GetCircuitSuperoperator

```
SetDirectory @ NotebookDirectory[];
Import["../Link/QuESTlink.m"];
CreateLocalQuESTEnv["../quest_link"];
```

Doc

? GetCircuitSuperoperator

> Symbol
>
> GetCircuitSuperoperator[circuit] returns the corresponding
>   superoperator circuit upon doubly–many qubits as per the Choi–Jamiolkowski
>   isomorphism. Decoherence channels become Matr[] superoperators.
> GetCircuitSuperoperator[circuit, numQubits] forces the circuit to be assumed
>   size numQubits, so that the output superoperator acts upon 2∗numQubits.
> GetCircuitSuperoperator accepts optional argument AssertValidChannels.
> ⌄

? AssertValidChannels

> Symbol
>
> Optional argument to functions like CalcCircuitMatrix, CalcPauliTransferMatrix,
>   GetCircuitConjugated, etc, specifying whether to simplify their outputs by asserting
>   that all channels therein are completely–positive and trace–preserving (default True).
> For example, this asserts that the symbolic argument to a
>   damping channel is constrained between 0 and 1 (inclusive), and that the
>   parameters of canonical parameterised gates (like Rx) are strictly real.
> Specifying AssertValidChannels–>False will not change the dimension of
>   the outputs (i.e. the returned objects would be applied upon states in the same
>   fashion), but will disable symbolic simplifications therein, and is necessary to obtain
>   correct expressions when all symbolic parameters are permitted to be complex.
> ⌄

Correctness

```
(* this method can only test when AssertValidChannels → True (default),
   and when all gate parameters are given numeric values *)
test[circ_, subs_:{}] := Module[
    {n, in, out, sup, ρ, err},
    n = 1 + Max @ GetCircuitQubits @ circ;
    in = RandomComplex[{-1-ⅈ,1+ⅈ}, {2^n,2^n}];
    ρ = SetQuregMatrix[CreateDensityQureg[n], in];
    ApplyCircuit[ρ, circ /. subs];
    sup = GetCircuitSuperoperator[circ];
    out = CalcCircuitMatrix[sup /. subs, 2 n] . Flatten @ Transpose @ in;
    err = Flatten @ Transpose @ GetQuregState[ρ] - out // N // Abs // Max // Chop;
    Echo[sup, "output: "];
    Echo[err, "error: "];
    If[err =!= 0 && err =!= 0., Style["ERRONEOUS SUPEROPERATOR!", Red]]]
```

Gates

Uncontrolled

test @ H_2

» output: $\{H_2, H_5\}$

» error: 0

test @ Id_2

» output: $\{Id_2, Id_5\}$

» error: 0

test @ S_2

» output: $\left\{S_2, Ph_5\left[-\frac{\pi}{2}\right]\right\}$

» error: 0

test @ T_1

» output: $\left\{T_1, Ph_3\left[-\frac{\pi}{4}\right]\right\}$

» error: 0

test @ $SWAP_{0,1}$

» output: $\{SWAP_{0,1}, SWAP_{2,3}\}$

» error: 0

```
test @ X₀
test @ Y₁
test @ Z₂
```

» output: $\{X_0, X_1\}$

» error: 0

» output: $\{Y_1, U_3[\{\{0, i\}, \{-i, 0\}\}]\}$

» error: 0

» output: $\{Z_2, Z_5\}$

» error: 0

```
test[Ph₁,₃,₀[x], x → RandomReal[]]
```

» output: $\{Ph_{1,3,0}[x], Ph_{5,7,4}[-x]\}$

» error: 0

```
test[R[x, X₀ X₁ Z₂], x → RandomReal[]]
test[R[x, Y₀ Y₁ Z₂], x → RandomReal[]]
test[R[x, X₀ Y₁ Z₂], x → RandomReal[]]
```

» output: $\{R[x, X_0 X_1 Z_2], R[-x, X_3 X_4 Z_5]\}$

» error: 0

» output: $\{R[x, Y_0 Y_1 Z_2], R[-x, Y_3 Y_4 Z_5]\}$

» error: 0

» output: $\{R[x, X_0 Y_1 Z_2], R[x, X_3 Y_4 Z_5]\}$

» error: 0

```
test[Rx₀[x], x → RandomReal[]]
test[Rx₀,₂,₃[x], x → RandomReal[]]
test[Ry₀[x], x → RandomReal[]]
test[Ry₀,₂,₃[x], x → RandomReal[]]
test[Rz₀[x], x → RandomReal[]]
test[Rz₀,₂,₃[x], x → RandomReal[]]
```

» output: $\{Rx_0[x], Rx_1[-x]\}$

» error: 0

» output: $\{Rx_{0,2,3}[x], Rx_{4,6,7}[-x]\}$

» error: 0

» output: $\{Ry_0[x], Ry_1[x]\}$

» error: 0

» output: $\{Ry_{0,2,3}[x], Ry_{4,6,7}[x]\}$

» error: 0

» output: $\{Rz_0[x], Rz_1[-x]\}$

» error: 0

» output: $\{Rz_{0,2,3}[x], Rz_{4,6,7}[-x]\}$

» error: 0

test @ $U_{0,1}$ @ RandomVariate @ CircularUnitaryMatrixDistribution @ 4

» output: $\{U_{0,1}[\{\{0.181902 + 0.219331\,i,$
$-0.508232 + 0.0095965\,i, 0.205379 + 0.633037\,i, -0.427538 - 0.186302\,i\},$
$\{-0.345852 - 0.565724\,i, -0.684023 - 0.0271223\,i, -0.0370904 - 0.28199\,i,$
$-0.0153565 - 0.10291\,i\}, \{0.187056 + 0.504434\,i, -0.433917 - 0.20901\,i,$
$-0.233328 - 0.340244\,i, -0.00833779 + 0.555257\,i\}, \{-0.287874 - 0.326854\,i,$
$0.107756 - 0.171478\,i, -0.143546 + 0.534206\,i, 0.00331872 + 0.680651\,i\}\}],$
$U_{2,3}[\{\{0.181902 - 0.219331\,i, -0.508232 - 0.0095965\,i, 0.205379 - 0.633037\,i,$
$-0.427538 + 0.186302\,i\}, \{-0.345852 + 0.565724\,i,$
$-0.684023 + 0.0271223\,i, -0.0370904 + 0.28199\,i, -0.0153565 + 0.10291\,i\},$
$\{0.187056 - 0.504434\,i, -0.433917 + 0.20901\,i, -0.233328 + 0.340244\,i,$
$-0.00833779 - 0.555257\,i\}, \{-0.287874 + 0.326854\,i,$
$0.107756 + 0.171478\,i, -0.143546 - 0.534206\,i, 0.00331872 - 0.680651\,i\}\}]\}$

» error: 0

test @ $UNonNorm_{0,1}$ @ RandomComplex[{-1 - i, 1 + i}, {4, 4}]

» output:
$\{UNonNorm_{0,1}[\{\{-0.511282 + 0.248489\,i, -0.633082 - 0.195985\,i, -0.121728 + 0.180578\,i,$
$0.976429 + 0.549827\,i\}, \{-0.138027 - 0.106615\,i, 0.128053 - 0.336605\,i,$
$-0.0617404 - 0.856429\,i, -0.13735 - 0.111372\,i\},$
$\{0.203453 - 0.173808\,i, 0.944329 + 0.29189\,i, -0.906104 - 0.308604\,i,$
$0.739776 - 0.960591\,i\}, \{-0.641016 + 0.752223\,i, 0.131106 - 0.156225\,i,$
$-0.0873335 - 0.997022\,i, 0.91434 - 0.810842\,i\}\}],$
$UNonNorm_{2,3}[\{\{-0.511282 - 0.248489\,i, -0.633082 + 0.195985\,i,$
$-0.121728 - 0.180578\,i, 0.976429 - 0.549827\,i\}, \{-0.138027 + 0.106615\,i,$
$0.128053 + 0.336605\,i, -0.0617404 + 0.856429\,i, -0.13735 + 0.111372\,i\},$
$\{0.203453 + 0.173808\,i, 0.944329 - 0.29189\,i, -0.906104 + 0.308604\,i,$
$0.739776 + 0.960591\,i\}, \{-0.641016 - 0.752223\,i, 0.131106 + 0.156225\,i,$
$-0.0873335 + 0.997022\,i, 0.91434 + 0.810842\,i\}\}]\}$

