

Material & Load Curve Encryption Tool



About



- This Oasys PRIMER tool is for encrypting *MATERIAL and *DEFINE_CURVE keywords for LS-DYNA.
- The tool allows you to choose between partially and fully encrypting a keyword.
- The tool works on models with multiple include files.
- Encrypted keywords can be used by both LS-DYNA and PRIMER.



Setup



GnuPG

- This tool needs an external software to perform the encryption.
- An example is the open-sourced, [GPLv3](#) licensed software GnuGP (or GPG).
- You can visit <https://gnupg.org/> to download GPG for your system.

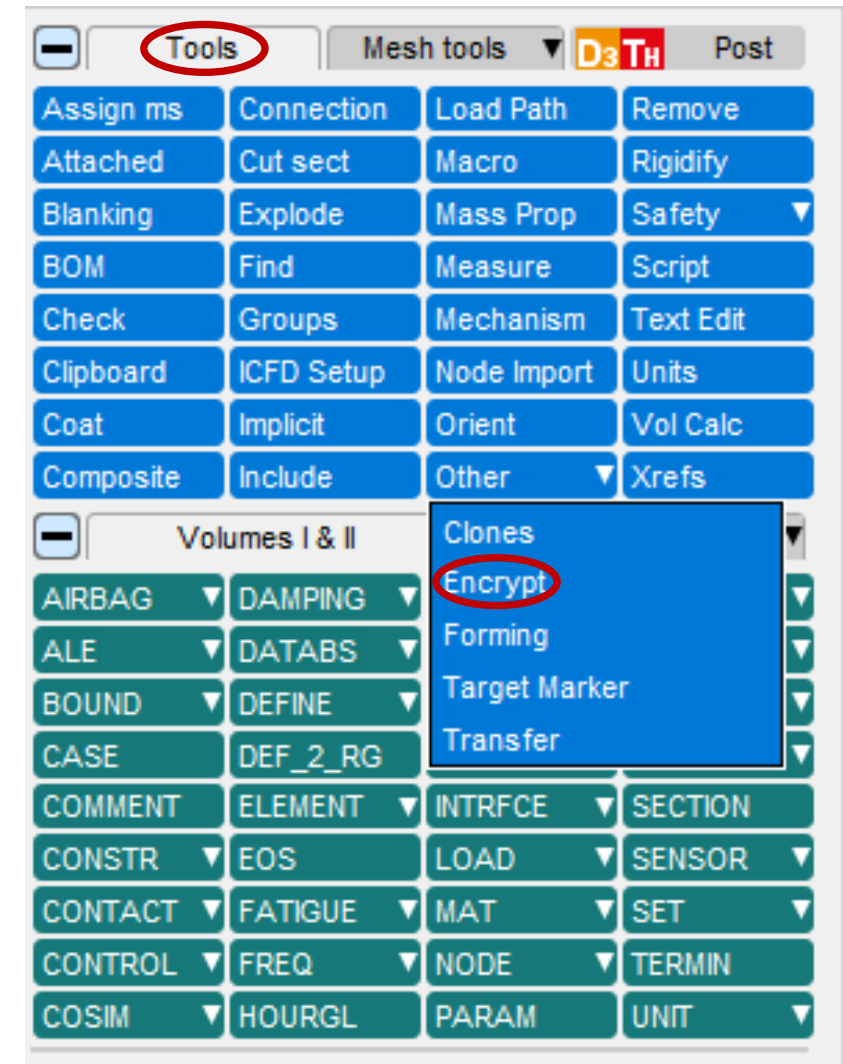


The First Step



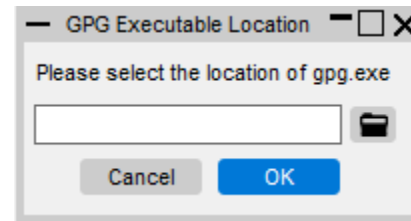
Run

- To run the tool go to the tools tab > other > encrypt.



gpg executable file

- First, you must already have the model you wish to encrypt open in PRIMER.
- You will be asked to select the location of the gpg executable file (e.g. *gpg.exe* in Windows or *gpg* in Linux) if the tool can not find it automatically.



