Foreword

This chapter shall describe how to use *ispark* in a strict direct way in form of a simple example. If you only want to evaluate permissible C_o and L_o on the base of one known source characteristic it's not necessary to be charged with a lot of background information. If some is desired, please refer to the *ispark* operating instructions and supplements for further information.

Start *ispark*

Note: Text written in red here means an input is expected, green data depict results.

At start the introduction screen appears reminding this program's objectives and version information.

```
program ispark, version 6.2, 27.04.2016 ** DEMOVERSION ** copyright @ PTB 2002

Program for the proof of intrinsically safe circuits according to IEC 60079-11
by calculation based on a thermoelectrical model of the standardized spark
test apparatus

***DEMOVERSION USES A SYNTHETIC GASGROUP IIX, LOCATED BETWEEN IIC AND IIB!***

All your comments are very welcome, please contact:

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For news, please visit www.explosionsschutz.ptb.de, "TechnologieTransfer"

press any key

call actual DataFile?         (y/n)
```

Please note: support addresses are outdated since March 2021!

If you ever have worked with *ispark* within the actual directory, a file named DataFile.txt exists, which comprises the latest calculation results; for better remembering you may present it typing (y)es.

Note: You must close notepad before proceeding with ispark.

Fixed to IIX with demo version

First step: defining most basic defaults

The next screen is destined for declaration of zone, gasgroup and general properties of the actual source characteristic, which is the first step with *ispark's* course of action.

Note: The matter freewheeling is in depth explained in ispark's operating instructions, please do not wonder here.

With this introduced example, zone 1, the (n)ormal safety factor and gasgroup IIC is chosen, a (s)ingle (l)inear source characteristic with predetermined I_o and no freewheeling.

Note: With data input, eventually formerly defined values are predetermined and can be confirmed simply by pressing <enter>.

```
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first step: defining most basic defaults

zone 0 (0),zone 1 (1) or zone 2 (2)?                          zo 1
accept 10% less safety factor? (y/n)                          n
gasgroup II(C), II(B), II(A) or (I)?                          IIX
(s)ingle or (m)ultiple source?                                s
(l)inear, (r)ectangular, (t)rapezoidal or (a)ngular source?   l
source defined by (I)o or (R)i?                               I
freewheeling with(o)ut or directly in outpu(t)                o
```

Second step: define quantitative data

The second step prompts you to determine the electrically active data; for linear sources only two electrical parameters are possible, chosen here to be 28 V and 100 mA (a commonly used standard safety barrier type).

```
program ispark, version 6.2, 27.04.2016 ** DEMOVERSION ** copyright @ PTB 2002

second step: define quantitative data

open loop voltage          [V]:       28.000
short circuit current      [mA]:     100.000
```

If the required data are passed to *ispark*, it will do the following:

- Firstly the circuit is examined to be intrinsically safe itself with no reactive load at all; *ispark* then reports `'this source keeps the claimed safety factor'`. If this condition isn't met (`'this source misses the claimed safety factor'`), no further evaluation is possible with this global and quantitative data. In this case you are prompted to (c)ontinue and have to determine lower electrical data or (s)tart to choose a less demanding gasgroup.
- Secondly, a maximum permissible inductance L_{pms} is determined by *ispark*, resulting from spark type o-0C (opening without any capacitance), here to be 5.241 mH.
- The next seven steps calculate allowed capacitances for all different spark types each (please see *ispark's* supplement for relevant spark and connection types) taking account of just this L_{pms}. One can see from the displayed data, that the most severe spark in this case is of type s/o-2-p with a permissible value of 0.109 µF.
- Finally the minimum value of all this capacitances (0.109 µF) is determined and reported as C_{pms}; L_{pms} just is repeated.