» error: 0

Controlled

GetCircuitSuperoperator @ C_1 @ H_2

$\{C_1[H_2], C_4[H_5]\}$

test @ C_0 @ Id_2

» output: $\{C_0[Id_2], C_3[Id_5]\}$

» error: 0

test @ C_1 @ S_2

» output: $\left\{C_1[S_2], C_4\left[Ph_5\left[-\frac{\pi}{2}\right]\right]\right\}$

» error: 0

test @ $C_{0,2}$ @ T_1

» output: $\left\{ C_{0,2}[T_1], C_{3,5}\left[Ph_4\left[-\frac{\pi}{4}\right]\right]\right\}$

» error: 0

test @ C$_{2,3}$@SWAP$_{0,1}$

» output: $\left\{C_{2,3}\left[SWAP_{0,1}\right], C_{6,7}\left[SWAP_{4,5}\right]\right\}$

» error: 0

test @ C$_{1,2,3}$ @ X$_0$
test @ C$_2$@Y$_1$
test @ C$_3$@Z$_2$

» output: $\left\{C_{1,2,3}[X_0], C_{5,6,7}[X_4]\right\}$

» error: 0

» output: $\{C_2[Y_1], C_5[U_4[\{\{0, i\}, \{-i, 0\}\}]]\}$

» error: 0

» output: $\{C_3[Z_2], C_7[Z_6]\}$

» error: 0

test$\left[C_{2,4}$@Ph$_{1,3,0}$[x], x → RandomReal[]$\right]$

» output: $\left\{C_{2,4}\left[Ph_{1,3,0}[x]\right], C_{7,9}\left[Ph_{6,8,5}[-x]\right]\right\}$

» error: 0

test[C$_3$@R[x, X$_0$ X$_1$ Z$_2$], x → RandomReal[]]
test[C$_{3,4}$@R[x, Y$_0$ Y$_1$ Z$_2$], x → RandomReal[]]
test[C$_3$@R[x, X$_0$ Y$_1$ Z$_2$], x → RandomReal[]]

» output: $\{C_3[R[x, X_0 X_1 Z_2]], C_7[R[-x, X_4 X_5 Z_6]]\}$

» error: 0

» output: $\left\{C_{3,4}[R[x, Y_0 Y_1 Z_2]], C_{8,9}[R[-x, Y_5 Y_6 Z_7]]\right\}$

» error: 0

» output: $\{C_3[R[x, X_0 Y_1 Z_2]], C_7[R[x, X_4 Y_5 Z_6]]\}$

» error: 0

test$\left[C_{1,2}$@ Rx$_0$[x], x → RandomReal[]$\right]$
test$\left[C_1$@Rx$_{0,2,3}$[x], x → RandomReal[]$\right]$
test$\left[C_{1,2,3}$@ Ry$_0$[x], x → RandomReal[]$\right]$
test$\left[C_1$@ Ry$_{0,2,3}$[x], x → RandomReal[]$\right]$
test$\left[C_{1,2,3}$@Rz$_0$[x], x → RandomReal[]$\right]$
test$\left[C_{1,4}$@Rz$_{0,2,3}$[x], x → RandomReal[]$\right]$

» output: $\{C_{1,2}[Rx_0[x]], C_{4,5}[Rx_3[-x]]\}$

» error: 0

» output: $\{C_1[Rx_{0,2,3}[x]], C_5[Rx_{4,6,7}[-x]]\}$

» error: 0

» output: $\{C_{1,2,3}[Ry_0[x]], C_{5,6,7}[Ry_4[x]]\}$

» error: 0

» output: $\{C_1[Ry_{0,2,3}[x]], C_5[Ry_{4,6,7}[x]]\}$

» error: 0

» output: $\{C_{1,2,3}[Rz_0[x]], C_{5,6,7}[Rz_4[-x]]\}$

» error: 0

» output: $\{C_{1,4}[Rz_{0,2,3}[x]], C_{6,9}[Rz_{5,7,8}[-x]]\}$

» error: 0

test @ $C_{2,3}$@ $U_{0,1}$@ RandomVariate @ CircularUnitaryMatrixDistribution @ 4

» output: $\{C_{2,3}[$

$U_{0,1}[\{\{-0.0506663 + 0.299448\,i, -0.178197 + 0.789933\,i, 0.29792 + 0.0345961\,i, 0.216312 +$
$0.339517\,i\}, \{-0.37405 + 0.226039\,i, 0.301695 - 0.150532\,i, -0.517628 - 0.0356516\,i,$
$0.105163 + 0.644239\,i\}, \{0.00784152 - 0.482321\,i, 0.300719 + 0.300631\,i,$
$-0.167931 + 0.73856\,i, -0.109945 + 0.0270907\,i\}, \{0.637247 - 0.279245\,i,$
$-0.0280165 - 0.221306\,i, 0.253307 - 0.0547739\,i, -0.0105128 + 0.631587\,i\}\}]],$

$C_{6,7}[U_{4,5}[\{\{-0.0506663 - 0.299448\,i, -0.178197 - 0.789933\,i, 0.29792 - 0.0345961\,i,$
$0.216312 - 0.339517\,i\}, \{-0.37405 - 0.226039\,i, 0.301695 + 0.150532\,i,$
$-0.517628 + 0.0356516\,i, 0.105163 - 0.644239\,i\},$
$\{0.00784152 + 0.482321\,i, 0.300719 - 0.300631\,i, -0.167931 - 0.73856\,i,$
$-0.109945 - 0.0270907\,i\}, \{0.637247 + 0.279245\,i, -0.0280165 + 0.221306\,i,$
$0.253307 + 0.0547739\,i, -0.0105128 - 0.631587\,i\}\}]]\}$

» error: 0

test @ $C_{2,3}$@UNonNorm$_{0,1}$@ RandomComplex[{-1 - i, 1 + i}, {4, 4}]

» output:
$\{C_{2,3}[UNonNorm_{0,1}[\{\{0.0508448 + 0.720073\,i, -0.585396 + 0.256124\,i, 0.725307 - 0.446057\,i,$
$-0.384357 - 0.363043\,i\}, \{0.10545 + 0.582045\,i,$
$0.16316 - 0.343721\,i, 0.424913 + 0.637291\,i, 0.765014 - 0.709477\,i\},$
$\{0.50184 + 0.700342\,i, 0.975469 - 0.318192\,i, -0.932429 - 0.834725\,i,$
$0.662282 - 0.238005\,i\}, \{-0.366955 - 0.95043\,i, 0.112315 + 0.844756\,i,$
$0.0760064 + 0.00691771\,i, -0.0920667 + 0.29749\,i\}\}]],$

$C_{6,7}[UNonNorm_{4,5}[\{\{0.0508448 - 0.720073\,i, -0.585396 - 0.256124\,i,$
$0.725307 + 0.446057\,i, -0.384357 + 0.363043\,i\}, \{0.10545 - 0.582045\,i,$
$0.16316 + 0.343721\,i, 0.424913 - 0.637291\,i, 0.765014 + 0.709477\,i\},$
$\{0.50184 - 0.700342\,i, 0.975469 + 0.318192\,i, -0.932429 + 0.834725\,i,$
$0.662282 + 0.238005\,i\}, \{-0.366955 + 0.95043\,i, 0.112315 - 0.844756\,i,$
$0.0760064 - 0.00691771\,i, -0.0920667 - 0.29749\,i\}\}]]\}$

