled through the test. The Count control sets the number of alarmed pulses, which must be present in the window before an alarm is given both on the panel and on the output connector. For example, if **Count** is set to 2 and Window is set to 8, then the alarm will be activated if 2 alarm "hits" are seen in any 8 pulses. The alarm will remain active for as long as the **Count** number of alarms are

in the scrolling **Window**.

This feature can be used to filter out the effects of extraneous noise such as electrical spikes or water bubbles in an immersion test.

Use the Count and Window UpDown Control to set up the values required, or set both to a value of "1" for instantaneous alarms on any alarm.

Data Config Menu Selections (thickness mode)

Click here to see Flaw Mode.

Sample Size 2 - 2000 pulses

Trigger Basis

Sample No of samples as entered above

Ext Trigger Max and Min will be accumulated between signals from an external trigger. Note that average is not available in Ext Trigger mode

Ecc. Mode

Single Channel Minimum thickness is subtracted from maximum. Used with a rotating part.

Cross Channel Readings from channel pairs are used instead of a max/min.

Used with a stationary part.

Note: Only currently enabled channels will be available, others will be grayed out to signal their inactivity.

Eccentricity Calculations

Single Channel $Ecc = |T_{max} - T_{min}|$, where T is the thickness

Cross Channel $Ecc = |T_{CH(A)} - T_{CH(B)}|$, where TCH(A) and TCH(B) is the (min/max/avg)

Thickness value of the first channel in the pair, and TCH (B) is the corresponding

(min/max/avg) thickness value of the second channel.










In cross channel mode, the user is able to select which measurement values (minimum, maximum and average) to use for each channel pair. The program will then calculate the eccentricity for each pair.

TCG Setup

The USPC 2100 has a time corrected gain feature, which can be used to compensate for variations in signal amplitude due to material attenuation or transducer characteristics, which vary with distance. The TCG correction curve can be automatically calculated by the USPC 2100 from a series of reference echoes, or can be entered or edited directly. Note that the USPC 2100 needs at least 2 points to calculate a TCG.

Additional features allow for the addition of material attenuation values, to accommodate attenuation variations between the sample used for calibration and the actual material under test. The following procedure is used to setup a TCG curve using the USPC 2100 automatic calculation method

First click on the TCG Button at the top of the screen to display the TCG Setup Panel

- ◆ Click on the **Start Rec** button to go to **TCG Rec** mode. The **TCG Rec** light at the top of the screen will turn red as a reminder that TCG Rec is enabled


- ◆ The **Start Rec** button will change to read **Stop Rec**. You will later click this button when all echos have been recorded and you are ready to use the TCG. Note that the **Select Echo** button which was previously grayed out now reads **REF. ECHO**


- ◆ Adjust the **Gain** of the USPC 2100 to the reference level required for the test. All further echos will be normalized to this reference screen height.
- ◆ Select the **Start Mode** required for the test.
- ◆ Use the **Gate Delay** and **Gate Range** controls to position the gate over the first echo.
- Note.** You can add points to the TCG table after this procedure. This may be useful if you wish to enter a point close to an interface but have no calibration reference echo.
- ◆ Click on **REF ECHO** to capture the gain and distance for the first TCG point
- ◆ The **REF ECHO** button now changes to read **POINT 2**


- ◆ Reposition the Gate over the second echo and click the button to select **POINT 2**. The position of POINT 2 is measured and the gain automatically adjusted to bring the POINT 2 echo to the reference level.
- ◆ The select button now changes to **POINT 3** to show that this is the next point to be taken.


- ◆ Continue as above until all points have been taken
- ◆ Click on the **Stop Rec** button to exit the automatic setup routine.

- ◆ The **TCG TABLE** control (grayed out during automatic setup) now becomes active so that any points can be edited if necessary.

TCG Table

Point	Gain	Distance
1	15	1
2	18.2	2
3	20.5	3
4	22.5	5
5	16.5	6
6	12.2	7
7	10.5	8
8	0	0
9	0	0
10	0	0
11	0	0
12	0	0
13	0	0
14	0	0
15	0	0
16	0	0

16 10.5 0.00

Clear Table OK
Clear Point Cancel

The TCG Table shows all values used to calculate the TCG curve. Up to 16 points can be entered in the curve; these are predefined in the left column of the table. The Gain and Distance for each point are shown in the other 2 columns. To select and change a point, first select the point to be edited using the adjustment row at the bottom of the table. You can also add points to the table. To add a point select the next vacant point in the table, enter the new data, and click OK. The USPC 2100 will automatically readjust the table to add the new point according to its distance. This technique can be useful to extend the TCG zone into an interface echo by entering a new value at, say 0.05 ins or microseconds.

Clear Table Button

This button will clear all points in the table

Clear Point Button

This button will clear the current point

TCG Start Mode

The start point (zero distance point) for the gates and their distance measurements is selectable to suit different measurement techniques. This selection is made from the Start Mode Selection Control, of the Interface gate. Note that Start Mode selections are not available if Probe Delay is turned on (this control is described later in this section).

Initial Pulse All measurements from all gates are made from the initial pulse of the transducer.

Interface *Interface mode is usually used with immersion or other water gap techniques to automatically adjust the start (zero) point for the measurement gates. With Interface Start Mode active, variations in water gap are automatically compensated.*

The measurement in the interface gate (Dist to IF) is taken from the Initial Pulse to the position where the Interface Gate Threshold is broken. Distances (for gate measurements and gate position) for the 2 measurement gates are taken from the end of the Interface gate measurement.

Artificial The measurement in the interface gate (Dist to IF) is taken from the Initial Pulse to the position where the Interface Gate Threshold is broken. Distances (for gate measurements and gate position) for the 2 measurement gates are taken from the end of the Interface Gate.

TCG Offset

Use this control to add or subtract gain from the current TCG curve. Typically used when calibrating at a lower sensitivity than the final testing sensitivity.

Material Attenuation

Use this control to add a linear attenuation value to the current TCG curve. Typically used when calibrating with a low attenuation material and testing a higher attenuation material.

TCG Display

A curve showing the relative TCG corrections can be displayed on the A-scan display.

- Off** No curve is displayed
- Baseline** The curve is displayed on the display baseline
- Mid Screen** The curve is displayed at 50% screen height.

TCG

Turns the TCG On or Off. When activated (On) the TCG light at the top of the display will be on **(red)**

Printing Reports

The USPC 2100 can send reports directly to a printer. The report types are selected in the Print select control in the File Settings panel. The printed reports will be printed on the printer selected in the **Printer Setup** menu accessed by clicking on the **Printer Setup** button in the Files panel.

The Print function is executed by clicking the **Print** button at the top of the screen.

Print Settings

- Chan Params** Saves current channel parameters as a readable text file suitable for importing into a document as part of a report.
- All Params** As **Channel Parameters** but for all active channels
- A-scan** Prints current Frozen A-scan
- Screen** Prints full screen picture

PC Configuration Panel

This panel is used to set up the PC configurations used with the USPC 2100. There are 3 sections to the panel: Switch Position Panel, which sets the base address for the output board, RS232 configuration which sets the default RS232 settings for serial communications to the USPC 2100, and default directories, which sets up directories to which file types will be saved to and loaded from.

RS232 Controls are:

Port	Sets the computer serial port, which the USPC 2100 will use.
Baud	Sets the baud rate, which defines the speed of data transmission. Both send and receive devices should be set to the same rate.
Length	Sets the length of the data word used for transmission
Parity	Sets the parity bit
Stop	Sets the mode for the stop bit to indicate the end of a data word

Note that RS232 commands are not yet supported; contact GE Inspection Technologies for latest status update

Directory Settings are:

A-Scan Files	Sets the default directory for A-scan files
Data Files	Sets the default directory for Data files (binary files used to store and recall USPC 2100 settings)
Parameter Files	Sets the default directory for Parameter files (ASCII text files of USPC 2100 settings)

Switch Settings:

The factory set base address of 330H should work for most installations.

