

Electronic Delays



electronic delay = non-directional, variable time

- o Electronic delays are inserted and simulated the same as pyrotechnic delays.
- o The electronic delay tools insert both an electronic delay in the hole (with a calculated delay time) and a surface delay from the previous hole (typically defined as 0 ms).
- o Interval and relief times can be positive or negative, but delay times cannot be less than 0ms.



[*single interval*] inter-hole/row interval between a pair of holes



[*multiple intervals*] inter-hole/row interval along a line of marked holes only



[*relief rate*] by distance from a reference point or line

suggestion >View >Display Options >Visibility >Downhole Delay Name
and >Downhole Actual Delay and >Electronic Surface Connection

Interval Methods *similar to surface delays*

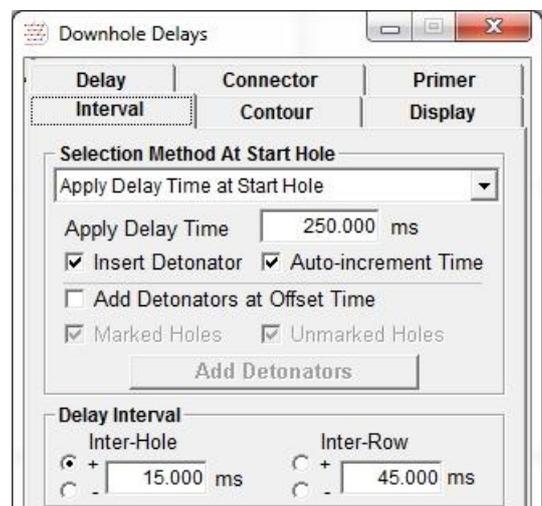
All methods based on delay time at start hole:

- (a) Apply time at start hole (uses [Apply] time)
- (b) Use minimum / maximum time in start hole
- (c) Use nearest time to collar/toe in start hole
- (d) Use first / last delay inserted in start hole

1. select Electronic Delay, Connector and Primer, set the position of the delay in the hole.

on the [Interval] tab:

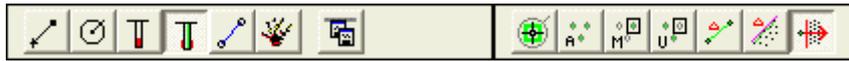
2. select method
 - for Apply Delay Time (a): enter time for start delay, click [Insert Detonator] to place delay in start hole
 - for Use Delay Time (other methods): set first delay time and insert single delay in start hole



3. enter the delay interval between holes and rows
4. select toolbar button, activate the cursor in Design Area, and [*click*] on the start hole
5. *single interval*: move the cursor to the next hole
multiple intervals (marked holes only): move the cursor to the end of the line of holes [*click*] again to insert the delays and surface connection (note the delay times)
6. continue to next hole or line of holes and [*click*] to insert more delays:
 - select or change Delay Interval on dialog at any time

suggestion: start with the control row, use method Apply Delay Time at Start Hole with Insert, then change to one of Use Delay Time methods for inter-hole rows

- to insert multiple delays per hole, at constant offset time from a delay already in hole:
 - check [Add Detonators at Offset Time] and select calculation method (changed options)
 - enter the [Delay Offset Time], can be positive or negative
 - select marked or unmarked holes, and click [Add Detonators]



Contour Methods

Calculated delay times are based on distance from a defined line or point, in the direction.

The Reference Point is the control point for placing lines and calculating the delay times.