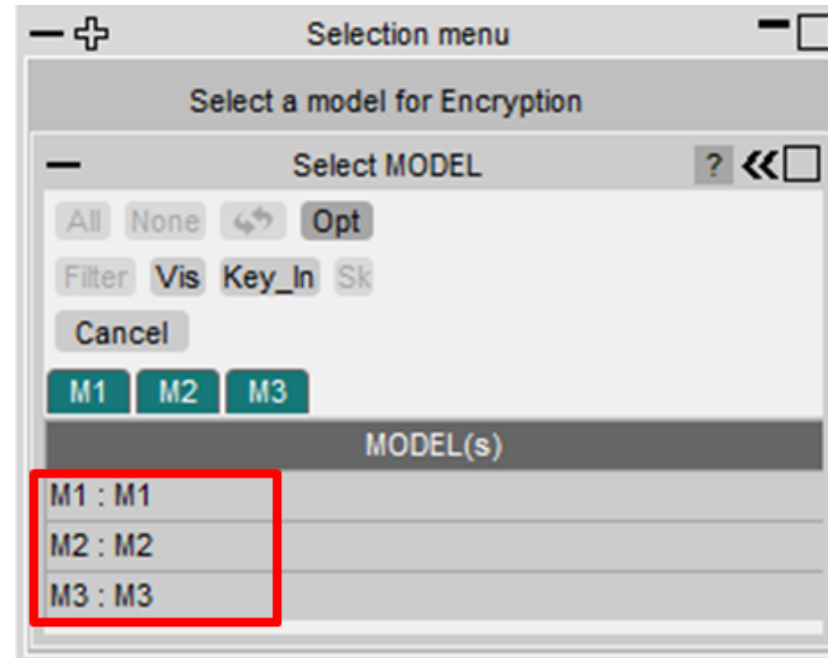
 **gpg.exe**

/usr/bin/gpg



Model Selection

- If you have multiple models open in PRIMER you will be asked to select a model for encryption.

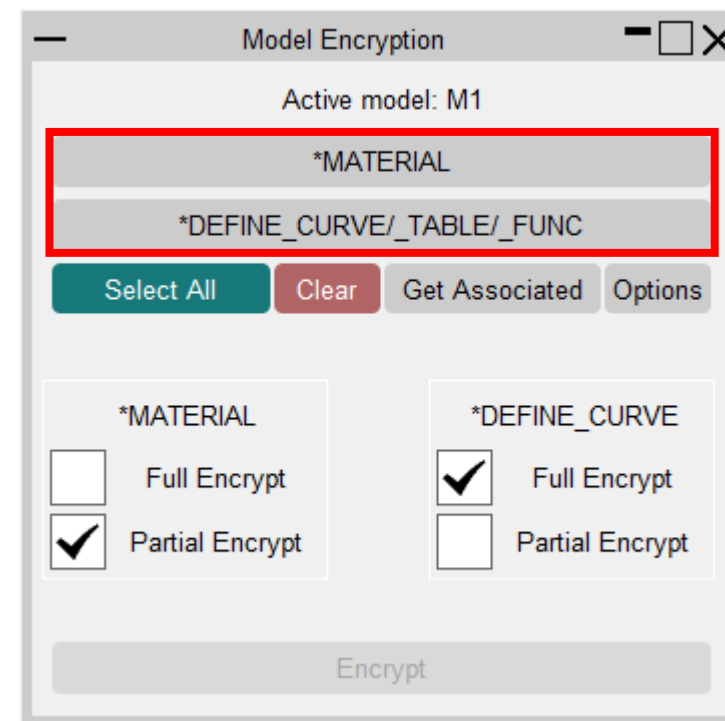
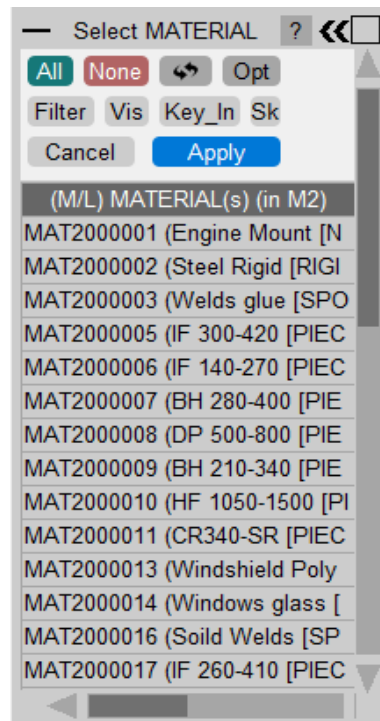
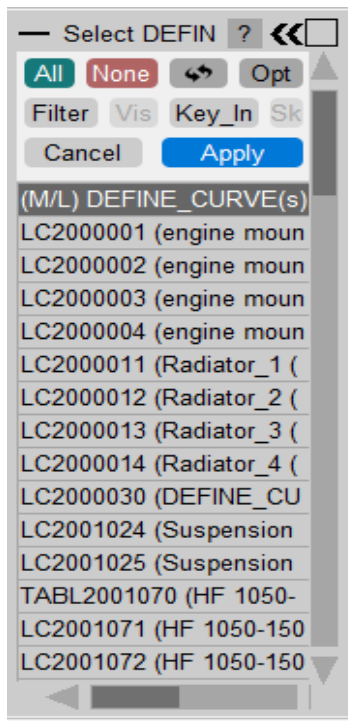