In case of conflict with another device, the value may be changed. (see below)

NOTE: The switches in PC config and on the output board must have the same settings.

To set **330H**: (Note: The USPC ships with this setting.)

1. Check that the switches on the Output Card are correct (See Output Card section)
2. Set the switches in the PC Config panel like this:

Switch	Setting
1	On
2	Off
3	Off
4	On
5	On
6	Off
7	Off
8	On

The base address currently set appears below the switches.

A visual signal is given when the software setting matches the hardware.

To set a different address:

Switch settings must be computed, using the following table.

◆With all switches on, the value is zero. Each switch in the OFF position adds to the value.

◆**Example:** 7 and 3 are OFF, while the rest are ON. ($200h + 20h = 220h$)

NOTE: Don't forget to add in base 16.

Example: Setting 3, 4, 5 OFF: $20h + 40h + 80h = E0h$

Table: Amount added to base address by each switch set OFF:

Switch Number	Off
1	8h
2	10h
3	20h
4	40h
5	80h
6	100h
7	200h
8	400h

Configuration of External Outputs

The USPC 2100 offers great flexibility in configuration of outputs. The Grayhill Relay Board facilitates the use of the USPC's outputs to control recorders and other devices. There are three important configuration options, which should always be considered during the configuration process. This help topic covers each item progressively. However, you can jump to each individual topic by clicking on one of the buttons above. Note that all settings listed here are saved with each data file.

After loading files between systems having different channels, you should carefully check all system and output configurations before using the USPC 2100 system.

Configuration Variable Options:

◆ **Output Pin Assignment** All pin assignments in the USPC 2100 are software configurable for the 37-pin Thickness and Flaw mode connector. This gives great flexibility, but you should always remember that this is not a physical connection, so it is always possible that pins may be inadvertently assigned. However all pins on the 50-pin Velocity mode connector are hard wired.

◆ **Data Output Control** This control allows outputs to be disabled when an external TTL signal is given to the instrument. This function allows outputs such as chart recorders, or paint spray guns to be disabled when there is no test component in place.

◆ **Statistical Data** Output measurements are available, real time, on a pulse-by-pulse basis. However, the USPC 2100 can also calculate results such as maximum, minimum and average for measurements taken over a given period (either a set number of pulses or a period between externally applied TTL inputs), these calculated results are then output rather than the raw shot by shot data.

You should be fully aware of all the above and their interactions when you configure outputs, especially if you are using the outputs to control machinery or other devices.

General Overview of Output Pin Assignments

Output pin assignments are made in the **Outputs Config** menu, accessed by clicking on the Outputs **Config** button at the bottom of the window.

Note:- To prevent accidental pin reassignments this function is only accessible if the USPC 2100 is started in Config Mode.

This menu contains tables for setting up: analog outputs and TTL outputs, together with controls to set the various output voltages and duration times.

The Analog and TTL tables are similar in layout and use the same basic procedures.

Analog Output Table

The table consists of rows and columns. Each row is preassigned to a pin on the output connector as shown in the leftmost **Pin** column. Note that there are 2 analog options available from each channel, which are also preassigned in the **Ch** column. The remaining columns are used to set up the various options.

Options are changed in the adjustment row immediately below the table. This row will show the current selection for the row shown in the left control box. To change a setting, first click on the down arrow below the pin column and select the pin number to be assigned or re-assigned (note that the channel is preassigned and cannot be changed). The various options are then changed by clicking on the down arrows and selecting the option required. Note that some of the options

will change dependent on the particular option.

Option Column Choices

Flaw Channel Options

Off	Output is turned off to this pin
GA & GB Amp	Current Amplitude of signal in Gates A or B (subject to offset control described below)
GA & GB Min	Minimum Amplitude according to settings in Gates Data Config menu
GA & GB Max	Maximum Amplitude according to settings in Gates Data Config menu
GA & GB Ave	Average Amplitude according to settings in Gates Data Config menu
GA & GB TOF	Current Distance measurement in Gates 1 or 2 (subject to offset control described below)
IF TOF	Current Distance to interface signal

Thickness & Velocity Channel Options

Off	Output is turned off to this pin
Thickness	Current thickness measurement (subject to offset and range control described below)
Min Thick	Minimum Thickness according to settings in Gates Data Config menu (subject to offset control described below)
Max Thick	Maximum Thickness according to settings in Gates Data Config menu (subject to offset control described below)
Ave Thick	Average Thickness according to settings in Gates Data Config menu (subject to offset control described below)
IF TOF	Current Distance to interface signal
Eccentricity	Current Eccentricity measurement (subject to offset and range controls)

Offset and Range Column Choices

Flaw Channel

Offset sets the amplitude above which the analog outputs will rise above zero voltage
Range is inoperative in Flaw mode. The max range which represents 100% screen amplitude is the voltage selected in the **Analog Range** control.
With an offset of 10%, and the output connected to a chart recorder, then the recorder will only rise above the baseline when gated signal amplitude rises above 10%. In this mode the Offset acts similarly to a reject control applied to the outputs.

Thickness Channel

Offset sets the thickness reading, which will be at zero voltage.
Range sets the thickness range, which will be displayed between 0 and max voltage.
With an offset of 1 inch and range of 2 inches, a 0-10 volt analog output will represent a range from 1 to 2 inches.

LOI/No Test Choices

If gates are set up in Interface Start mode, this setting this control determines the state of an output in the event of the loss of the interface trigger signal

Last reading	Output will hold last reading until interface is re-established
Alarmed	Output will go to max until interface is reestablished
No Alarm	Output will go to min until interface is reestablished
Edge Write	Output will go to max for 1 pulse then down to zero until interface is reestablished

Analog Timed Hold Choices

Analog measurements are output at an accurate level on a shot by shot basis. However, some recording devices cannot react at these speeds and may show a low value. Timed hold will automatically hold an output level for 0.25 secs to allow a recorder to respond.

Additional Analog Control

Analog Full Scale. Options are

2 volts	0 - full scale will be represented by a 2 volt output
5 volts	0 - full scale will be represented by a 5 volt output
10 volts	0 - full scale will be represented by a 10 volt output

TTL Output Table

The table consists of rows and columns. Each row is preassigned to a pin on the output connector as shown in the leftmost **Pin** column. Note that there 2 TTL options available from each channel, which are also preassigned in the **Ch** column. The remaining columns are used to set up the various options.

Options are changed in the adjustment row immediately below the table. This row will show the current selection for the row shown in the left control box. To change a setting, first click on the down arrow below the pin column and select the pin number to be assigned or re-assigned (note that the channel is preassigned and cannot be changed. The various options are then changed by clicking on the down arrows and selecting the option required. Note that some of the options will change dependent on the particular option.

Note: TTL outputs are dependent on the **Count** and **Window** settings in the Flaw and Thickness Gate setup panels.

Option Column Choices

Flaw Channel Options

Off	Output is turned off to this pin
GA Amp	Signal will be output if Gate A is alarmed
GB Amp	Signal will be output if Gate B is alarmed
LOI	Signal will be output if there is no echo in the interface gate.
GA or GB	Signal will be output if Gate A or B is alarmed.

Thickness Channel Options

Off	Output is turned off to this pin
Min Thick	Signal will be output if the measurement falls below the Min value set in the Thickness Gates panel
Max Thick	Signal will be output if the measurement rises above the Max value set in the Thickness Gates panel
Min OR Max	Signal will be output if the measurement rises above the Max or falls below the Min.
Eccentricity	Signal will be output if the measurement rises above the max eccentricity set in the Thickness Gates panel.
LOI	Signal will be output if there is no echo in the interface gate.

Velocity Channel Options

Off	Output is turned off to this pin
Min Thick	Signal will be output if the measurement falls below the Min value set in the Velocity Gates panel
Max Thick	Signal will be output if the measurement goes above the Max value set in the Velocity Gates panel.