» error: 0

Special

```
test[{G[x], Id₀}, x → RandomReal[]]
```

» output: $\{Id_0, Id_1\}$

» error: 0

```
test[{Fac[x], Id₀}, x → RandomReal[]]
```

» output: $\{Fac[x], Id_0, Id_1\}$

» error: 0

```
test[Matr₀[{{1, 2}, {3, 4}}]]
```

» output: $\{Matr_0[\{\{1, 2\}, \{3, 4\}\}]\}$

» error: 0

Channels

```
test[Damp₀[x], x → .2]
```

» output: $\left\{Matr_{0,1}\left[\left\{\{1, 0, 0, x\}, \left\{0, \sqrt{1-x}, 0, 0\right\}, \left\{0, 0, \sqrt{1-x}, 0\right\}, \{0, 0, 0, 1-x\}\right\}\right]\right\}$

» error: 0

```
test[Deph₀[x], x → .1]
test[Deph₁,₂[x], x → .4]
```

» output: $\{\text{Matr}_{0,1}[\{\{1, 0, 0, 0\}, \{0, 1 - 2x, 0, 0\}, \{0, 0, 1 - 2x, 0\}, \{0, 0, 0, 1\}\}]\}$

» error: 0

» output:

$\{\text{Matr}_{1,2,4,5}[\{\{1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\}, \{0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0,$
$0, 0, 0, 0, 0, 0, 0, 0\}, \{0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 1, 0, 0,$
$0, 0, 0, 0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0,$
$1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,$
$0, 1 - \frac{4x}{3}, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0,$
$0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1\}\}]\}$

» error: 0

```
test[Depol₀[x], x → .1]
test[Depol₁,₂[x], x → .4]
```

» output: $\{\text{Matr}_{0,1}[\{\{1, 0, 0, 0\}, \{0, 1 - 2x, 0, 0\}, \{0, 0, 1 - 2x, 0\}, \{0, 0, 0, 1\}\}]\}$

» error: 0

» output:

$\{\text{Matr}_{1,2,4,5}[\{\{1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\}, \{0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0,$
$0, 0, 0, 0, 0, 0, 0, 0\}, \{0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 1, 0, 0,$
$0, 0, 0, 0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0,$
$1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,$
$0, 1 - \frac{4x}{3}, 0, 0, 0, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0\},$
$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0,$
$0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0\}, \{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1\}\}]\}$

» error: 0

$\text{test}[\text{Depol}_0[x], \ x \to .1]$

$\text{test}[\text{Depol}_{1,2}[x], \ x \to .4]$

» output:

$$\left\{\text{Matr}_{0,1}\left[\left\{\left\{1 - \frac{2x}{3}, 0, 0, \frac{2x}{3}\right\}, \left\{0, 1 - \frac{4x}{3}, 0, 0\right\}, \left\{0, 0, 1 - \frac{4x}{3}, 0\right\}, \left\{\frac{2x}{3}, 0, 0, 1 - \frac{2x}{3}\right\}\right\}\right]\right\}$$

» error: 0

» output:

$$\left\{\text{Matr}_{1,2,4,5}\left[\left\{\left\{1 - \frac{4x}{5}, 0, 0, 0, 0, \frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}\right\}, \left\{0, 1 - \frac{16x}{15}, 0, 0, \right.\right.\right.$$
$$0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\Big\}, \left\{0, 0, 1 - \frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\right\},$$
$$\left\{0, 0, 0, 1 - \frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\right\},$$
$$\left\{0, 0, 0, 0, 1 - \frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\right\}, \left\{\frac{4x}{15}, 0, 0, 0, 0, 1 - \frac{4x}{5}, 0, 0,\right.$$
$$0, 0, \frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}\Big\}, \left\{0, 0, 0, 0, 0, 0, 1 - \frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0, 0, 0\right\},$$
$$\left\{0, 0, 0, 0, 0, 0, 0, 1 - \frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0, 0\right\}, \left\{0, 0, 0, 0, 0, 0, 0, 0, 0, \right.$$
$$1 - \frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0\Big\}, \left\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{16x}{15}, 0, 0, 0, 0, 0, 0\right\},$$
$$\left\{\frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}, 0, 0, 0, 0, 1 - \frac{4x}{5}, 0, 0, 0, 0, \frac{4x}{15}\right\},$$
$$\left\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{16x}{15}, 0, 0, 0, 0\right\},$$
$$\left\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{16x}{15}, 0, 0, 0\right\},$$
$$\left\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{16x}{15}, 0, 0\right\},$$
$$\left\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{16x}{15}, 0\right\},$$
$$\left.\left.\left.\left\{\frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}, 0, 0, 0, 0, 1 - \frac{4x}{5}\right\}\right\}\right]\right\}$$

» error: 0

```
m = Table[RandomVariate @ CircularUnitaryMatrixDistribution @ 4, 1];
test[Kraus₀,₁[m]]
```

» output:

$\left\{\text{Matr}_{0,1,2,3}\left[\left\{\left\{0.276075 + 0.\, i, -0.107384 + 0.378888\, i, -0.0833896 - 0.16882\, i, -0.0666051 + \right.\right.\right.$
$0.0698553\, i, -0.107384 - 0.378888\, i, 0.561759 + 0.\, i, -0.199255 + 0.18011\, i,$
$0.121777 + 0.0642383\, i, -0.0833896 + 0.16882\, i, -0.199255 - 0.18011\, i,$
$0.128422 + 0.\, i, -0.0225982 - 0.0618291\, i, -0.0666051 - 0.0698553\, i,$
$0.121777 - 0.0642383\, i, -0.0225982 + 0.0618291\, i, 0.0337444 + 0.\, i\},$
$\{0.113455 + 0.148148\, i, 0.0882889 + 0.173687\, i, 0.240396 + 0.2404\, i,$
$0.263158 - 0.135861\, i, 0.15919 - 0.213331\, i, 0.204029 - 0.188727\, i,$
$0.236422 - 0.42343\, i, -0.288816 - 0.308316\, i, -0.124862 + 0.0246289\, i,$
$-0.132878 + 0.00152585\, i, -0.219618 + 0.0743885\, i, 0.00359082 + 0.201959\, i,$
$0.0101141 - 0.0644492\, i, 0.0226477 - 0.064243\, i, 0.00283116 - 0.118826\, i,$
$-0.0978657 - 0.0338095\, i\}, \{0.0603701 + 0.0770828\, i, 0.0851857 + 0.0347236\, i,$
$0.0875352 + 0.275605\, i, -0.408949 + 0.0846542\, i, 0.0823074 - 0.112835\, i,$
$0.0145208 - 0.130416\, i, 0.344195 - 0.227335\, i, 0.275248 + 0.528319\, i,$

```
     -0.0653712 + 0.0136332 i, -0.0469642 + 0.0416027 i, -0.194973 - 0.0297198 i,
    0.0717587 - 0.275643 i, 0.00493953 - 0.0338722 i, -0.0117655 - 0.0299318 i,
    0.0486178 - 0.0886407 i, 0.120082 + 0.083053 i}, {0.352123 - 0.177372 i,
    -0.153346 - 0.225938 i, -0.0989889 + 0.177817 i, 0.0590234 - 0.0340435 i,
    -0.380391 - 0.414266 i, -0.250434 + 0.298335 i, 0.282542 + 0.0666885 i,
    -0.0696797 - 0.0677626 i, 0.00210264 + 0.268899 i, 0.18448 - 0.0255253 i,
    -0.0788354 - 0.114242 i, 0.00298936 + 0.0463758 i, -0.129833 - 0.0463055 i,
    -0.0201734 + 0.0933103 i, 0.0688749 - 0.0178526 i, -0.0228538 - 0.00672144 i},
  {0.113455 - 0.148148 i, 0.15919 + 0.213331 i, -0.124862 - 0.0246289 i,
   0.0101141 + 0.0644492 i, 0.0882889 - 0.173687 i, 0.204029 + 0.188727 i,
   -0.132878 - 0.00152585 i, 0.0226477 + 0.064243 i, 0.240396 - 0.2404 i,
   0.236422 + 0.42343 i, -0.219618 - 0.0743885 i, 0.00283116 + 0.118826 i,
   0.263158 + 0.135861 i, -0.288816 + 0.308316 i, 0.00359082 - 0.201959 i,
   -0.0978657 + 0.0338095 i}, {0.126124 + 0. i, 0.129487 + 0.024 i,
   0.227796 - 0.0302079 i, 0.0352407 - 0.197049 i, 0.129487 - 0.024 i, 0.137507 + 0. i,
   0.228122 - 0.0743602 i, -0.00131583 - 0.209009 i, 0.227796 + 0.0302079 i,
   0.228122 + 0.0743602 i, 0.418664 + 0. i, 0.110844 - 0.347455 i, 0.0352407 + 0.197049 i,
   -0.00131583 + 0.209009 i, 0.110844 + 0.347455 i, 0.317705 + 0. i},
  {0.0661738 - 0.000718267 i, 0.053641 - 0.0314426 i, 0.183869 + 0.0662883 i,
   -0.122633 + 0.25424 i, 0.0678015 - 0.0133295 i, 0.0490881 - 0.0424882 i,
   0.201385 + 0.0330676 i, -0.0775237 + 0.284355 i, 0.11969 + 0.0145519 i,
   0.104413 - 0.0439418 i, 0.316214 + 0.163763 i, -0.282383 + 0.429818 i,
   0.0196119 + 0.103185 i, 0.0641121 + 0.0750202 i, -0.0521897 + 0.305788 i,
   -0.431475 - 0.120557 i}, {0.0495256 - 0.261849 i, -0.184262 - 0.0105621 i,
   0.0547407 + 0.126195 i, 0.00598753 - 0.0456636 i, 0.00101935 - 0.278255 i,
   -0.191185 + 0.0242191 i, 0.0802135 + 0.119143 i, -0.00254206 - 0.0480205 i,
   0.152165 - 0.46107 i, -0.33027 - 0.0632088 i, 0.0686438 + 0.241034 i,
   0.0217511 - 0.0810402 i, 0.422936 + 0.00421209 i, -0.0349834 - 0.290831 i,
   -0.181864 + 0.120784 i, 0.0730152 - 0.0034044 i}, {0.0603701 - 0.0770828 i,
   0.0823074 + 0.112835 i, -0.0653712 - 0.0136332 i, 0.00493953 + 0.0338722 i,
   0.0851857 - 0.0347236 i, 0.0145208 + 0.130416 i, -0.0469642 - 0.0416027 i,
   -0.0117655 + 0.0299318 i, 0.0875352 - 0.275605 i, 0.344195 + 0.227335 i,
   -0.194973 + 0.0297198 i, 0.0486178 + 0.0886407 i, -0.408949 - 0.0846542 i,
   0.275248 - 0.528319 i, 0.0717587 + 0.275643 i, 0.120082 - 0.083053 i},
  {0.0661738 + 0.000718267 i, 0.0678015 + 0.0133295 i, 0.11969 - 0.0145519 i,
   0.0196119 - 0.103185 i, 0.053641 + 0.0314426 i, 0.0490881 + 0.0424882 i,
   0.104413 + 0.0439418 i, 0.0641121 - 0.0750202 i, 0.183869 - 0.0662883 i,
   0.201385 - 0.0330676 i, 0.316214 - 0.163763 i, -0.0521897 - 0.305788 i,
   -0.122633 - 0.25424 i, -0.0775237 - 0.284355 i, -0.282383 - 0.429818 i,
   -0.431475 + 0.120557 i}, {0.0347236 + 0. i, 0.028323 - 0.0161916 i,
   0.0960931 + 0.0358266 i, -0.0657898 + 0.132694 i, 0.028323 + 0.0161916 i,
   0.0306523 + 0. i, 0.0616743 + 0.0740308 i, -0.115538 + 0.0775569 i,
   0.0960931 - 0.0358266 i, 0.0616743 - 0.0740308 i, 0.302891 + 0. i,
   -0.0451556 + 0.435094 i, -0.0657898 - 0.132694 i, -0.115538 - 0.0775569 i,
   -0.0451556 - 0.435094 i, 0.631734 + 0. i}, {0.0274759 - 0.137103 i,
   -0.0966167 - 0.00659098 i, 0.0280022 + 0.0665225 i, 0.00340153 - 0.0239243 i,
   0.086342 - 0.0990184 i, -0.0757339 - 0.0504283 i, -0.00817882 + 0.0673177 i,
   0.0139304 - 0.0179282 i, -0.0654219 - 0.407763 i, -0.274175 + 0.0814462 i,
   0.146128 + 0.155201 i, -0.015271 - 0.0697171 i, -0.575988 + 0.154767 i,
   0.15787 + 0.381703 i, 0.201157 - 0.233047 i, -0.0978701 + 0.0323299 i},
  {0.352123 + 0.177372 i, -0.380391 + 0.414266 i, 0.00210264 - 0.268899 i,
```

```
        -0.129833 + 0.0463055 i, -0.153346 + 0.225938 i, -0.250434 - 0.298335 i,
        0.18448 + 0.0255253 i, -0.0201734 - 0.0933103 i, -0.0989889 - 0.177817 i,
        0.282542 - 0.0666885 i, -0.0788354 + 0.114242 i, 0.0688749 + 0.0178526 i,
        0.0590234 + 0.0340435 i, -0.0696797 + 0.0677626 i,
        0.00298936 - 0.0463758 i, -0.0228538 + 0.00672144 i},
      {0.0495256 + 0.261849 i, 0.00101935 + 0.278255 i, 0.152165 + 0.46107 i,
        0.422936 - 0.00421209 i, -0.184262 + 0.0105621 i, -0.191185 - 0.0242191 i,
        -0.33027 + 0.0632088 i, -0.0349834 + 0.290831 i, 0.0547407 - 0.126195 i,
        0.0802135 - 0.119143 i, 0.0686438 - 0.241034 i, -0.181864 - 0.120784 i,
        0.00598753 + 0.0456636 i, -0.00254206 + 0.0480205 i, 0.0217511 + 0.0810402 i,
        0.0730152 + 0.0034044 i}, {0.0274759 + 0.137103 i, 0.086342 + 0.0990184 i,
        -0.0654219 + 0.407763 i, -0.575988 - 0.154767 i, -0.0966167 + 0.00659098 i,
        -0.0757339 + 0.0504283 i, -0.274175 - 0.0814462 i, 0.15787 - 0.381703 i,
        0.0280022 - 0.0665225 i, -0.00817882 - 0.0673177 i, 0.146128 - 0.155201 i,
        0.201157 + 0.233047 i, 0.00340153 + 0.0239243 i, 0.0139304 + 0.0179282 i,
        -0.015271 + 0.0697171 i, -0.0978701 - 0.0323299 i}, {0.563077 + 0. i,
        -0.0504264 - 0.386697 i, -0.2405 + 0.163201 i, 0.0971542 - 0.00550004 i,
        -0.0504264 + 0.386697 i, 0.270082 + 0. i, -0.0905416 - 0.17978 i,
        -0.00492347 + 0.0672139 i, -0.2405 - 0.163201 i, -0.0905416 + 0.17978 i,
        0.150024 + 0. i, -0.0430904 - 0.0258099 i, 0.0971542 + 0.00550004 i,
        -0.00492347 - 0.0672139 i, -0.0430904 + 0.0258099 i, 0.0168169 + 0. i}}]}
```

» error: 0

```
m = RandomComplex[{-1 - i, 1 + i}, {7, 4, 4}];
test[KrausNonTP_{0,1}[m]]
```