Selecting Materials and Load Curves



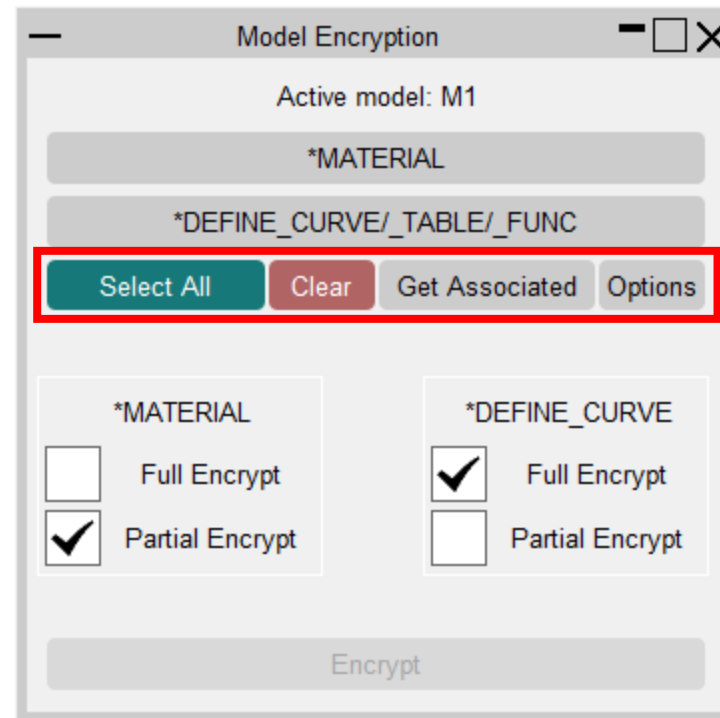
Manual Selection

- Use the buttons at the top of the panel to select the MATERIALs and DEFINE_CURVEs in the model you wish to encrypt.



Select All, Get Associated, Clear and Options

- Select All: Selects all of the MATERIALs and DEFINE_CURVEs within the model
- Get Associated: Selects all of the DEFINE_CURVES that are associated with the currently selected MATERIAL (i.e. referenced).
- Clear: This removes all the selected MATERIALs and DEFINE_CURVEs.
- Options: Opens the Options menu.