Min OR Max	Signal will be output if the measurement rises above the Max or falls below the Min.
Eccentricity	Signal will be output if the measurement rises above the max eccentricity set in the Thickness Gates panel.
LOI	Signal will be output if there is no echo in the interface gate.

LOI/No Test Choices

If gates are set up in Interface Start mode, this setting this control determines the state of an output in the event of the loss of the interface trigger signal

Last reading	Output will hold last reading until interface is re-established
Alarmed	Output will go to alarmed state until interface is reestablished
No Alarm	Output will go to non-alarmed state until interface is reestablished
Edge Write	Output will go to alarmed state for 1 pulse then go to non-alarmed state until interface is reestablished

Additional TTL Controls

The following settings on the Outputs Configuration Panel will also affect TTL outputs

TTL Alarm Level

Sets the alarm state for TTL outputs. Options are

High	5 volt TTL output on alarm condition 0 volt normal
Low	0 volt TTL output on alarm condition 5 volt normal

TTL Hold Time

Sets the duration of TTL alarm pulses. Options are

Inst	Alarm will stay active only for duration of cycle when it occurred and will be reset with the next cycle
Timed	Alarm will stay active for a minimum of 0.25 secs
Latched	Alarm will turn on and stay on until manually or automatically reset

Data Output Inhibit (TDR PDF)

Options are

Internal	Outputs will be inhibited from an internal USPC 2100 signal (App Window)
External	Outputs will be inhibited from an external signal

Because outputs are not always needed, say during calibration or when parts are being changed in a test fixture, the USPC 2100 provides an input pin on the I/O connector, which can receive an input signal to disable all outputs as long as the signal is present. This function is turned on or off with the TDR control in the Outputs Config menu. There is a separate control for each USPC 2100 card so that individual alarms can be controlled for situations such as those encountered when multiple probes are used.

Although this control directly affects USPC 2100 **Outputs**, it also controls and affects the operation of the 2 USPC 2100 internal applications the **Application Window**, and the **Strip Chart**. All three situations are review separately in this section.

Data Output Inhibit Control -- Outputs

Data Output Inhibit Control	Function	Effect
Off (manual)	All outputs, displayed measurements and alarms	All active
Automatic (During test)	TTL outputs	All active
	Latched TTL outputs	All active
	Analog outputs	All active
	Current displayed measurements	All active
	Current displayed alarms	All active
Automatic (After test)	Statistic displayed measurements	All active
	TTL outputs	Non alarmed state
	Latched TTL outputs	Remain Latched
	Analog outputs	Disabled (go to zero)
	Current displayed measurements	All active
	Current displayed alarms	All active
	Statistic displayed measurements	All active

Data Output Inhibit Control -- Application Window

Data Output Inhibit Control	Function	Effect
Off (manual)	Test Button	Active
	Retest Button	Active
	Reset Button	Active
	Auto/Manual Button	
	Counters	Activated with test button
	Testing indicator light	Activated with test button
	Good light	Update at end of test
	Bad light	Update at end of test
	Measurements and alarms on drawing	Active
Automatic (during test)	Test Button	Inactive
	Retest Button	Inactive
	Reset Button	Inactive
	Counters	Show results up to previous test
	Testing indicator light	On
	Good light	Off
	Bad light	Off
	Measurements and alarms on sketch	Active
Automatic (after test)	Test Button	Inactive
	Retest Button	Inactive
	Reset Button	Active with warning
	Counters	Updated with last test result
	Testing indicator light	Off
	Good light	Shows result of last test
	Bad light	Shows result of last test
	Measurements and alarms on sketch	Active

Data Output Inhibit Control --Strip Chart

Data Output Inhibit Control	Function	Effect
Off (manual)	All recordings	All active
Automatic (During test)	TTL recordings	All active
	Latched TTL	All active
	Analog recordings	All active
Automatic (After test)	Statistic displayed measurements	All active
	TTL recordings	Go to non alarmed state
	Latched TTL	Remain latched
	Analog recordings	Go to zero

Statistical Data - Min, Max, Average

Controls for Statistical Data options are in the **Gates: Data Config** menu.

The USPC 2100 provides calculations to determine the **Min**, **Max**, and **Average** of measurements over a given sample size. These results are available as displayed readings, analog outputs, or for use in the **Strip Chart** or **Application** windows. Typical uses include minimum and maximum thickness readings over a part, or outputs based on a fixed sample size, such as one complete revolution of tube, or every inch of a plate.

The sample over which the **Min** and **Max** readings are calculated can be a fixed sample size based on a preset number of pulses (2 - 2,000), or can be timed from externally supplied signals. The Average reading is calculated from a fixed sample size.

In **Flaw Mode**, results are calculated from **Amplitudes**, and **Distances** in Gate A and Gate B. In **Thickness Mode**, results are calculated on **Thickness Measurements**.

The input signals to control the Statistical Data are applied to the **Mechanical Strobe** pin on the IO.

Output of Statistical Data

The **Min Max** and **Average** values are selectable as Analog outputs, or as displayed values in the **Application Window**. The values on the outputs will be updated either at the end of the **Sample** setting defined in the **Gate Data Config** menus, or in the case of Mechanical Strobe the outputs will be updated on the presence of a new strobe signal. When new data is available at the outputs, then the **Data Ready** output signal will reset.

The above outputs will also be controlled by the **Data Output Inhibit** control as described above.

System and Channel Configuration

See also Hardware Configuration for adding or moving USPC 2100 boards

System configuration is set up in the **General Config** menu, accessed by clicking the **General Config** button at the bottom of the window.

Note 1: To prevent accidental re-programming of sequences this function is only accessible if the USPC 2100 is started in Config Mode.

Note 2: All system configuration information is stored with the current data file. **After loading files between systems having different channels, you should carefully check all system and output configurations before using the USPC 2100 system.**

System Overview

The USPC 2100 is a multi channel system using individual PC cards for each test channel. Each USPC 2100 PC card is a self-contained ultrasonic instrument with its own Pulser, Receiver, Gates, Evaluation, and Outputs, all self contained on the card. Although the card operates in a Pentium PC host computer, it uses its own on board computers for all ultrasonic calculations and does not use the PC's resources as part of the real time testing program. This means that up to 8 cards can operate simultaneously and independently in a host PC. Also, because each card has independent pulser and receiver/evaluation capability, this means that in addition to cards operating in parallel, one card can act as a pulser, while another card operates as a receiver.

All USPC 2100 cards are identical but they can be configured to be in Flaw Detection Mode, or Thickness Measurement Mode, each being configured and optimized for the given application. In a multi channel system, some cards can be assigned as flaw cards. while others are programmed as thickness cards.

In the USPC 2100 system a **Channel** is defined as a receiver channel. A **Channel** refers to a receiver channel and is fixed to one particular card. A **Channel** will refer to the: A-scan display, Amplifier, and Gating Evaluation from that card. Note that a receiver **Channel** does not necessarily have to use the pulser located on the same card. These assignments are selected in the **General Config** menu.

System Configuration and Firing Sequence

Sequence Table

The table consists of rows and columns. Each row is preassigned to a **Channel**., the columns are used to enter the Pulser, Cycle, Name, and Mode for each Channel.

Options are changed in the adjustment row immediately below the table. This adjustment row will show the currently selected Channel in the leftmost control box. To change a setting, first click on the down arrow below the channel column and select the channel number to be configured (note that the channel is preassigned and cannot be changed). The various options are then either by directly entering the parameters in the option box, or by clicking on the down arrows and selecting the option required.