» output: {Matr_{0,1,2,3}[
```
      {{2.49289 + 0. i, -0.997707 - 1.44233 i, 1.17898 + 0.0431297 i, -0.0711321 + 1.4758 i,
        -0.997707 + 1.44233 i, 3.46007 + 0. i, 0.890193 + 0.508589 i, -0.238343 - 1.04447 i,
        1.17898 - 0.0431297 i, 0.890193 - 0.508589 i, 3.65023 + 0. i, -0.321455 - 0.0904113 i,
        -0.0711321 - 1.4758 i, -0.238343 + 1.04447 i, -0.321455 + 0.0904113 i, 6.4003 + 0. i},
      {-0.48417 - 1.10371 i, -0.781695 + 0.446238 i, 0.566639 - 1.04113 i,
        0.1176 - 0.347512 i, 1.36196 + 0.536229 i, 1.87831 + 0.0685901 i, 1.71522 - 1.20387 i,
        2.09015 + 0.432963 i, -0.805893 - 0.448595 i, -0.117784 + 0.668681 i,
        1.80906 - 2.45177 i, 2.91595 - 0.273138 i, 1.02182 + 1.51325 i,
        0.756708 - 0.431762 i, -0.65061 - 0.872411 i, -0.35737 + 0.188402 i},
      {0.178585 + 0.463909 i, 0.139997 - 1.29744 i, 0.144713 - 1.70963 i,
        -0.250428 - 1.16193 i, 1.12045 + 0.155689 i, 1.67458 + 1.07813 i, 0.246251 + 1.80658 i,
        2.16059 + 0.865465 i, 3.23365 + 0.0713732 i, 1.47384 + 0.275105 i,
        -0.45904 + 0.134044 i, 2.31387 + 1.47911 i, 0.455977 - 0.786856 i,
        -2.62037 + 1.61997 i, -3.64869 - 0.44496 i, -0.836 + 1.96482 i},
      {0.184798 - 0.326832 i, 0.197429 + 0.0563472 i, -0.570096 + 1.23257 i,
        0.18935 + 0.187618 i, 0.380178 - 1.8411 i, -0.231103 - 0.056392 i,
        -0.757504 - 1.61016 i, -0.527754 - 1.22736 i, 0.800536 - 2.89293 i,
        0.679378 - 0.350116 i, -0.714096 - 0.678139 i, -1.31583 - 0.640512 i,
        1.64447 - 0.888361 i, -3.17369 + 0.118918 i, 2.70308 + 0.134329 i, 2.25441 - 2.49014 i},
      {-0.48417 + 1.10371 i, 1.36196 - 0.536229 i, -0.805893 + 0.448595 i,
        1.02182 - 1.51325 i, -0.781695 - 0.446238 i, 1.87831 - 0.0685901 i,
        -0.117784 - 0.668681 i, 0.756708 + 0.431762 i, 0.566639 + 1.04113 i,
        1.71522 + 1.20387 i, 1.80906 + 2.45177 i, -0.65061 + 0.872411 i, 0.1176 + 0.347512 i,
        2.09015 - 0.432963 i, 2.91595 + 0.273138 i, -0.35737 - 0.188402 i},
```

```
{4.96993 + 0. i, 2.33271 + 1.83897 i, 1.4335 - 0.0824692 i, -0.0528706 - 0.71527 i,
  2.33271 - 1.83897 i, 6.479 + 0. i, 0.800278 - 3.49448 i, 0.313052 - 1.02489 i,
  1.4335 + 0.0824692 i, 0.800278 + 3.49448 i, 5.72265 + 0. i, 2.40714 + 1.94948 i,
  -0.0528706 + 0.71527 i, 0.313052 + 1.02489 i, 2.40714 - 1.94948 i, 3.83966 + 0. i},
 {-0.110972 - 2.09594 i, 0.317239 + 0.0799497 i, 0.811696 - 0.0690812 i,
  0.338765 + 0.305033 i, -0.112413 - 1.7492 i, -0.17621 + 0.203363 i,
  -0.642015 - 0.828002 i, 0.346057 + 0.444142 i, 1.7943 + 1.48869 i,
  -0.660655 + 0.218982 i, 1.0734 - 1.1303 i, -0.106032 + 2.04472 i, 3.68159 + 0.446919 i,
  0.748491 + 0.421405 i, 0.343988 + 1.36986 i, 2.00761 + 1.77917 i},
 {0.354423 - 0.0597601 i, -0.642735 + 2.27633 i, -0.570327 - 1.28483 i,
  -1.42464 - 1.87055 i, -0.122057 - 0.845265 i, 1.008 - 0.191196 i,
  -0.176703 - 0.423482 i, -1.87255 + 0.773001 i, 2.45498 - 1.18765 i,
  0.617148 + 0.749458 i, 0.652035 - 1.20052 i, -1.44895 - 1.78769 i, 0.518931 - 2.75532 i,
  0.142358 - 0.563047 i, -0.596319 - 0.756033 i, -1.3292 - 1.8802 i},
 {0.178585 - 0.463909 i, 1.12045 - 0.155689 i, 3.23365 - 0.0713732 i,
  0.455977 + 0.786856 i, 0.139997 + 1.29744 i, 1.67458 - 1.07813 i,
  1.47384 - 0.275105 i, -2.62037 - 1.61997 i, 0.144713 + 1.70963 i,
  0.246251 - 1.80658 i, -0.45904 - 0.134044 i, -3.64869 + 0.44496 i,
  -0.250428 + 1.16193 i, 2.16059 - 0.865465 i, 2.31387 - 1.47911 i, -0.836 - 1.96482 i},
 {-0.110972 + 2.09594 i, -0.112413 + 1.7492 i, 1.7943 - 1.48869 i, 3.68159 - 0.446919 i,
  0.317239 - 0.0799497 i, -0.17621 - 0.203363 i, -0.660655 - 0.218982 i,
  0.748491 - 0.421405 i, 0.811696 + 0.0690812 i, -0.642015 + 0.828002 i,
  1.0734 + 1.1303 i, 0.343988 - 1.36986 i, 0.338765 - 0.305033 i,
  0.346057 - 0.444142 i, -0.106032 - 2.04472 i, 2.00761 - 1.77917 i},
 {5.47035 + 0. i, 1.43156 - 0.0948294 i, 0.117148 + 0.756608 i, 1.52203 + 2.29226 i,
  1.43156 + 0.0948294 i, 5.51744 + 0. i, 1.00323 + 1.75548 i, 2.84959 - 0.804959 i,
  0.117148 - 0.756608 i, 1.00323 - 1.75548 i, 4.73346 + 0. i, 0.305355 - 2.29736 i,
  1.52203 - 2.29226 i, 2.84959 + 0.804959 i, 0.305355 + 2.29736 i, 4.73696 + 0. i},
 {1.18928 - 2.34684 i, -0.448452 - 1.0005 i, 0.0646155 - 0.337814 i, -0.759659 -
    2.08741 i, -0.193468 - 1.07464 i, 0.868041 + 0.27137 i, -2.19016 - 1.05128 i,
  -0.582258 + 0.215905 i, -1.80933 + 0.895303 i, 0.263566 + 0.645783 i,
  -0.383258 + 0.303869 i, -2.7026 + 0.408611 i, -0.946513 - 3.15003 i,
  -0.180844 - 0.187503 i, -1.56097 - 0.871055 i, -1.62006 - 0.380897 i},
 {0.184798 + 0.326832 i, 0.380178 + 1.8411 i, 0.800536 + 2.89293 i, 1.64447 + 0.888361 i,
  0.197429 - 0.0563472 i, -0.231103 + 0.056392 i, 0.679378 + 0.350116 i,
  -3.17369 - 0.118918 i, -0.570096 - 1.23257 i, -0.757504 + 1.61016 i,
  -0.714096 + 0.678139 i, 2.70308 - 0.134329 i, 0.18935 - 0.187618 i,
  -0.527754 + 1.22736 i, -1.31583 + 0.640512 i, 2.25441 + 2.49014 i},
 {0.354423 + 0.0597601 i, -0.122057 + 0.845265 i, 2.45498 + 1.18765 i,
  0.518931 + 2.75532 i, -0.642735 - 2.27633 i, 1.008 + 0.191196 i, 0.617148 - 0.749458 i,
  0.142358 + 0.563047 i, -0.570327 + 1.28483 i, -0.176703 + 0.423482 i,
  0.652035 + 1.20052 i, -0.596319 + 0.756033 i, -1.42464 + 1.87055 i,
  -1.87255 - 0.773001 i, -1.44895 + 1.78769 i, -1.3292 + 1.8802 i},
 {1.18928 + 2.34684 i, -0.193468 + 1.07464 i, -1.80933 - 0.895303 i, -0.946513 +
    3.15003 i, -0.448452 + 1.0005 i, 0.868041 - 0.27137 i, 0.263566 - 0.645783 i,
  -0.180844 + 0.187503 i, 0.0646155 + 0.337814 i, -2.19016 + 1.05128 i,
  -0.383258 - 0.303869 i, -1.56097 + 0.871055 i, -0.759659 + 2.08741 i,
  -0.582258 - 0.215905 i, -2.7026 - 0.408611 i, -1.62006 + 0.380897 i},
 {3.92263 + 0. i, -0.105473 - 0.388833 i, 0.766349 - 0.132955 i, 1.92071 - 1.52407 i,
  -0.105473 + 0.388833 i, 3.23068 + 0. i, -1.9985 - 0.541475 i, -1.28858 + 2.13755 i,
  0.766349 + 0.132955 i, -1.9985 + 0.541475 i, 4.09897 + 0. i, -0.217755 - 1.58493 i,
```
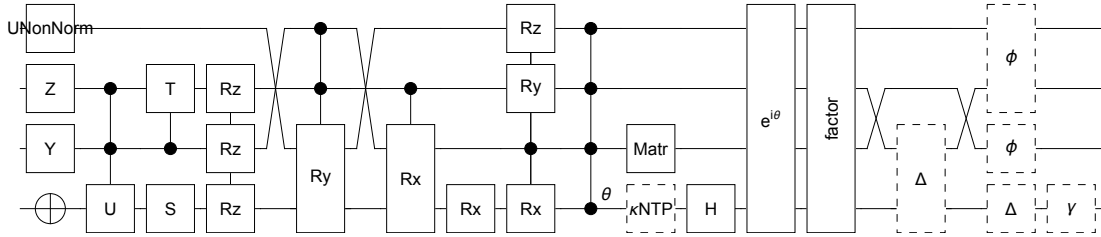
» error: 0