Options

- Encryption Keys:
 - 1024bit LSTC (Default):
 - This is the standard LSTC encryption key and is chosen by default.
 - 2048bit LSTC:
 - This is the double-strength LSTC encryption key. Note that this encryption key will create ~double the encrypted file size.
 - R6 LSTC Legacy:
 - This is the old legacy LSTC encryption key, meant only for older versions of LS-DYNA e.g. R6.

Encryption Options

Encryption Key Options

Encryption Key: 1024bit LSTC (Default)

Partial Encryption Options

☐ Append *MATERIAL Info In Title

Encryption Start Line: 2

Full Encryption Options

☒ Create Extra Data

☐ Do Not Create Extra Data

☐ Remove Title

☐ Convert All Materials Into *MAT_ELASTIC

☐ Preset Data For *MAT_ELASTIC

Density: 7.8e-9

Young's Modulus: 210000

Poisson's Ratio: 0.3

PGP Comment Options

☐ Enable Comment Line

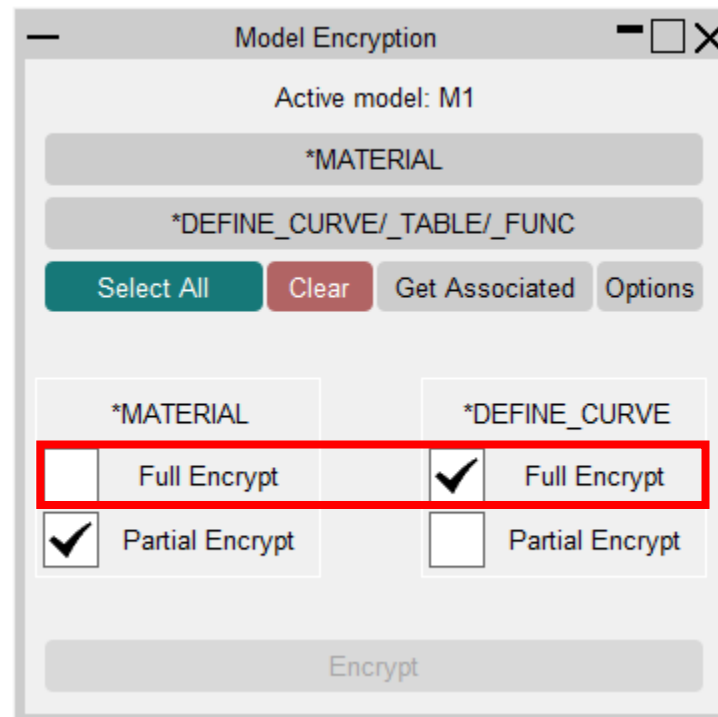
VENDOR OPTIONS CANCEL APPLY

Full Encryption



Full Encryption

- Full encryption means the whole selected keyword(s) are encrypted, including the title and the material type.
- When writing the model. the encrypted text data is included at the end of the file.
- Full encryption works with multiple include files and will include the encrypted text data at the end of the file in which the original keyword is located.