Following is a description of each column and its options, followed by examples of setups

Rec/Trace	This column is preassigned and will show one row for each USPC 2100 card installed in the system
Pul	Used to select the pulser to be used with the selected channel in the left column.
Cycle	Instrument cycles are the basic "counts" used to operate the pulsing of the system. For instance if all Channels are set to cycle "1", then all cards will fire in parallel. If Channel 1 is set to Cycle 1, Ch 2 to Cyc 2, and Ch 3 to Cyc 3. Then the system will fire Ch 1, then Ch 2, then Ch 3, then Ch 1 2,3 etc. So each Channel will fire at one third of the selected Master PRF. Note that the system will detect the maximum Cycle number and select that as the top number in its

sequential count. If there is no Channel assigned to a Cycle, then the instrument will "idle" for that Cycle.

Name This Column is used assign a name for a particular Channel. This name will appear at the top of the Status Panel. This function is to give a direct text reference to each Channel.

Mode Selects if a Channel will be assigned as a Thickness Channel or a Flaw Channel

Sample Configuration Table

Rec/ Trac	Pul	Cycle	Name	Mode
1	1	1	Flaw Channel 1	Flaw
2	2	2	Flaw Channel 2	Flaw
3	3	3	Thickness Channel 1	Thickness
4	4	4	Thickness Channel 2	Thickness
5	1	1	Coupling Check	Flaw
6	6	1,2,3,4	<i>Test Configuration</i>	<i>Flaw</i>
7				
8				

Channel 1 is set to receive from pulser 1 on Cycle 1 and has been assigned the name " Flaw Channel 1", and is configured as a Flaw channel.

Channel 2 is set to receive from pulser 2 on Cycle 2 and has been assigned the name " Flaw Channel 2", and is configured as a Flaw channel.

Channel 3 is set to receive from pulser 3 on Cycle 3 and has been assigned the name " Thickness Channel 1", and is configured as a Thickness channel.

Channel 4 is set to receive from pulser 4 on Cycle 4 and has been assigned the name " Thickness Channel 2", and is configured as a Thickness channel.

Channel 5 is set to receive from pulser 1 on Cycle 1 (this will need a "T" connector between Channel 1 and the receive connector of Channel 5) the result of this configuration is that the signal from Pulser 1 is received simultaneously by Channels 1 and 5. Typically, Channel 1 would have gates and gain set up for flaw detection, and Channel 5 would be set up to monitor interface or back wall echoes.

Channel 6 is shown as a demonstration that Channels can be set to fire on multiple cycles.

Back Echo Attenuation

A USPC 2100 can be configured for a back echo attenuation function by using a second (or more) USPC 2100 card, connecting the probe to both cards, and configuring the system so that only one card is set to pulse, but both cards receive. If you configure this way and use the copy command to copy all settings from the primary channel to the secondary channel then you can effect back echo attenuation.

Specifications

Specifications

This section contains the ultrasonic and system specifications of the USPC 2100

PC System Specifications

Software

Windows XP (backup supplied on CD ROM)
USPC 2100 Program (backup supplied on CD ROM)
Floppy disks to enable Velocity and/or Flaw mode, if applicable.

Base Computer Hardware

Computer

Intel Pentium 166 MHz (minimum)
16 Mb main memory
4 Mb video memory
250-watt power supply
1 full length PCI slot for each USPC 2100 card
1 ISA slot for the output card

Hard Drive

1.2 Gb (minimum)

Floppy Drive

1.44 Mb

CD ROM drive

8 x (minimum)

Monitor

17 in 1024x768 min resolution

Keyboard

101

Pointing Device

Microsoft mouse or industrial pointing device dependent on options ordered

Modem

28.8 bps modem for general use, service diagnostics, or new program installation.

USPC 2100 Hardware

USPC 2100 Card

Each test channel uses a single USPC 2100 card. Therefore a 1-channel system will be installed with 1 card, a 2-channel system with 2 cards etc.

Input/Output Card

Inputs and outputs, such as analog signal voltages or trigger timing signals are available from each USPC 2100 card. Individual USPC 2100 card outputs are connected by a ribbon cable to an output card. A single output card can connect the outputs from up to 8 USPC 2100 cards and connect up to 4 of them to each of 2 output connectors on the output card. For systems with up to 4 channels (4 USPC 2100 cards), only OP connector A on the output card is used. The second connector (B) is used for channels 5 to 8.

UT System Specifications

Pulser Receiver/Amplifier Gates Measurement Precision A-scan Display

1. Voltage: HI: 250 Volts into 50 Ohms
 LO: 100 Volts into 50 Ohms
2. Energy: HI: 1470 pF
 LO: 470 pF
3. Rise time: <10 nsecs.
4. Damping: 50, 75, or 500 Ohms
5. Rep Rate: 10 KHz/Channel or 20 KHz system (note gate range varies with Rep Rate. Max gate range at 10 KHz is 4 microseconds in half wave rectified mode and 2 microseconds in full wave rectified mode. See table under gates section for details.)
6. Probe: Single or Dual element

Receiver/Amplifier

1. Bandwidth: 0.8 to 12.5 MHz (-3dB)
2. Filters: 1, 2.25, 5, 10 MHz, or BB
3. Gain: +80 dB
4. Dyn. Range: 110 dB (0.1 dB steps)
5. DAC: 40 dB range, 16 segments, 12-dB/microsec max slew rate.
6. RF Output: 1 Vpp into 50 Ohms

Gates

1. Number: 1 Interface and 2 measurement gates per channel
2. Thresholds: 1 threshold per gate
 Software selectable coincidence/anti coincidence (5% to 100%)
3. Noise: Selectable number of alarms (1-16) in a selectable number of cycles (1-16)
4. Synchron.: Initial Pulse, Artificial, or Interface Trigger
5. Data: Alarms Flaw Channel - Loss of Interface, Gate A & B Thresholds
 Alarms Thickness Channel - Loss of Interface, Thickness Low and High Limits, eccentricity.
 Measurements Flaw Channel - Water Path, Gate A & B Amplitudes (5% to 127%) and Distance to Echo,
 Measurements Thickness Channel - Water Path, IP to Echo, Echo to Echo, Interface to Echo.
 Statistical Data - Min, Max, and Average for all measurements

6. Range:

Note that the range for gates on the USPC 2100 is a function of PRF. This is because the software needs a finite time to calculate echo amplitudes and distances. The following table shows the gate widths.