Circuits

```
circ = Circuit[Damp₀[.1] Deph₁[.1] Deph₂,₃[.5] Depol₀[.2] Depol₀,₂[.4]
    Fac[.3 + .3 𝕚] × G[π] H₀ Id₁ KrausNonTP₀@RandomComplex[{0, 1 + 𝕚}, {3, 2, 2}]
    Matr₁@RandomComplex[{0, 1 + 𝕚}, {2, 2}] C₀,₁,₂@Ph₃[.6] C₁@R[π, X₀ Y₂ Z₃]
    Rx₀[.1] C₂@Rx₁,₀[.8] C₁,₂@Ry₃,₀[π / 3] Rz₀,₁,₂[.9] S₀ C₁[T₂]
    C₁,₂@U₀@RandomVariate @ CircularUnitaryMatrixDistribution[2]
    UNonNorm₃@RandomComplex[{0, 1 + 𝕚}, {2, 2}] X₀ Y₁ Z₂] // Reverse;
```

DrawCircuit[%]

test @ circ

» output: $\{Z_2, Z_6, Y_1, U_5[\{\{0, 𝕚\}, \{-𝕚, 0\}\}], X_0,$

$X_4, UNonNorm_3[\{\{0.939064 + 0.652941\,𝕚, 0.714666 + 0.48563\,𝕚\},$
$\{0.930006 + 0.660488\,𝕚, 0.630213 + 0.453642\,𝕚\}\}],$

$UNonNorm_7[\{\{0.939064 - 0.652941\,𝕚, 0.714666 - 0.48563\,𝕚\},$
$\{0.930006 - 0.660488\,𝕚, 0.630213 - 0.453642\,𝕚\}\}],$

$C_{1,2}[U_0[\{\{0.238006 + 0.0751351\,𝕚, 0.43714 - 0.86407\,𝕚\},$
$\{-0.59793 + 0.7617\,𝕚, -0.168787 - 0.183856\,𝕚\}\}]],$

$C_{5,6}[U_4[\{\{0.238006 - 0.0751351\,𝕚, 0.43714 + 0.86407\,𝕚\},$
$\{-0.59793 - 0.7617\,𝕚, -0.168787 + 0.183856\,𝕚\}\}]], C_1[T_2],$

$C_5\left[Ph_6\left[-\frac{\pi}{4}\right]\right], S_0, Ph_4\left[-\frac{\pi}{2}\right], Rz_{0,1,2}[0.9], Rz_{4,5,6}[-0.9], C_{1,2}\left[Ry_{3,0}\left[\frac{\pi}{3}\right]\right],$

$C_{5,6}\left[Ry_{7,4}\left[-\frac{\pi}{3}\right]\right], C_2\left[Rx_{1,0}[0.8]\right], C_6\left[Rx_{5,4}[-0.8]\right], Rx_0[0.1],$

$Rx_4[-0.1], C_1[R[\pi, X_0 Y_2 Z_3]], C_5[R[\pi, X_4 Y_6 Z_7]], C_{0,1,2}\left[Ph_3[0.6]\right],$

$C_{4,5,6}\left[Ph_7[-0.6]\right], Matr_1[\{\{0.0433638 + 0.037496\,𝕚, 0.747555 + 0.350197\,𝕚\},$
$\{0.256458 + 0.556372\,𝕚, 0.314154 + 0.529126\,𝕚\}\}],$

$Matr_{0,4}[\{\{1.39652 + 0.\,𝕚, 1.14074 - 0.943531\,𝕚, 1.14074 + 0.943531\,𝕚, 2.47912 + 0.\,𝕚\},$
$\{1.10516 + 0.638879\,𝕚, 1.61705 - 0.978374\,𝕚, 0.600817 + 1.5064\,𝕚, 2.66221 + 0.752945\,𝕚\},$
$\{1.10516 - 0.638879\,𝕚, 0.600817 - 1.5064\,𝕚, 1.61705 + 0.978374\,𝕚, 2.66221 - 0.752945\,𝕚\},$
$\{1.45759 + 0.\,𝕚, 1.0415 - 1.36484\,𝕚, 1.0415 + 1.36484\,𝕚, 3.62453 + 0.\,𝕚\}\}],$

$Id_1, Id_5, H_0, H_4, Fac[0.3 + 0.3\,𝕚], Matr_{0,2,4,6}[\{\{0.68 + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚,$
$0. + 0.\,𝕚, 0. + 0.\,𝕚, 0.106667 + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚,$
$0.106667 + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0.106667 + 0.\,𝕚\},$
$\{0. + 0.\,𝕚, 0.573333 + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚,$
$0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚\},$
$\{0. + 0.\,𝕚, 0. + 0.\,𝕚, 0.573333 + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚,$
$0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚\},$
$\{0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0.573333 + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚, 0. + 0.\,𝕚,$

```
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i},
       {0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.573333 + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i},
       {0.106667 + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.68 + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.106667 + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.106667 + 0. i},
       {0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.573333 + 0. i, 0. + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i},
       {0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.573333 + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i},
       {0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i,
          0.573333 + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i},
       {0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i,
          0. + 0. i, 0.573333 + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i},
       {0.106667 + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.106667 + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.68 + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.106667 + 0. i},
       {0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0.573333 + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i},
       {0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.573333 + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i},
       {0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.573333 + 0. i, 0. + 0. i, 0. + 0. i},
       {0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.573333 + 0. i, 0. + 0. i},
       {0.106667 + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.106667 + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.106667 + 0. i,
          0. + 0. i, 0. + 0. i, 0. + 0. i, 0. + 0. i, 0.68 + 0. i}}],
    Matr₀,₄[{{0.866667 + 0. i, 0. + 0. i, 0. + 0. i, 0.133333 + 0. i},
       {0. + 0. i, 0.733333 + 0. i, 0. + 0. i, 0. + 0. i}, {0. + 0. i, 0. + 0. i, 0.733333 + 0. i,
          0. + 0. i}, {0.133333 + 0. i, 0. + 0. i, 0. + 0. i, 0.866667 + 0. i}}],
    Matr₂,₃,₆,₇[{{1., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.},
       {0., 0.333333, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.},
       {0., 0., 0.333333, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.},
       {0., 0., 0., 0.333333, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.},
       {0., 0., 0., 0., 0.333333, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.},
       {0., 0., 0., 0., 0., 1., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.},
       {0., 0., 0., 0., 0., 0., 0.333333, 0., 0., 0., 0., 0., 0., 0., 0., 0.},
       {0., 0., 0., 0., 0., 0., 0., 0.333333, 0., 0., 0., 0., 0., 0., 0., 0.},
       {0., 0., 0., 0., 0., 0., 0., 0., 0.333333, 0., 0., 0., 0., 0., 0., 0.},
       {0., 0., 0., 0., 0., 0., 0., 0., 0., 0.333333, 0., 0., 0., 0., 0., 0.},
       {0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 1., 0., 0., 0., 0., 0.},
       {0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.333333, 0., 0., 0., 0.},
       {0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.333333, 0., 0., 0.},
       {0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.333333, 0., 0.},
       {0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.333333, 0.},
       {0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 1.}}],
    Matr₁,₅[{{1., 0., 0., 0.}, {0., 0.8, 0., 0.}, {0., 0., 0.8, 0.}, {0., 0., 0., 1.}}],
    Matr₀,₄[{{1., 0., 0., 0.1}, {0., 0.948683, 0., 0.},
       {0., 0., 0.948683, 0.}, {0., 0., 0., 0.9}}]}
```