Delay Time = distance from Reference Point or Contour Line x Relief Rate

Relief Rate = positive in indicated direction = increasing times, negative = decreasing

Calculation Rules:

[Reference Time] = start time for calculation at the Reference Point

[Nearest Hole] = calculated from Reference point, time applied to nearest hole, all adjusted

[Minimum Time] = times adjusted after calculation so that first delay = minimum time

Note: Minimum Time must be >=0 ms, applied to all delays

For all methods

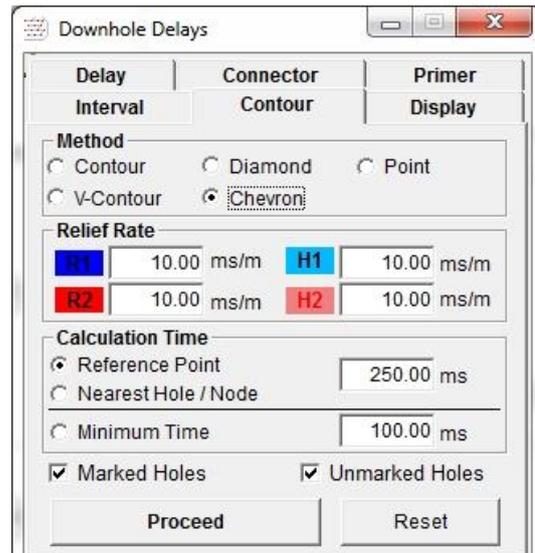
1. select the Contour tool on the toolbar
2. select a detonator and set the position in hole
3. enter relief rates and set the calculation time
4. select marked or unmarked holes or both
5. click [Accept New Values]

Point

6. [R-click] to leave cursor at Reference Point

Contour, V-Contour, Diamond, Chevron

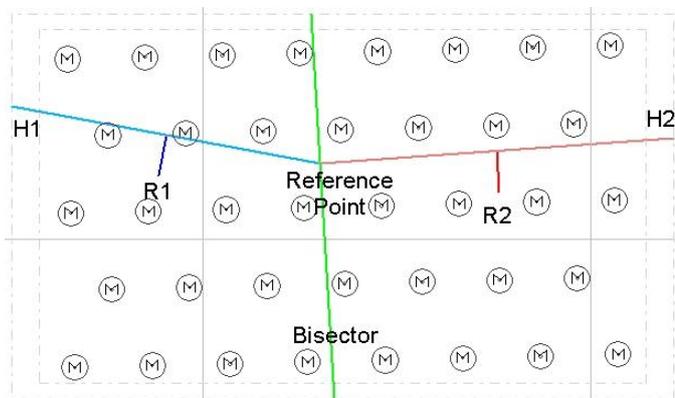
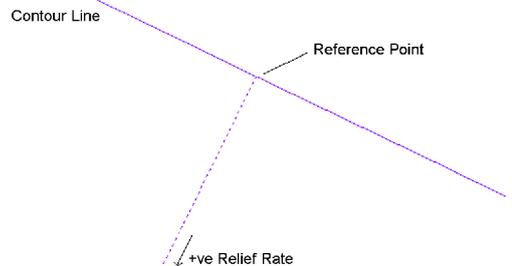
6. place cursor at the Reference Point and [click]
7. move the cursor in the direction of R1 and [click] to set - [Backspace] to change the direction



Chevron

selected holes surrounded by two boxes (dashed lines)

6. – place the Reference Point inside
7. move the cursor to set the direction of H1 – [click] to extend first chevron to the outer box
8. [click] on one side of H1 line to set R1 direction
9. repeat steps 7 and 8 for the second chevron to set H2 and R2
10. the Bisector appears after R2 is set [Ctrl]+[drag] at the end of the H or Bisector lines to rotate the lines, or at Reference Point to move the point.
11. [Backspace] to go back one step, [Delete] or [Reset] to start again