Example of Encrypted Text Data

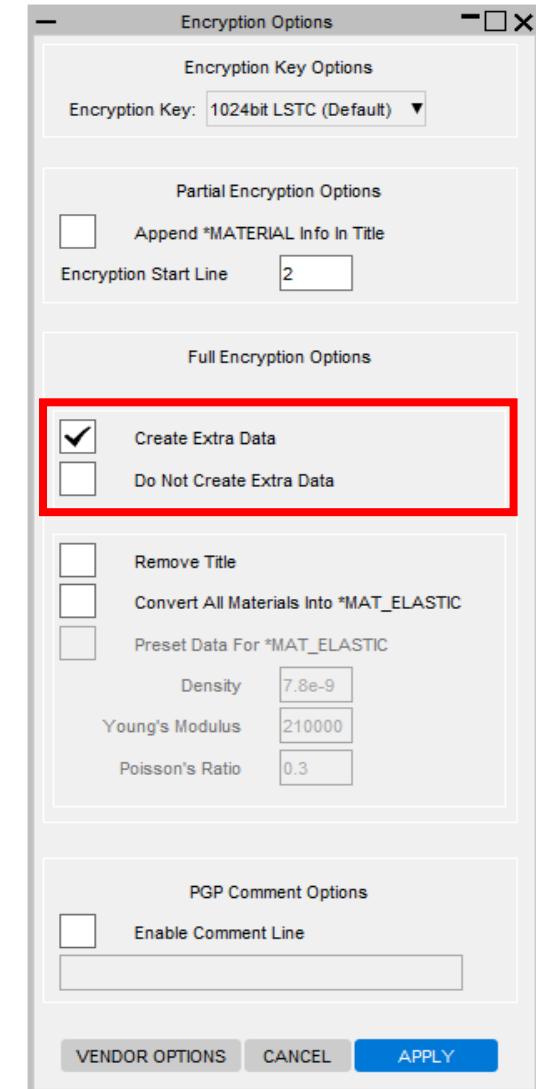
-----BEGIN PGP MESSAGE-----

```
hQEOAx24cNFeERoiEAP+IsFpyYre40SfNxTWOQcglbQ9sxGebgbkDlYRYBt8pVd7
nj6oSLHMiR8sNgDyR+vicZbmTpaVSRQL+9eFrvEyq5lUguCxxKkLwdq5+ndBJv4D
QvBgY9yn2CfiBIiZZKhvzKl9B0j+AIIdFzz0OhcBlW5gNc4UAE/MSEDcoSomi4m4E
ANcDM5aBLJue5d7wQmdP9lqUbwuyQwC004qHEiPDUd7APTue679pdrIQNW4OnWOU
HuOtFS2rbcY8+UpHQMtIlo2ocQaZabfF89oWunx2xsq5SwxX6SV9V8crt5rSN9jP
Cl0EbaGs4/5pdfc7vB8yT6b4iiRl6kaunr8uIDuedjroybmQRqmbCofNq39b4C5d
E/yBBokwzjn64uH9IlHfaBvKNsu7wqle5u4v3V8lrH0v6ABkYUhq4lkGqY30sBB+
lfZybcUuSoRuvzSBMmI3/bLySZIeKTaZ0Ifb0kkzGUOFSLMm+oWLDg2i3tPxAEoh
DL3G2g5g4HO14DhWZDRrXiIS0raJenYNITRI+qiHivyOLanSNU/cEE5xCpXnI9KA
mKljIQDgWV86JtTY2bg8HLkaexlCxCKW56sJJg==
=qpNl
```

-----END PGP MESSAGE-----

*END Data

- *END Data is extra data that is written after the keyword *END.
- The data is not processed by LS-DYNA and is only used by PRIMER for users' convenience.
- *END Data is only available for full encryption.
- This extra data contains basic material information, without exposing the whole material card. PRIMER will then use this basic information in enhanced functionalities such as model checking and mass calculations.
- This extra data is enclosed within *ENCRYPTED_START and *ENCRYPTED_END lines.
- If you do not want the extra data to be created then select "Do Not Create Extra Data"
- *END Data for *DEFINE_FUNC is currently not created however the keyword will be encrypted normally



The screenshot shows the 'Encryption Options' dialog box. It is divided into several sections: 'Encryption Key Options' with a dropdown set to '1024bit LSTC (Default)'; 'Partial Encryption Options' with an unchecked 'Append *MATERIAL Info In Title' checkbox and an 'Encryption Start Line' set to 2; 'Full Encryption Options' which contains a red-bordered box with two options: 'Create Extra Data' (checked) and 'Do Not Create Extra Data' (unchecked); and 'PGP Comment Options' with an unchecked 'Enable Comment Line' checkbox. At the bottom are buttons for 'VENDOR OPTIONS', 'CANCEL', and 'APPLY'. The 'Density' field is set to 7.8e-9, 'Young's Modulus' to 210000, and 'Poisson's Ratio' to 0.3.