Receiver Frequency	Rectification	Main PRF	Max GA Gate Width in uS	Max Gate Width Ins. Long	Max Gate Width Ins. Shear	Max Gate Width mm. Long	Max Gate Width mm. Shear	Percentage of PRF sampled	Percentage of PRF based on y=mx+b
5 MHz	Pos	1000	75.0	8.7	4.4	221.9	952.5	7.50	6456.28
		2000	36.5	4.3	2.1	108.0	463.6	7.30	12906.28
		3000	23.6	2.7	1.4	69.8	299.7	7.08	19356.28
		4000	17.4	2.0	1.0	51.5	221.0	6.96	25806.28
		5000	13.3	1.5	0.8	39.4	168.9	6.65	32256.28
		6000	10.7	1.2	0.6	31.7	135.9	6.42	38706.28
		7000	8.7	1.0	0.5	25.7	110.5	6.09	45156.28
		8000	7.1	0.8	0.4	21.0	90.2	5.68	51606.28
		9000	6.1	0.7	0.4	18.1	77.5	5.49	58056.28
		10000	5.0	0.6	0.3	14.8	63.5	5.00	64506.28
			Slope				#####		
			Offset				#####		
5 MHz	Full Wave	1000	64.5	7.5	3.8	190.9	819.2	6.45	7487.26
		2000	31.4	3.7	1.8	92.9	398.8	6.28	14967.26
		3000	20.5	2.4	1.2	60.7	260.4	6.15	22447.26
		4000	15.0	1.7	0.9	44.4	190.5	6.00	29927.26
		5000	11.4	1.3	0.7	33.7	144.8	5.70	37407.26
		6000	8.9	1.0	0.5	26.3	113.0	5.34	44887.26
		7000	7.4	0.9	0.4	21.9	94.0	5.18	52367.26
		8000	6.0	0.7	0.3	17.8	76.2	4.80	59847.26
		9000	5.1	0.6	0.3	15.1	64.8	4.59	67327.26
		10000	4.3	0.5	0.3	12.7	54.6	4.30	74807.26
			Slope		#VALUE!		#####		
			Offset		#VALUE!		#####		
					0.0				
10 MHz	Pos	1000	74.8	8.7	4.4	221.3	950.0	7.48	3873.72
		2000	36.3	4.2	2.1	107.4	461.0	7.26	7743.72
		3000	23.4	2.7	1.4	69.2	297.2	7.02	11613.72
		4000	17.1	2.0	1.0	50.6	217.2	6.84	15483.72
		5000	13.1	1.5	0.8	38.8	166.4	6.55	19353.72
		6000	10.3	1.2	0.6	30.5	130.8	6.18	23223.72
		7000	8.3	1.0	0.5	24.6	105.4	5.81	27093.72
		8000	6.9	0.8	0.4	20.4	87.6	5.52	30963.72
		9000	5.7	0.7	0.3	16.9	72.4	5.13	34833.72
		10000	4.8	0.6	0.3	14.2	61.0	4.80	38703.72
			Slope				#####		
			Offset				#####		
10 MHz	Full Wave	1000	38.7	4.5	2.3	114.5	491.5	3.87	0.00
		2000	18.6	2.2	1.1	55.0	236.2	3.72	0.00
		3000	11.8	1.4	0.7	34.9	149.9	3.54	0.00
		4000	8.4	1.0	0.5	24.9	106.7	3.36	0.00
		5000	6.4	0.7	0.4	18.9	81.3	3.20	0.00
		6000	5.0	0.6	0.3	14.8	63.5	3.00	0.00
		7000	3.9	0.5	0.2	11.5	49.5	2.73	0.00
		8000	3.2	0.4	0.2	9.5	40.6	2.56	0.00
		9000	2.6	0.3	0.2	7.7	33.0	2.34	0.00
		10000	2.1	0.2	0.1	6.2	26.7	2.10	0.00
			Slope				#####		
			Offset				#####		

The following are max values and step sizes

1 microsec to 321 sec (0.05 microsec steps)
0.05 inches to 50.05 inches (0.005 inch steps)
1 mm to 1001 mm (0.1 mm steps)
(note gate range varies with Rep Rate. Max gate range at 10 KHz is 4 microsecs
in half wave rectified mode and 2 microsecs in full wave rectified mode)

7. Delay: 0 microsec to 320 microsecsec (0.05 microsec. steps)
0 inches to 50 inches (0.005 inch steps)
0 mm to 1000 mm (0.1 mm steps)

Measurement Precision

1. Digitization: 50 MHz sampling, upsampled to 200 MHz for flaw measurements and 800 MHz for thickness measurements.

2. Distance Resolution: (single shot, steel, longitudinal)

Channel Mode	Gate	Threshold Mode	Time Resolution	mm of Steel	Inches of Steel
Flaw Mode	GA & GB	Peak	5.00E-09	0.0295	0.00115
		Flank	2.00E-08	0.118	0.0046
	I/F Gate	Flank	5.00E-09	0.0295	0.00115
		Peak	2.00E 08	.118	.0046
Thickness Mode	GA <-> GB	All	1.25E-09	0.007375	0.0002875
	IF	Zero and Flank	2.50E-09	0.01475	0.000575
		Peak	2.00E-08	.118	.0046

3. Distance Modes:

Initial Pulse to any Gate
Interface to either Flaw Gate
First Flaw Gate to Second Flaw Gate
Zero crossing (thickness mode only), Peak, or Flank
Phase selection independent for start and end signal

4. Full Scale Distance Analog Outputs:

2, 5 or 10 volts, 12 bit resolution
Software selectable offset and range

5. Full Scale Amplitude analog Outputs:

2, 5, or 10 volts 8 bit resolution

6. Data Update Rate:

Updated on a single shot basis.

7. Rectification: Full Wave, HW Positive, HW Negative, or RF

8. Peak Error: < 1%

A-Scan Display

1. Modes: Full Wave rectified (FW), Positive Half Wave rectified (HWP), Negative Half Wave rectified (HWN), RF.

2. Gates: Bars indicating start, stop, and threshold of each gate

3. DAC: Curve displayed at baseline or mid screen.

4. Range: 1 microsec to 321 sec (0.5 microsec steps)
0.05 inches to 50.05 inches (0.05 inch steps)
1 mm to 1001 mm (1 mm steps)

- 5. Delay: -10 microsec to 310 sec (0.5 microsec steps)
 -1 inch to 49 inches (0.05 inch steps)
 -25 mm to 975 mm (1 mm steps)
- 6. Trigger: Initial Pulse, Artificial, or Interface Trigger
- 7. Update: Average 130 Hz (Pentium 166), 200 Hz (Pentium II)
 Minimum 20 Hz with Interface Triggered Gates displayed
- 8. Traces: 1, 2, 4, or ALL (on Baseline)
- 9. Displayed Peak: < 1% error

Appendix A Example Files

Several files have been included with the USPC 2100 to illustrate settings for some typical applications. Following is a list of the files included together with a description of the configuration.

Sample Files

The USPC 2100 is shipped with several preconfigured multi-channel setup files and **Application Window** sketches. We intend that ultimately we will maintain and support a library of USPC 2100 files and libraries on the **www.GE Inspection Technologies.com** Website for user reference. However you should note that you must run the USPC 2100 as a full 8 channel system or in demo8 mode before loading the files, and run **USPC 2100 Setup** to reset the USPC 2100 to its original configuration after you have finished.

The following files are presently installed. The bitmap file names have been included for reference; however, you only need recall the .ads file from the **Files Panel** with the file select set for **All Data Sets**. The bitmap (sketch) file will automatically be loaded.

Scroll down this list to show all files

ERW 2 Long Top View.ads **ERW 2 Long Top View.bmp**

This setup is for a typical 2-probe tube weld test system with coupling check. The USPC 2100 is configured as a 3-channel system, which fires on 2 cycles.

The system is physically configured so that USPC 2100 channel 1 is connected to **Long Probe 1**, channel 2 is connected to **Long Probe 2**, and channel 3 is also connected as receive only (dual mode) to **Long Probe 2**. (A "BNC T" connector will link **Long Probe 2** to channels 2 and 3)

Cycle 1 fires **Probe 1** and receives on both **Long Probe 1** and **Long Probe 2** (as a coupling check).

Cycle 2 fires and receives on **Long Probe 2**.

The sketch in the App Window shows a top view of the probe configuration with typical defect indicators.

ERW 2 Long 2 Trans Top View.ads **ERW 2 Long 2 Trans Top View.bmp**

This setup is for a 4 probe Longitudinal and Transverse tube weld test system with coupling check. The USPC 2100 is configured as a 5-channel system, which fires on 4 cycles.

The system is physically configured so that USPC 2100 channel 1 is connected to **Long Probe 1**, channel 2 is connected to **Long Probe 2**, and channel 3 is also connected as receive only (dual mode) to **Long Probe 2**. (A "BNC T" connector will link **Long Probe 2** to channels 2 and 3)

Cycle 1 fires **Probe 1** and receives on both **Long Probe 1** and **Long Probe 2** (as a coupling check).

Cycle 2 fires and receives on **Long Probe 2**.

Cycle 3 fires and receives on **Trans Probe 1**

Cycle 4 fires and receives on **Trans Probe 2**

The sketch in the App Window shows a top view of the probe configuration with typical defect indicators.

ERW 4 Long Top View.ads **ERW 4 Long Top View.bmp**

This setup is for a 4 probe tube weld test system where 2 longitudinal probes are setup for ID defects, and 2 longitudinal probes setup for OD defects. . The USPC 2100 is configured as a 6-channel system, which fires on 4 cycles.