For all methods

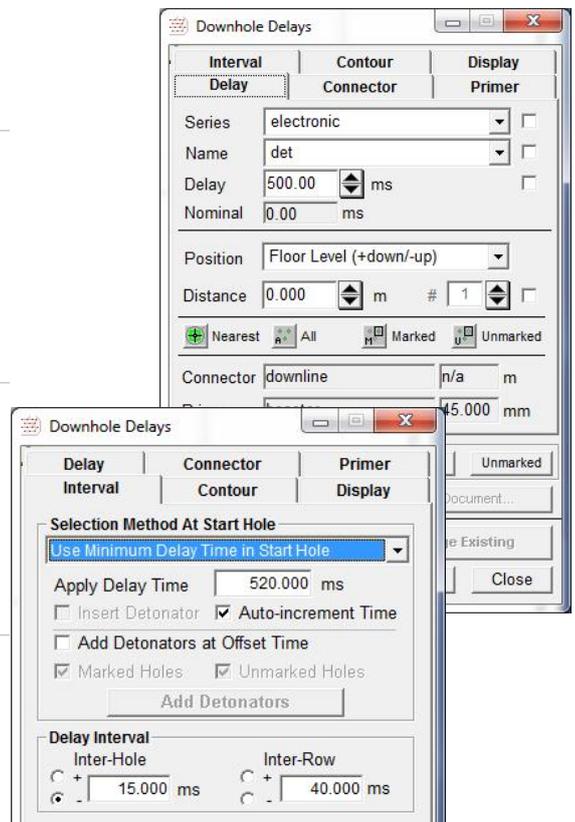
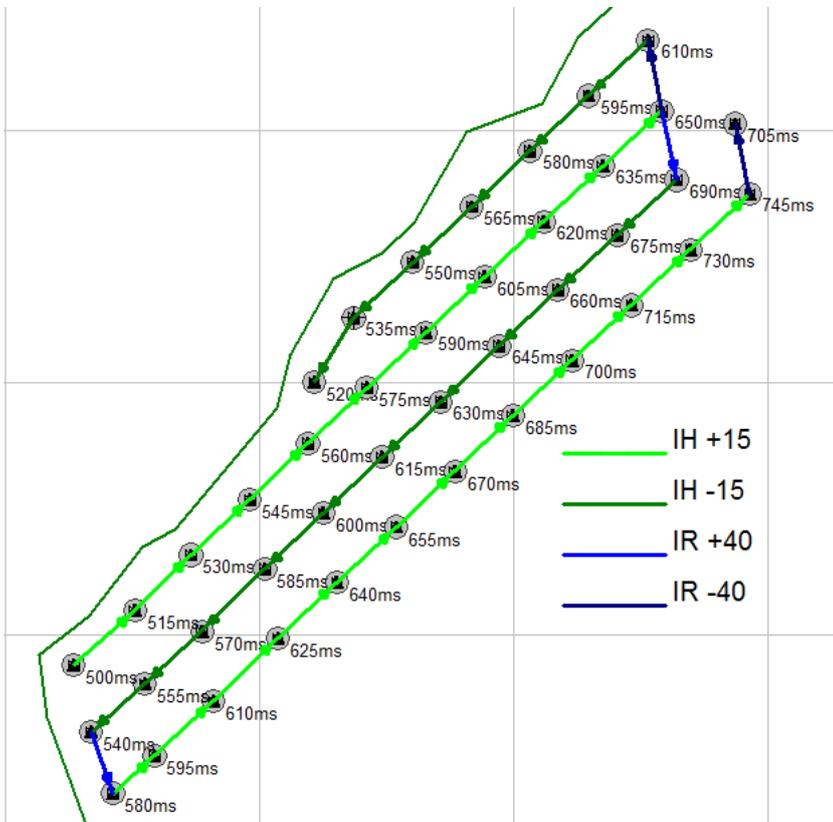
click [Proceed] to insert the delays and calculate the delay times

Multiple Delays per hole: repeat the above steps, but note that changing the method or hole marking options will cause the contour line or chevron to reset.