Intermediate results based on L_{pms}

```
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second step: define quantitative data

open loop voltage          [V]:       28.000
short circuit current     [mA]:      100.000

intermediate results based on Lpms:

0 - this source keeps the claimed safety factor
X 0 Lpms according to spark type   o-0C    in mH :    5.241

X 0 Cpms according to spark type   s/o-1-s in uF :    0.260
X 0 Cpms according to spark type   s/o-2-s in uF :    0.114
X 0 Cpms according to spark type   s-s     in uF :    0.418
X 0 Cpms according to spark type   s-0L-s  in uF :    0.357

X 0 Cpms according to spark type   s/o-2-p in uF :    0.109
X 0 Cpms according to spark type   s-p     in uF :    0.455
X 0 Cpms according to spark type   s-0L-p  in uF :    0.355

Cpms summ. accord. to spark type   s/o-2-p in uF :    0.109
Lpms                                       in mH :    5.241

L(l)ist, (e)nd, (c)ontinue, new (s)tart or (i)nclude cable
```

Please keep in mind, that the results presented above are `'intermediate results based on Lpms'` only; you in fact may get a rough overview about ignition properties but the complex mutual influence of inductance and capacitance with spark ignition requires to evaluate the situation against smaller values of the inductance also.

This will be carried out if typing one of the letters L resp. (l)ist;

The other options will carry you back to define basic defaults (s)tart, determine different active electrical data (c)ontinue or end the program (e)nd at all.

All parameters and final results

You should use (l)ist here and a final output of *ispark* is generated. It comprises the predetermined data and the concluding results of the calculation. The latter are presented as a list of maximum permissible C_o and L_o as pairs in a decreasing 5, 2, 1 manner with L_o.

```
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all parameters and final results

zone    : 1
gasgroup: IIX
source  : linear

Uo       [V]=   28.000
Io      [mA]=  100.000
freewheeling: without

Lo[mH]   5.200    -       -       -       -      5.000   2.000   1.000   0.500
Co[uF]   0.110    -       -       -       -      0.110   0.130   0.160   0.190

Lo[mH]   0.200   0.100   0.050   0.020   0.010   0.005   0.002   0.001
Co[uF]   0.232   0.232   0.232   0.232   0.232   0.232   0.232   0.232

interpolate Co?               (y/n)
```

Please note, that always L_o/C_o pairs are delivered as results, for example 5 mH and 0.110 µF.

If you prefer to use an L_o not comprised of the given list you may determine a different one and get an interpolated result for C_o.

The result with 0.3 mH for example is 0.230 µF:

```
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all parameters and final results

zone    : 1
gasgroup: IIX
source  : linear

Uo       [V]=   28.000
Io      [mA]=  100.000
freewheeling: without

Lo[mH]   5.200    -       -       -       -      5.000   2.000   1.000   0.500
Co[uF]   0.110    -       -       -       -      0.110   0.130   0.160   0.190

Lo[mH]   0.200   0.100   0.050   0.020   0.010   0.005   0.002   0.001
Co[uF]   0.232   0.232   0.232   0.232   0.232   0.232   0.232   0.232

interpolate Co?               (y/n)
alternative Lo in mH         :        5.200   0.3
rounded Lo in mH is          :        0.300
interpolated Co in uF is     :        0.230

interpolate Co?               (y/n)
```

Your actual source circuit then is calculated to be safe including a reactive load of up to 0.3 mH and 0.230 µF irrespective of their arrangement within a circuit block only fed from this source.

You may continue with another L_o to undergo interpolation and if not, you are offered to call the file DataFile via the Windows notepad.

Datafile

With this example, the file DataFile.txt looks like:

```
program ispark, version 6.2, 27.04.2016 ** DEMOVERSION ** copyright @ PTB 2002

zone    : 1
gasgroup: IIX
source  : linear

Uo       [V]=   28.000
Io      [mA]=  100.000
freewheeling: without

Lo[mH]   5.200    -       -       -       -      5.000   2.000   1.000   0.500
Co[uF]   0.110    -       -       -       -      0.110   0.130   0.160   0.190

Lo[mH]   0.200   0.100   0.050   0.020   0.010   0.005   0.002   0.001
Co[uF]   0.232   0.232   0.232   0.232   0.232   0.232   0.232   0.232

actual Lo:   0.300 [mH]; actual Co:    0.230 [uF]
```

Using the common Windows capabilities, the content may copied and pasted to a further document or be saved and archived with a different filename at any convenient location.

Note: You must close notepad before proceeding with ispark.

And if you want to (e)nd, (c)ontinue or have a new (s)tart as described on the last page:

```
(e)nd, (c)ontinue or new (s)tart
```