The system is physically configured so that USPC 2100 channel 1 is connected to **Long Probe 1**, channel 2 is connected to **Long Probe 2**, and channel 3 is also connected as receive only (dual mode) to **Long Probe 2**. (A "BNC T" connector will link **Long Probe 2** to channels 2 and 3).

Similarly **Long Probes 3 and 4** are connected to channels 4, 5, and 6.

Cycle 1 fires **Long Probe 1** and receives on both **Long Probe 1** and **Long Probe 2** (as a coupling check)

Cycle 2 fires and receives on **Long Probe 2**.

Cycle 3 fires Long Probe 3 and receives on both **Long Probe 3** and **Long Probe 4** (as a coupling check).

Cycle 4 fires and receives on **Long Probe 4**.

The sketch in the App Window shows a top view of the probe configuration with typical defect indicators.

ERW 4 Long 2 Trans Top View.ads

ERW 4 Long 2 Trans Top View.bmp

This setup is for a 6 probe tube weld test system where 2 longitudinal probes are setup for ID defects, 2 longitudinal probes setup for OD defects, and 2 transverse probes setup for transverse defects. The USPC 2100 is configured as an 8-channel system, which fires on 6 cycles.

The system is physically configured so that USPC 2100 channel 1 is connected to **Long Probe 1**, channel 2 is connected to **Long Probe 2**, and channel 3 is also connected as receive only (dual mode) to **Long Probe 2**. (A "BNC T" connector will link **Long Probe 2** to channels 2 and 3). Similarly **Long Probes 3 and 4** are connected to channels 4, 5, and 6.

Cycle 1 fires **Long Probe 1** and receives on both **Long Probe 1** and **Long Probe 2** (as a coupling check)

Cycle 2 fires and receives on **Long Probe 2**.

Cycle 3 fires Long Probe 3 and receives on both **Long Probe 3** and **Long Probe 4** (as a coupling check).

Cycle 4 fires and receives on **Long Probe 4**.

Cycle 5 fires and receives on **Trans Probe 1**

Cycle 6 fires and receives on **Trans Probe 2**

The sketch in the App Window shows a top view of the probe configuration with typical defect indicators.

ERW 4 Long 2 Thick Top View.ads

ERW 4 Long 2 Thick Top View.bmp

This setup is for a 6 probe tube weld test system where 2 longitudinal probes are setup for ID defects, 2 longitudinal probes setup for OD defects, and with 2 probes setup up for a thickness test on each side of the weld. The USPC 2100 is configured as an 8-channel system, which fires on 6 cycles. Channels 1 - 6 are configured as Flaw Channels, and Channels 7 and 8 as Thickness Channels.

The system is physically configured so that USPC 2100 channel 1 is connected to **Long Probe 1**, channel 2 is connected to **Long Probe 2**, and channel 3 is also connected as receive only (dual mode) to **Long Probe 2**. (A "BNC T" connector will link **Long Probe 2** to channels 2 and 3). Similarly **Long Probes 3 and 4** are connected to channels 4, 5, and 6.

Cycle 1 fires **Long Probe 1** and receives on both **Long Probe 1** and **Long Probe 2** (as a coupling check)

Cycle 2 fires and receives on **Long Probe 2**.

Cycle 3 fires Long Probe 3 and receives on both **Long Probe 3** and **Long Probe 4** (as a coupling check).

Cycle 4 fires and receives on **Long Probe 4**.

Cycle 5 fires and receives on **Thick Probe 1**

Cycle 6 fires and receives on **Thick Probe 2**

The sketch in the App Window shows a top view of the probe configuration with typical defect indicators.

ERW 2 Long Side View.ads

ERW 2 Long Side View.bmp

This setup is for a typical 2-probe tube weld test system with coupling check. The USPC 2100 is

configured as a 3-channel system, which fires on 2 cycles.

The system is physically configured so that USPC 2100 channel 1 is connected to **Long Probe 1**, channel 2 is connected to **Long Probe 2**, and channel 3 is also connected as receive only (dual mode) to **Long Probe 2**. (A "BNC T" connector will link **Long Probe 2** to channels 2 and 3)

Cycle 1 fires **Probe 1** and receives on both **Long Probe 1** and **Long Probe 2** (as a coupling check).

Cycle 2 fires and receives on **Long Probe 2**.

The sketch in the App Window shows a tube end view of the probe configuration with typical defect indicators.

ERW 2 Thick Side View.ads
ERW 2 Thick Side View.bmp

This setup is for a system to test tube thickness adjacent to the weld area. The USPC 2100 is configured as a 2 channel, 2 cycles, thickness system.

Cycle 1 fires **Thick Probe 1**

Cycle 2 fires **Thick Probe 2**

The sketch in the App Window shows a tube end view of the probe configuration with typical defect indicators.

ERW 2 Long 2 Thick Side View.ads
ERW 2 Long 2 Thick Side View.bmp

This setup is for a 4-probe tube weld test system with coupling check. 2 probes are set to check for longitudinal defects, and 2 probes for thickness measurements adjacent to the weld area. The USPC 2100 is configured as a 5-channel system, which fires on 4 cycles. Channels 1 - 3 are configured as Flaw channels, and channels 4 and 5 as Thickness channels

The system is physically configured so that USPC 2100 channel 1 is connected to **Long Probe 1**, channel 2 is connected to **Long Probe 2**, and channel 3 is also connected as receive only (dual mode) to **Long Probe 2**. (A "BNC T" connector will link **Long Probe 2** to channels 2 and 3)

Cycle 1 fires **Probe 1** and receives on both **Long Probe 1** and **Long Probe 2** (as a coupling check).

Cycle 2 fires and receives on **Long Probe 2**.

Cycle 3 fires and receives on **Thick Probe 1**

Cycle 4 fires and receives on **Thick Probe 2**

The sketch in the App Window shows a tube end view of the probe configuration with typical defect indicators.

Plate Test 4 Probe.ads
Plate Test 4 Probe.bmp

This setup is for a 4-probe plate or strip test system for defect detection using single element probes. However, by changing the USPC 2100 configuration to Thickness mode the same setup could be used for thickness monitoring.

The system is configured for 4 channel parallel firing

Channel 1 would be setup to suit actual plate or strip requirements, and the **Copy Settings >>** command from the **File Panel** used to copy these settings to the other channels.

The sketch in the App Window shows the probe configuration with typical defect indicators.

Plate Test 4 Probe Dual.ads
Plate Test 4 Probe Dual.bmp

This setup is for a 4 probe plate or strip test system for defect detection using dual element probes. However, by changing the USPC 2100 configuration to Thickness mode the same setup could be used for thickness monitoring.

The system is configured for 4 channel parallel firing
Channel 1 would be setup to suit actual plate or strip requirements, and the **Copy Settings >>**
command from the **File Panel** used to copy these settings to the other channels.
The sketch in the App Window shows the probe configuration with typical defect indicators.

Plate Test 8 Probe.ads

Plate Test 8 Probe.bmp

This setup is for a 8 probe plate or strip test system for defect detection using single element
probes. However, by changing the USPC 2100 configuration to Thickness mode the same setup
could be used for thickness monitoring.

The system is configured for 8 channel parallel firing

Channel 1 would be setup to suit actual plate or strip requirements, and the **Copy Settings >>**
command from the **File Panel** used to copy these settings to the other channels.

The sketch in the App Window shows the probe configuration with typical defect indicators.

Plate Test 8 Probe Dual.ads

Plate Test 8 Probe Dual.bmp

This setup is for a 8 probe plate or strip test system for defect detection using dual element
probes. However, by changing the USPC 2100 configuration to Thickness mode the same setup
could be used for thickness monitoring.

The system is configured for 8 channel parallel firing

Channel 1 would be setup to suit actual plate or strip requirements, and the **Copy Settings >>**
command from the **File Panel** used to copy these settings to the other channels.

The sketch in the App Window shows the probe configuration with typical defect indicators.

Valve.ads

Valve.bmp

This setup is for a 3-probe thickness test system used to measure thickness at three places on an
automotive valve.