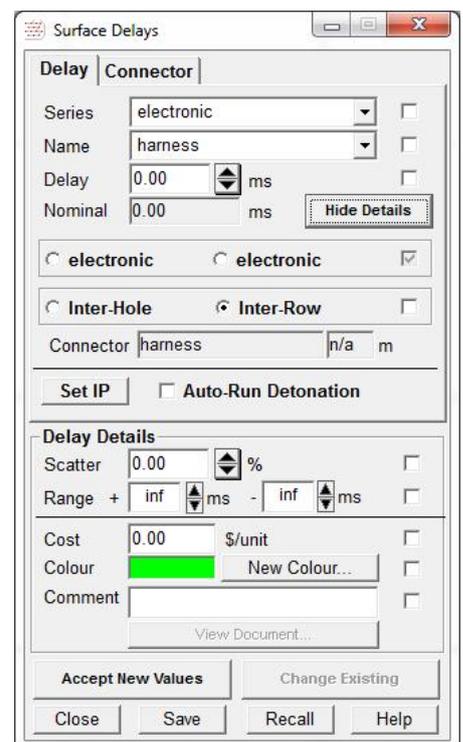
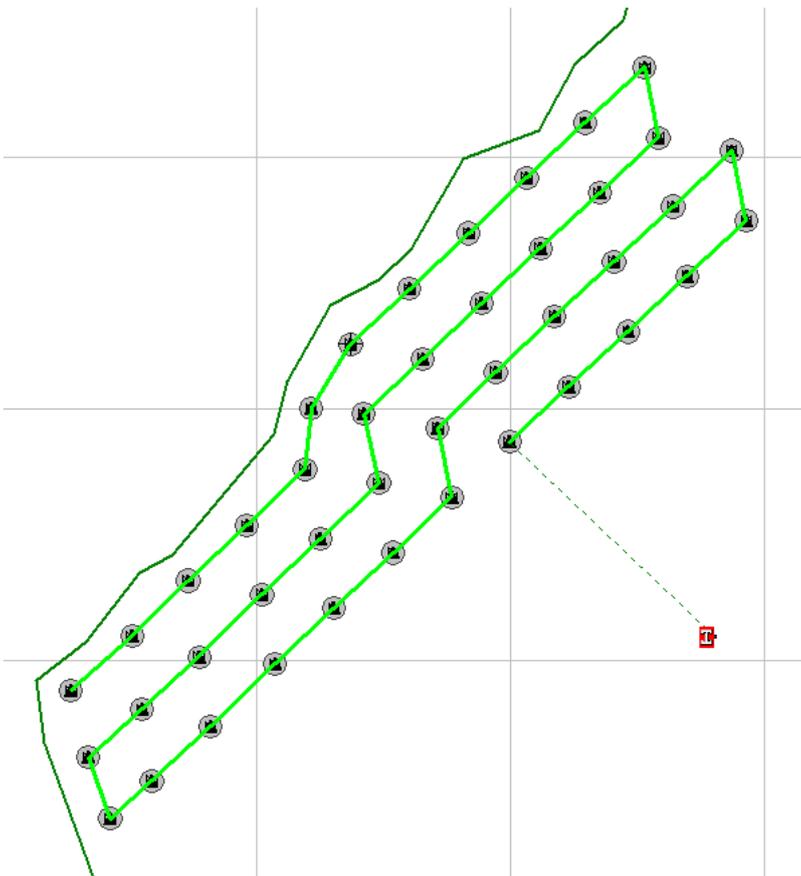
2DBench – Electronic Delays

Interval Method Connection Sequence

- 1) select delay, set first delay time and set position
- 2) insert first delay in hole
- 3) select interval method and set inter-hole and inter-row times
- 4) insert delays