Extra Data Options

- Remove Title: Removes the title from the *END data
- Convert All Materials into *MAT_ELASTIC: This option changes the type of material into MAT_ELASTIC and is useful if you wish to hide the type of material that has been. If unticked the extra data will use the original *MATERIAL type
- Preset Data For *MAT_ELASTIC: Changes the density, Young's modulus and Poisson's ratio to values determined by the user. If unticked the density, Young's modulus and Poisson's ratio will be unchanged from the original unencrypted material.

Encryption Options

Encryption Key Options

Encryption Key: 1024bit LSTC (Default)

Partial Encryption Options

☐ Append *MATERIAL Info In Title

Encryption Start Line: 2

Full Encryption Options

☒ Create Extra Data

☐ Do Not Create Extra Data

☐ Remove Title

☐ Convert All Materials Into *MAT_ELASTIC

☐ Preset Data For *MAT_ELASTIC

Density: 7.8e-9

Young's Modulus: 210000

Poisson's Ratio: 0.3

PGP Comment Options

☐ Enable Comment Line

VENDOR OPTIONS CANCEL APPLY

*END Data Example

- The data includes basic info such as the encrypted material's ID, Density, Young's Modulus and Poisson's Ratio.

```
$ =====  
$ ENCRYPTED cards (simplistic info for encrypted items in main deck)  
$ =====  
$  
*ENCRYPTED_START  
$  
*MAT_PLASTIC_KINEMATIC_TITLE  
(Encrypted) subframe mount - nofail  
    2001019    7.89E-9    200000.0        0.3  
$  
$  
*ENCRYPTED_END  
$
```

Partial Encryption



Partial Encryption

- Partial Encrypt means that only some of the chosen item is encrypted.
- The encrypted text data is written directly below the unencrypted part of the keyword definition.
- Use this option to encrypt the bulk of the material data, but leave the material type, title and basic material properties human-readable.

```
$
*MAT_RIGID
| 3 7.85E-9 210.0 0.3 0.0 0.0 0.0
$
-----BEGIN PGP MESSAGE-----

hQE0Ax24cNFeERoiEAP/epcIuBhIJzqW/A3ihqKBat6EoXEBc1LBZI5t0mDWteyT
fGdbqWwNI9ZfDx01mF5r3EjHXDoi+TSEjOxidS9Fwi2fk+008hiiiMeufy5Vi22g
H/SWtpQiwNm+nfnp9VRZ/IULvzYHX2gXBg4qzCiFGfBw0JvgLod16Y1r5zfiv00D
/Apv31R22r+jSH57V/feX5xSS+LLqMmFPLvb8wT450hegHp2RkILMMmyA6kfa0Ji
gsxWwZWzfVtENoZu7A0ZqGKBiIBnZFPgVRqJ0fTWmM6Gw4JEDkDIw11HEK/JMjJj
Qj/bwxTrX3gV8svEv0YHbIgLvpiRw71CcDYY2mFVD7ELyYIPpl8oS+NdBg/SYYXB
vvAznaw00Sn09kkK4vC5UzkWBYaKbHYcIhVdZ5KbbiJjazR5KsNZBPzCbZBZpcsM
T8uP5Lj3c+qTSQSCQz/gtcaJWZ01rQkZ8CeG0bAkGQuMz5+m8BsXtr9+A/y+cbLE
fkSgw9SMR9DcttHXl6EJDxhYbYe
=pSA5
-----END PGP MESSAGE-----
$
```

Model Encryption

Active model: M1

*MATERIAL

*DEFINE_CURVE/_TABLE/_FUNC

Select All Clear Get Associated Options

*MATERIAL	*DEFINE_CURVE
<input type="checkbox"/> Full Encrypt	<input checked="" type="checkbox"/> Full Encrypt
<input checked="" type="checkbox"/> Partial Encrypt	<input type="checkbox"/> Partial Encrypt

Encrypt

Partial Material Encryption Options

- Append Info In Title: The density, Young's modulus, and Poisson's ratio will be written in the title of the material. PRIMER can again use this information internally for functionality such as checking and mass calculation. (Requires Encrypt Title not to be selected).
- Append Info In Title only works with material types Null, Elastic and Rigid.