» error: 0

AssertValidChannels -> False

```
Fac[x];
GetCircuitSuperoperator[%]
GetCircuitSuperoperator[%%, AssertValidChannels → False ]
```

$\{Fac[x]\}$

$\{Fac[x]\}$

```
GetCircuitSuperoperator[ G[x] ]
GetCircuitSuperoperator[ G[x], AssertValidChannels → False ]
```

$\{\}$

$\{G[2 \, \mathbb{i} \, Im[x]]\}$

```
Ph₀[x];
GetCircuitSuperoperator[%]
GetCircuitSuperoperator[%%, AssertValidChannels → False ]
```

$\{Ph_0[x], Ph_1[-x]\}$

$\{Ph_0[x], Ph_1[-Conjugate[x]]\}$

```
C₀,₁ @ R[x, X₂ Y₃ Z₄];
GetCircuitSuperoperator[%]
GetCircuitSuperoperator[%%, AssertValidChannels → False ]
```

$\{C_{0,1}[R[x, X_2 Y_3 Z_4]], C_{5,6}[R[x, X_7 Y_8 Z_9]]\}$

$\{C_{0,1}[R[x, X_2 Y_3 Z_4]], C_{5,6}[R[Conjugate[x], X_7 Y_8 Z_9]]\}$

```
Circuit[Rx₀[x] Ry₁[y] Rz₂[z]];
GetCircuitSuperoperator[%]
GetCircuitSuperoperator[%%, AssertValidChannels → False ]
```

$\{Rx_0[x], Rx_3[-x], Ry_1[y], Ry_4[y], Rz_2[z], Rz_5[-z]\}$

$\{Rx_0[x], Rx_3[-Conjugate[x]], Ry_1[y],$
$\ Ry_4[Conjugate[y]], Rz_2[z], Rz_5[-Conjugate[z]]\}$

```
Circuit[Ry₀[x] Ry₀,₁[x] Ry₀,₁,₂[x] Ry₀,₁,₂,₃[x]];
GetCircuitSuperoperator[%]
GetCircuitSuperoperator[%%, AssertValidChannels → False ]
```

$\{Ry_0[x], Ry_4[x], Ry_{0,1}[x], Ry_{4,5}[-x], Ry_{0,1,2}[x], Ry_{4,5,6}[x], Ry_{0,1,2,3}[x], Ry_{4,5,6,7}[-x]\}$

$\{Ry_0[x], Ry_4[Conjugate[x]], Ry_{0,1}[x], Ry_{4,5}[-Conjugate[x]],$
$\ Ry_{0,1,2}[x], Ry_{4,5,6}[Conjugate[x]], Ry_{0,1,2,3}[x], Ry_{4,5,6,7}[-Conjugate[x]]\}$

```
Damp₀[x];
GetCircuitSuperoperator[%]
GetCircuitSuperoperator[%%, AssertValidChannels → False ]
```

$\left\{\text{Matr}_{0,1}\left[\left\{\{1, 0, 0, x\}, \left\{0, \sqrt{1-x}, 0, 0\right\}, \left\{0, 0, \sqrt{1-x}, 0\right\}, \{0, 0, 0, 1-x\}\right\}\right]\right\}$

$\left\{\text{Matr}_{0,1}\left[\left\{\left\{1, 0, 0, \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right]\right\}, \left\{0, \sqrt{1-x}, 0, 0\right\},\right.\right.\right.$
$\left.\left.\left.\left\{0, 0, \text{Conjugate}\left[\sqrt{1-x}\right], 0\right\}, \left\{0, 0, 0, \sqrt{1-x}\ \text{Conjugate}\left[\sqrt{1-x}\right]\right\}\right\}\right]\right\}$

```
Deph₁[x];
GetCircuitSuperoperator[%]
GetCircuitSuperoperator[%%, AssertValidChannels → False ]
```

$\left\{\text{Matr}_{1,3}[\{\{1, 0, 0, 0\}, \{0, 1-2x, 0, 0\}, \{0, 0, 1-2x, 0\}, \{0, 0, 0, 1\}\}]\right\}$

$\left\{\text{Matr}_{1,3}\left[\left\{\left\{\sqrt{1-x}\ \text{Conjugate}\left[\sqrt{1-x}\right] + \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right], 0, 0, 0\right\},\right.\right.\right.$
$\left\{0, \sqrt{1-x}\ \text{Conjugate}\left[\sqrt{1-x}\right] - \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right], 0, 0\right\},$
$\left\{0, 0, \sqrt{1-x}\ \text{Conjugate}\left[\sqrt{1-x}\right] - \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right], 0\right\},$
$\left.\left.\left.\left\{0, 0, 0, \sqrt{1-x}\ \text{Conjugate}\left[\sqrt{1-x}\right] + \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right]\right\}\right\}\right]\right\}$

```
Deph₀,₁[x];
GetCircuitSuperoperator[%]
GetCircuitSuperoperator[%%, AssertValidChannels → False ]
```

$$\left\{ \text{Matr}_{0,1,2,3}\left[\left\{ \{1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\}, \right. \right. \right.$$

$$\left\{ 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 \right\},$$

$$\left\{ 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 \right\},$$

$$\left\{ 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 \right\},$$

$$\left\{ 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 \right\},$$

$$\{0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\},$$

$$\left\{ 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0, 0 \right\},$$

$$\left\{ 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0, 0 \right\},$$

$$\left\{ 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0, 0 \right\},$$

$$\left\{ 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0, 0, 0 \right\},$$

$$\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0\},$$

$$\left\{ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0, 0 \right\},$$

$$\left\{ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0, 0 \right\},$$

$$\left\{ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0, 0 \right\},$$

$$\left\{ 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1 - \frac{4x}{3}, 0 \right\},$$

$$\left. \left. \left. \{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1\} \right\} \right] \right\}$$

```
{Matr_{0,1,2,3}[
   {{√(1-x) Conjugate[√(1-x)] + √x Conjugate[√x], 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
      0, 0, 0}, {0, √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x], 0, 0, 0, 0, 0, 0,
      0, 0, 0, 0, 0, 0, 0, 0}, {0, 0, √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x],
      0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
    {0, 0, 0, √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x],
      0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0,
      √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x], 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0},
    {0, 0, 0, 0, 0, √(1-x) Conjugate[√(1-x)] + √x Conjugate[√x],
      0, 0, 0, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0,
      √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x], 0, 0, 0, 0, 0, 0, 0, 0, 0},
    {0, 0, 0, 0, 0, 0, 0, √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x],
      0, 0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0,
      √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x], 0, 0, 0, 0, 0, 0, 0},
    {0, 0, 0, 0, 0, 0, 0, 0, 0, √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x],
      0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
      √(1-x) Conjugate[√(1-x)] + √x Conjugate[√x], 0, 0, 0, 0, 0},
    {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x],
      0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
      √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x], 0, 0, 0}, {0, 0, 0, 0, 0, 0,
      0, 0, 0, 0, 0, 0, 0, √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x], 0, 0},
    {0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
      √(1-x) Conjugate[√(1-x)] - 1/3 √x Conjugate[√x], 0}, {0, 0, 0, 0, 0, 0, 0,
      0, 0, 0, 0, 0, 0, 0, 0, √(1-x) Conjugate[√(1-x)] + √x Conjugate[√x]}}]}

Depol_{0,2}[x];
GetCircuitSuperoperator[%]
GetCircuitSuperoperator[%%, AssertValidChannels → False]
```