The sketch in the App Window shows the probe configuration with typical defect indicators

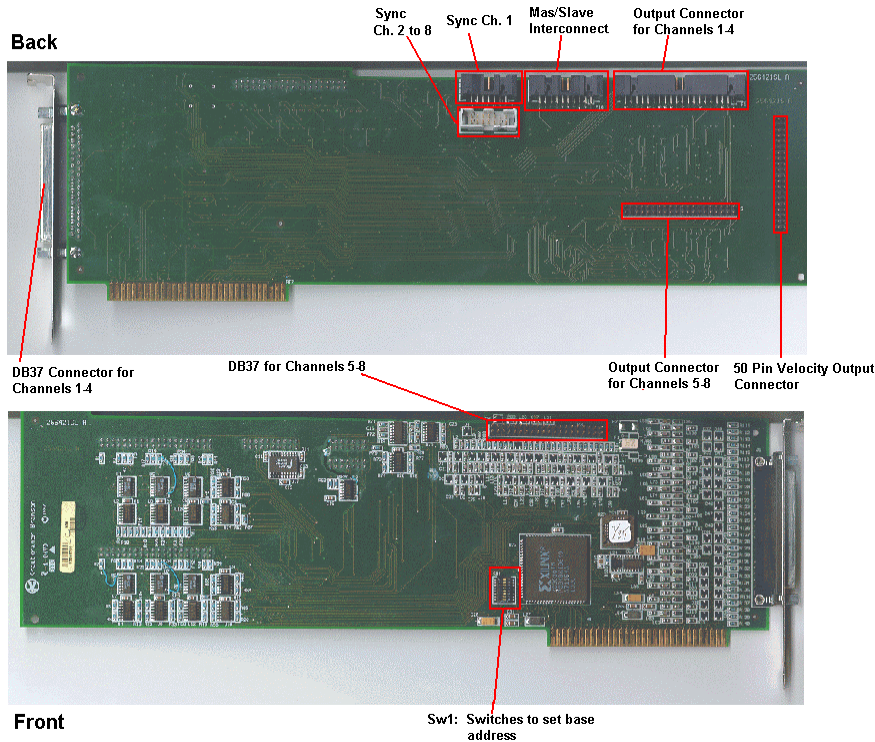
Appendix B Outputs

Appendix B Outputs

List of available USPC 2100 inputs and outputs for synchronization and recorder and control outputs.

*Output Card
Output Pins
Add On Devices*

Output Card



See the Interconnects section for more on the master/slave and sync connectors.

See Output Pins for pinouts of the 37 pin output connectors.

See Velocity Outputs in the Velocity section for pinouts of the 50-pin connector.

See Add Ons for details about the relay board that uses the 50-pin connector.

See Setup Outputs for instructions on configuring outputs.

Sw1: Output Card Base address Switches

Base address is used by external programs to communicate with the output board.
Factory setup shown (330H)

8	X	
7		X
6		X
5	X	
4	X	
3		X 0
2		X F
1	X	F

See Setup PC Config section for more on setting base address.

Output and Internal Connections

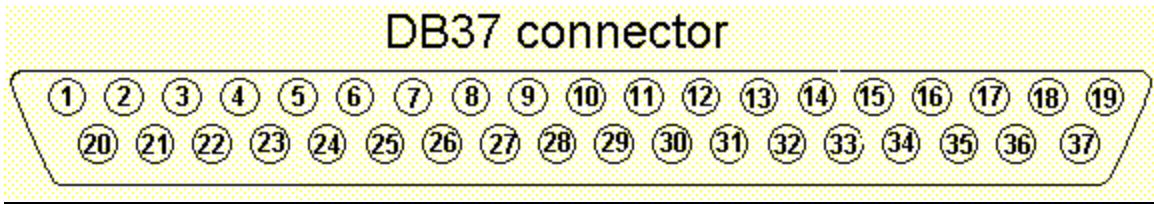
Note: This Connector is for Flaw and Thickness mode Outputs. For a pinout of the Velocity connector, see Velocity Pins.

One USPC2100 output board will support up to 8 USPC2100 channel cards. For systems with more than 4 channels installed the second output connector is utilized. Outputs from Channels 1 through 4 will be on OP connector A and from Channels 5 through 8 will be on OP connector B. The pin assignments are shown on the

Configure Outputs panel of the USPC2100 A1 thru A37 refer to OP connector A and B1 thru B37 refer to OP connector B.

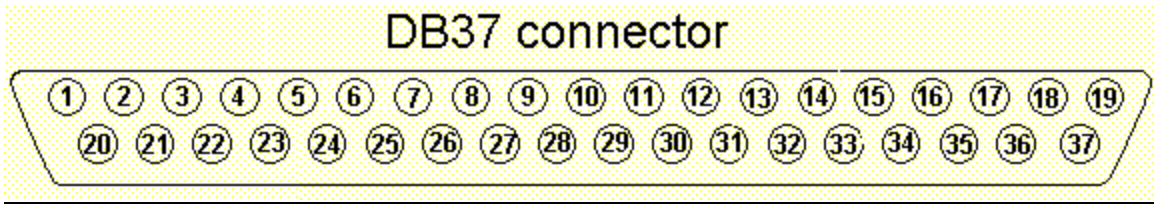
Analog 1	= Analog output 1 as selected in the Configure Outputs Table
Analog 2	= Analog output 2 as selected in the Configure Outputs Table
TTL 1	= TTL output 1 as selected in the Configure Outputs Table
TTL 2	= TTL output 2 as selected in the Configure Outputs Table
TTL 3	= Loss of interface or no (or invalid) reading in thickness mode
T-Synch	= TTL OP goes High when Channel 1 fires (used to synch other systems)
Alarm Reset	= Resets latched alarms
SAP	= Main Timing Pulse (output)
External SAP	= Main Timing Pulse (input)
Mechanical	
Strobe	= Timing input for Min, Max, and Average functions
External	
T-Synch	= External trigger for Channel 1 (used to synchronize system)

Pin Assignments for socket A - channels 1 to 4 (View towards socket on PC)



Pin	Pin Assignment
1	Ch 4 TTL 1
2	Ch 3 Data Output Inhibit
3	Ch 3 TTL3 Loss of Interface
4	Ch 3 TTL 2
5	Ch 3 Analog 2
6	Ch 3 Analog 1
7	Ch 3 TTL 1
8	Ch 2 Data Output Inhibit
9	Ch 2 TTL3 Loss of Interface
10	Ch 2 TTL 2
11	Ch 2 Analog 2
12	Ch 2 Analog 1
13	Ch 2 TTL 1
14	Ch 1 Data Output Inhibit
15	Ch 1 TTL3 Loss of Interface
16	Ch 1 TTL 2
17	Ch 1 Analog 2
18	Ch 1 Analog 1
19	Ch 1 TTL 1
20	SAP
21	Ground
22	External SAP
23	T-Sync
24	Ground
25	External T-Sync
26	Ground
27	+5 volts (1 amp Max)
28	Alarm Reset
29	Mech Strobe
30	Ground
31	Ground
32	Ground
33	Ch 4 Data Output Inhibit
34	Ch 4 TTL 3 Loss of Interface
35	Ch 4 TTL 2
36	Ch 4 Analog output 2
37	Ch 4 Analog output 1

Pin Assignments for socket B - channels 5 to 8 (View towards socket on PC)



Pin	Pin Assignment
1	Ch 8 TTL 1
2	Ch 7 Data Output Inhibit
3	Ch 7 TTL3 Loss of Interface
4	Ch 7 TTL 2
5	Ch 7 Analog 2
6	Ch 7 Analog 1
7	Ch 7 TTL 1
8	Ch 6 Data Output Inhibit
9	Ch 6 TTL3 Loss of Interface
10	Ch 6 TTL 2
11	Ch 6 Analog 2
12	Ch 6 Analog 1
13	Ch 6 TTL 1
14	Ch 5 Data Output Inhibit
15	Ch 5 TTL3 Loss of Interface
16	Ch 5 TTL 2
17	Ch 5 Analog 2
18	Ch 5 Analog 1
19	Ch 5 TTL 1
20	SAP
21	Ground
22	<unused>
23	T-Sync
24	Ground
25	<unused>
26	Ground
27	+5 Volts (1 Amp Max.)
28	<unused>
29	<unused>
30	Ground
31	Ground
32	Ground
33	Ch 8 Data Output Inhibit
34	Ch 8 TTL3 Loss of Interface
35	Ch 8 TTL 2
36	Ch 8 Analog 2
37	Ch 8 Analog 1

Add on devices

Optional equipment for the USPC 2100 Windaq Data Recorder Relay Rack

For information on any of this equipment, please contact your GE INSPECTION TECHNOLOGIES representative.