Encryption Options

Encryption Key Options

Encryption Key: 1024bit LSTC (Default) ▼

Partial Encryption Options

☐ Append *MATERIAL Info In Title

Encryption Start Line: 2

Full Encryption Options

☒ Create Extra Data

☐ Do Not Create Extra Data

☐ Remove Title

☐ Convert All Materials Into *MAT_ELASTIC

☐ Preset Data For *MAT_ELASTIC

Density: 7.8e-9

Young's Modulus: 210000

Poisson's Ratio: 0.3

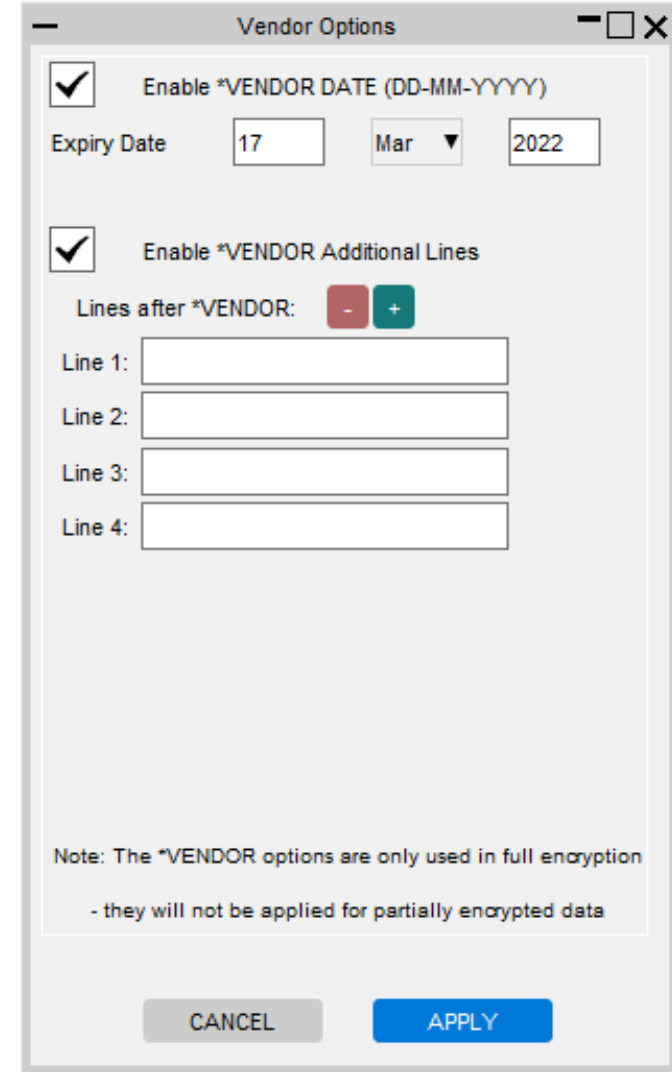
PGP Comment Options

☐ Enable Comment Line

VENDOR OPTIONS CANCEL APPLY

*VENDOR options

- You can create an expiry date of your choosing by enabling *VENDOR DATE. Keywords encrypted with the *VENDOR option will expire at the specify date.
- When the keyword expires the model will no t run in LS-DYNA.
- You can use additional lines option to add up to 9 comments into the PGP Encrypted text. These comments are only shown when the license expires



The screenshot shows the 'Vendor Options' dialog box. It has two main sections, both with checked checkboxes. The first section is 'Enable *VENDOR DATE (DD-MM-YYYY)' with an 'Expiry Date' field set to '17', a month dropdown set to 'Mar', and a year field set to '2022'. The second section is 'Enable *VENDOR Additional Lines' with a 'Lines after *VENDOR:' field set to '1' (between minus and plus buttons) and four empty text input fields labeled 'Line 1:', 'Line 2:', 'Line 3:', and 'Line 4:'. At the bottom, there is a note: 'Note: The *VENDOR options are only used in full encryption - they will not be applied for partially encrypted data'. Below the note are 'CANCEL' and 'APPLY' buttons.