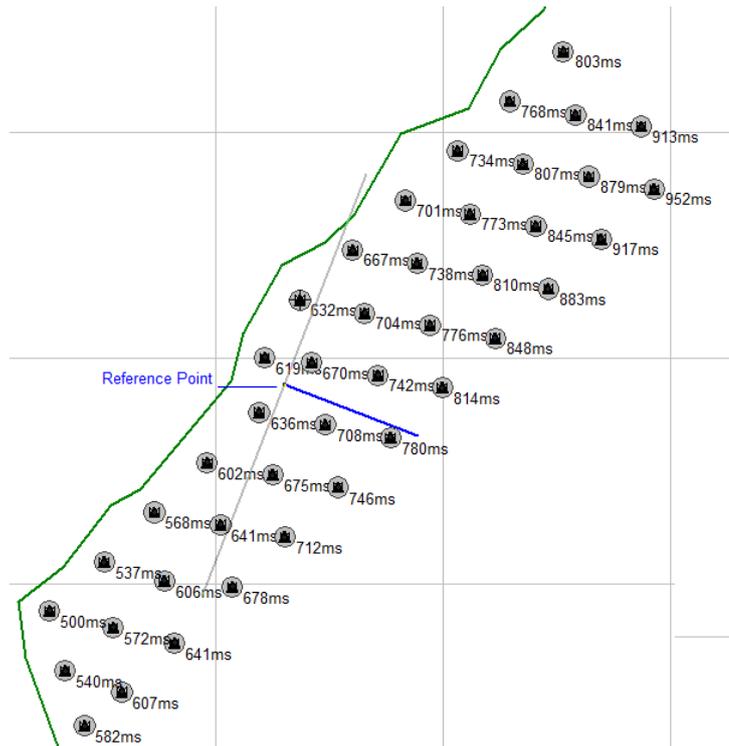


Surface Connections ... delete default electronic surface ties ... insert surface connections as single *chain*



Contour Methods $Delay\ Time = Calculation\ Time + Relief\ Rate \times (distance\ from\ Reference\ Point/Contour\ Line)$

- 1) select delay, set position
- 2) select method, set relief rates
- 3) click Reference Position and Direction
- 4) [Proceed]



Downhole Delays

Delay Interval	Connector Contour	Primer Display
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Method

Contour Diamond Point
 V-Contour Chevron

Relief Rate

R1	10.00 ms/m	H1	5 ms/m
R2	10.00 ms/m	H2	20 ms/m

Calculation Time

Reference Point 250.00 ms
 Nearest Hole / Node

Minimum Time 500 ms

Marked Holes Unmarked Holes

Downhole Delays

Delay Interval	Connector Contour	Primer Display
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Method

Contour Diamond Point
 V-Contour Chevron

Relief Rate

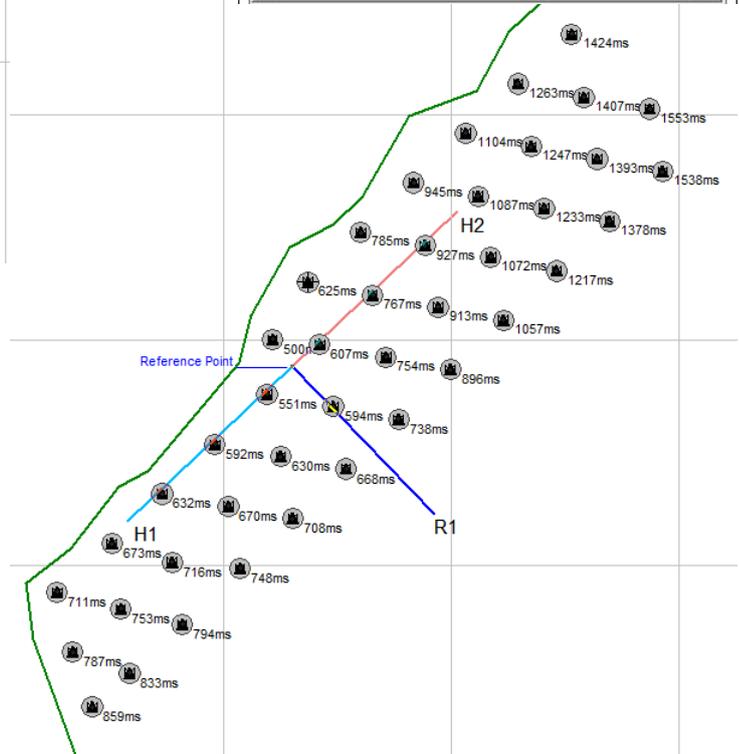
R1	10.00 ms/m	H1	10.00 ms/m
R2	10.00 ms/m	H2	10.00 ms/m

Calculation Time

Reference Point 250.00 ms
 Nearest Hole / Node

Minimum Time 500 ms

Marked Holes Unmarked Holes



Chain *single sequence of downhole delays, initiated by Firing Unit, connected by Chain Unit, control by system rules*