$$\left\{\text{Matr}_{0,2,3,5}\left[\left\{\left\{1-\frac{4x}{5}, 0, 0, 0, 0, \frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}\right\},\right.\right.\right.$$

$$\left\{0, 1-\frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\right\},$$

$$\left\{0, 0, 1-\frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\right\},$$

$$\left\{0, 0, 0, 1-\frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\right\},$$

$$\left\{0, 0, 0, 0, 1-\frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\right\},$$

$$\left\{\frac{4x}{15}, 0, 0, 0, 0, 1-\frac{4x}{5}, 0, 0, 0, 0, \frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}\right\},$$

$$\left\{0, 0, 0, 0, 0, 0, 1-\frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0, 0, 0\right\},$$

$$\left\{0, 0, 0, 0, 0, 0, 0, 1-\frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0, 0\right\},$$

$$\left\{0, 0, 0, 0, 0, 0, 0, 0, 1-\frac{16x}{15}, 0, 0, 0, 0, 0, 0, 0\right\},$$

$$\left\{0, 0, 0, 0, 0, 0, 0, 0, 0, 1-\frac{16x}{15}, 0, 0, 0, 0, 0, 0\right\},$$

$$\left\{\frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}, 0, 0, 0, 0, 1-\frac{4x}{5}, 0, 0, 0, 0, \frac{4x}{15}\right\},$$

$$\left\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1-\frac{16x}{15}, 0, 0, 0, 0\right\},$$

$$\left\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1-\frac{16x}{15}, 0, 0, 0\right\},$$

$$\left\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1-\frac{16x}{15}, 0, 0\right\},$$

$$\left\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1-\frac{16x}{15}, 0\right\},$$

$$\left.\left.\left.\left\{\frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}, 0, 0, 0, 0, \frac{4x}{15}, 0, 0, 0, 0, 1-\frac{4x}{5}\right\}\right\}\right]\right\}$$

$$\left\{\text{Matr}_{0,2,3,5}\left[\left\{\left\{\sqrt{1-x}\ \text{Conjugate}\left[\sqrt{1-x}\right]+\frac{1}{5}\ \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right],\right.\right.\right.\right.$$

$$0, 0, 0, 0, \frac{4}{15}\ \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right], 0, 0, 0, 0,$$

$$\frac{4}{15}\ \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right], 0, 0, 0, 0, \frac{4}{15}\ \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right]\right\},$$

$$\left\{0, \sqrt{1-x}\ \text{Conjugate}\left[\sqrt{1-x}\right]-\frac{1}{15}\ \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right], 0, 0, 0, 0, 0, 0, 0,\right.$$

$$\left.0, 0, 0, 0, 0, 0, 0\right\}, \left\{0, 0, \sqrt{1-x}\ \text{Conjugate}\left[\sqrt{1-x}\right]-\frac{1}{15}\ \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right],\right.$$

$$\left.0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\right\},$$

$$\left\{0, 0, 0, \sqrt{1-x}\ \text{Conjugate}\left[\sqrt{1-x}\right]-\frac{1}{15}\ \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right], 0, 0, 0, 0, 0, 0,\right.$$

$$\left.0, 0, 0, 0, 0, 0\right\}, \left\{0, 0, 0, 0, \sqrt{1-x}\ \text{Conjugate}\left[\sqrt{1-x}\right]-\frac{1}{15}\ \sqrt{x}\ \text{Conjugate}\left[\sqrt{x}\right],\right.$$

$$0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0\}, \Big\{\frac{4}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0,$$

$$0, 0, \sqrt{1-x} \; \text{Conjugate}\big[\sqrt{1-x}\,\big] + \frac{1}{5} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0, 0,$$

$$0, \frac{4}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0, 0, 0, \frac{4}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big]\Big\},$$

$$\Big\{0, 0, 0, 0, 0, 0, \sqrt{1-x} \; \text{Conjugate}\big[\sqrt{1-x}\,\big] - \frac{1}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big],$$

$$0, 0, 0, 0, 0, 0, 0, 0, 0\}, \Big\{0, 0, 0, 0, 0, 0, 0,$$

$$\sqrt{1-x} \; \text{Conjugate}\big[\sqrt{1-x}\,\big] - \frac{1}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0, 0, 0, 0, 0, 0, 0\Big\},$$

$$\Big\{0, 0, 0, 0, 0, 0, 0, 0, \sqrt{1-x} \; \text{Conjugate}\big[\sqrt{1-x}\,\big] - \frac{1}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big],$$

$$0, 0, 0, 0, 0, 0, 0\}, \Big\{0, 0, 0, 0, 0, 0, 0, 0, 0,$$

$$\sqrt{1-x} \; \text{Conjugate}\big[\sqrt{1-x}\,\big] - \frac{1}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0, 0, 0, 0, 0\Big\},$$

$$\Big\{\frac{4}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0, 0, 0, \frac{4}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0,$$

$$0, 0, \sqrt{1-x} \; \text{Conjugate}\big[\sqrt{1-x}\,\big] + \frac{1}{5} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0,$$

$$0, 0, \frac{4}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big]\Big\}, \Big\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,$$

$$\sqrt{1-x} \; \text{Conjugate}\big[\sqrt{1-x}\,\big] - \frac{1}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0, 0, 0\Big\}, \Big\{0, 0, 0, 0, 0,$$

$$0, 0, 0, 0, 0, 0, 0, \sqrt{1-x} \; \text{Conjugate}\big[\sqrt{1-x}\,\big] - \frac{1}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0, 0\Big\},$$

$$\Big\{0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,$$

$$\sqrt{1-x} \; \text{Conjugate}\big[\sqrt{1-x}\,\big] - \frac{1}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0\Big\}, \Big\{0, 0, 0, 0, 0, 0,$$

$$0, 0, 0, 0, 0, 0, 0, 0, \sqrt{1-x} \; \text{Conjugate}\big[\sqrt{1-x}\,\big] - \frac{1}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0\Big\},$$

$$\Big\{\frac{4}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0, 0, 0, \frac{4}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big],$$

$$0, 0, 0, 0, \frac{4}{15} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big], 0, 0, 0, 0,$$

$$\sqrt{1-x} \; \text{Conjugate}\big[\sqrt{1-x}\,\big] + \frac{1}{5} \sqrt{x} \; \text{Conjugate}\big[\sqrt{x}\,\big]\Big\}\Big\}\Big]\Big\}$$

Errors

`GetCircuitSuperoperator[e]`

⚫⚫⚫ GetCircuitSuperoperator : Invalid arguments. See ?GetCircuitSuperoperator

`$Failed`

GetCircuitSuperoperator$[Eh_{0,1}]$

••• GetCircuitSuperoperator : Cannot obtain conjugate of unrecognised or unsupported operator: $Eh_{0,1}$

$Failed

GetCircuitSuperoperator @ M_0

••• GetCircuitSuperoperator : Cannot obtain conjugate of unrecognised or unsupported operator: M_0

$Failed

GetCircuitSuperoperator[$Damp_0$[-1]]

••• GetCircuitSuperoperator : One or more channels could not be asserted as completely positive and
    trace−preserving (CPTP) and ergo could not be simplified. Prevent this error with
    AssertValidChannels −> False.

$Failed

GetCircuitSuperoperator$[Deph_{0,1}[i]]$

••• GetCircuitSuperoperator : One or more channels could not be asserted as completely positive and
    trace−preserving (CPTP) and ergo could not be simplified. Prevent this error with
    AssertValidChannels −> False.

$Failed