Vendor Options

☒ Enable *VENDOR DATE (DD-MM-YYYY)

Expiry Date: 17 Mar 2022

☒ Enable *VENDOR Additional Lines

Lines after *VENDOR: - +

Line 1:

Line 2:

Line 3:

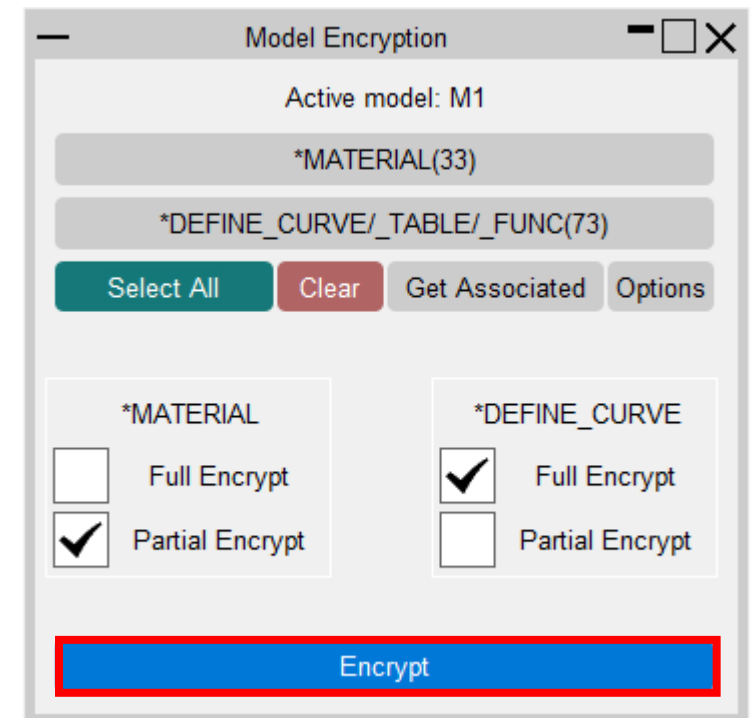
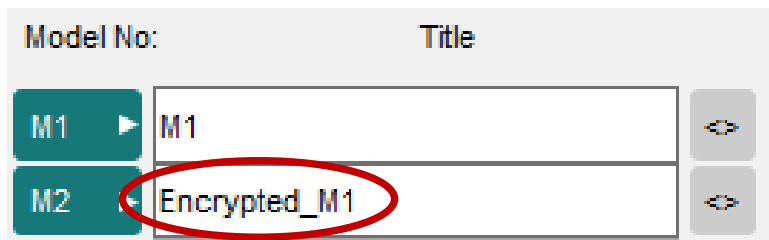
Line 4:

Note: The *VENDOR options are only used in full encryption
- they will not be applied for partially encrypted data

CANCEL APPLY

Encrypt

- Once you have chosen at least one material or load curve the Encrypt button will become active.
- When clicked, the tool will create a copy of the original model in PRIMER and will replace the chosen materials and/or load curves with their encrypted counterparts.
- The encrypted model will be a new model number in PRIMER, and can be written out in the usual way.



Additional Notes

- The encrypted data (which uses LSTC encryption key) can only be decrypted and read by LS-DYNA.
- Oasys PRIMER is not able to decrypt the encrypted data. However, it can use the *END Data info (see previous slides [here](#) and [here](#)), where available, for some of its enhanced functionalities such as model checking and mass calculations, for the convenience of PRIMER users.
- If you lose/delete your original unencrypted keyword file, there is no way to recover it from the encrypted file. Please be careful with your file management.



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