Information is also available on the World Wide Web:

Grayhill: WWW.GRAYHILL.COM

Dataq WWW.DATAQ.COM

Grayhill Relay Rack

NOTE: See Outputs Config for instructions on setting up outputs for use with the relay rack.

Click on the following two links for diagrams of operation with the USPC when connected to:

- 50 Pin Velocity Connector**
- 37 Pin Standard Output Connector**

Click on one of the following two links for pinouts of the connectors.

- 50-pin connector
- 37 pin connectors

Description

The Grayhill relay rack connects to the output card with either the 50-pin connector (velocity mode), or one of the 37 pin connectors (thickness and flaw). By providing a means for external devices to control and be controlled by the USPC, it allows automation of the testing process. Tests conducted activate the relevant output relays illustrated in the diagrams. Also, the USPC 2100 responds to signals fed into the inputs, if Data Output Inhibit in Outputs Config is set up for "External Signal".

Output relays Closed (activated) by the relevant event on the associated channel.

Input relays Activated by an input voltage, will return a signal to the USPC 2100.

Also provided on the relay rack is a 5-volt, 1 amp power supply.

The normal state of the relays is open (non-conducting.) When a relay is closed (activated), its LED will light so the operator knows which relay is closed.

Usage (Thickness and Flaw mode)

1. Set up the USPC for measurements for the required measurements, as normal.
2. The 37 pin connector on the Grayhill relay rack must be connected to one of the 37 pin output connectors on the output card, one of which handles channels 1-4 and the other 5-8. See the output board section.

Note: The following options in Outputs Config : must be set.

3. For **output relays**, **TTL Alarm Level** must be set. When set to High, each relay will be activated (closed) by an alarm condition, and when set to low; it will be closed until an alarm, caused by the relevant event on its channel. For instance if the output for pin 1 enters an alarm condition, relay 9 will close (conduct) if TTL Alarm is set to High, but open (cease to conduct) if set to Low. (See Additional TTL Controls in Outputs Config for more information.)

4. The **TTL Output** section must be configured so the desired outputs are sent to the correct relays. Click here for a diagram relating the output pins to their respective relays and functions.

The following steps relate to input relays.

5. For the **input relays**, **Data Output Inhibit** is set to either External High or Low for DOI relays to have any effect. If set to high, a voltage applied to an input relay would trigger the relevant input, but if set to low, would turn the input off.

Options are

- External High If Data Output Inhibit is activated; outputs on relevant channel are frozen and testing stops until signal ceases.
- External Low Unless DOI is activated; outputs on relevant channel are frozen and testing stops until DOI is triggered.

6. When triggered, **Alarm Reset** sends a global command to the USPC to set all alarms back to their inactive (un-triggered) state.
7. The other input is **Mechanical Strobe**.

Usage (Velocity mode)

1. Set up the USPC for measurements for the required measurements, as normal.
2. The 50-pin plug on the Grayhill relay rack must be connected to its equivalent on the USPC's output card. See the output board section.

Note: The following options in Outputs Config must be set:

3. For the output relays, TTL Alarm Level in must be set. When set to High, each relay will be activated (closed) by an alarm condition, and when set to low; it will be closed until an alarm, caused by the relevant event on its channel. For instance if a Fail condition is encountered on channel 1, relay 6 will close (conduct) if TTL Alarm is set to High, and open (cease to conduct) if set to Low. (See Additional TTL Controls in Outputs Config for more information.)
4. For the input relays, Data Output Inhibit is set to either External High or Low for relays to have any effect.

Options are

- External High If Retest relay is activated, current test on relevant channel is canceled and its data lost, and component count is not incremented.
If Test Inhibit is activated, testing halts on relevant channel.
- External Low Retest is constantly activated during testing, if deactivated test is cancelled as above.
Test Inhibit must be activated for tests to proceed, testing on relevant channel stops if it is de-activated.

Available Relay Types

Any type of miniature relay module available from Grayhill for installation on the relay rack can be used. Below are the relevant specifications.

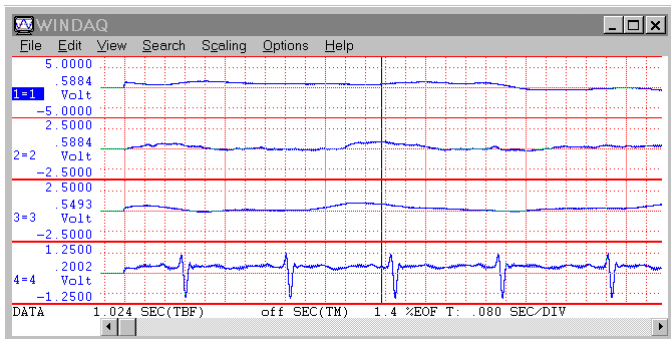
Output Modules

Type and Color	Load Voltage/Current	Control Voltage	Notes
Digital AC (Black)	Up to 220 Vac, 2 A	5, 15, or 24	
Digital DC (Red)	Up to 60 Vdc	5, 15, or 24	Dry contact version is available

Input Modules

Type and Color	Supply Voltage/Current	Input Voltage
Digital AC (Yellow)	Up to 220 Vac, 2 A	5, 15, 24
Digital DC (White)	Up to 3 to 32 Vdc	5, 15, 24

Dataq Windaq data acquisition tool



Description

Designed to record multi-channel data in large quantities, this product interfaces with the USPC 2100 through the output connectors on the Output card. Through settings in the Outputs Config window the operator can specify which outputs to record.

Usage

1. Set up the USPC for measurements as normal.
2. The 37-pin plug on the Dataq acquisition card must be connected to the output connector on the USPC's output card. Refer to the output connectors section.
3. The outputs must be configured in Outputs Config so the USPC is sending the output signals.
4. Refer to the output pins section to see which pins are in use, and make sure the Dataq board is set to receive on the correct pins.

Relay Board (Thick or Flaw mode, w/ 37 pin connector)

	Relay Pin #	Pin #	Function	Relay Pin #	Pin #	Function
Chan 4/8	11	34	TTL Output 3	12	29	Mech. Strobe
	10	35	TTL Output 2	13	28	Alarm Reset
	9	1	TTL Output 1	14	33	Chan 1 DOI*
Chan 3/7	8	3	TTL Output 3	15		Unused
	7	4	TTL Output 2	16		Unused
	6	7	TTL Output 1	17	2	Chan 2 DOI*
Chan 2/6	5	9	TTL Output 3	18		Unused
	4	10	TTL Output 2	19		Unused
	3	13	TTL Output 1	20	8	Chan 3 DOI*
Chan 1/5	2	15	TTL Output 3	21		Unused
	1	16	TTL Output 2	22		Unused
	0	19	TTL Output 1	23	14	Chan 4 DOI*

* Data Output Inhibit

GE Inspection Technologies is an active participant in Europe's Waste Electrical and Electronic Equipment (WEEE) take-back initiative, directive 2002/96/EC.



The equipment you purchased required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment. In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Visit <http://www.geinspectiontechnologies.com> for take-back instructions and more information about this initiative.

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