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Figure S1
Growth behavior of yeast cells in blue light compared to darkness. A) Growth rate measurements of yeast cells (ESM356-1 carrying plasmid pRS315) in darkness or under blue-light illumination (465 nm 30 µmol m\(^{-2}\) s\(^{-1}\)) for 8 hours. The optical density at 600 nm (OD\(_{600}\)) of the cultures was measured at the indicated time points (error bars: standard deviation, n=4). B) A YAP1 deletion strain is growing slower when illuminated with blue light. Wild type and YAP1 deletion cells were streaked on YPD plates and incubated in darkness or under constant blue-light illumination (465 nm 30 µmol m\(^{-2}\) s\(^{-1}\)) for two days at room temperature.
|          | darkness | blue light 465 nm 30 μmol m⁻² s⁻¹ | C |
|----------|----------|----------------------------------|---|
| (time min) | 0 30 60 90 | 0 30 60 90 | 0 30 60 90 |
| psd      |          |                                  |   |
| G138A N148E |          |                                  |   |
| XL156 AP157 |          |                                  |   |
| N148E    |          |                                  |   |
| G138A    |          |                                  |   |
| CACA     |          |                                  |   |
| K121M N128Y N148E |          |                                  |   |
| V19l     |          |                                  |   |
| E132D E139K |          |                                  |   |
| CACA     |          |                                  |   |
| N148E R154G E155G |          |                                  |   |
| E139N    |          |                                  |   |
| K121M N128Y G138A |          |                                  |   |
| K92R E132A E155G |          |                                  |   |
| G138A V142A R154G E155G |          |                                  |   |
| K92R E132A N148D E155G |          |                                  |   |
| K92R E132A E139N N148D E155G |          |                                  |   |
| K121M N128Y |          |                                  |   |
| G138A R154G E155G |          |                                  |   |
| R154G E155G |          |                                  |   |

**A**

**B**

**C**
Figure S2
Mutational analysis of psd module stability. A) Yeast cells expressing P_{ADH1}-RFP-psd (plasmid based) or one of the variants (as indicated) were grown in liquid medium in darkness. After taking the first sample (t=0 hours), the translation inhibitor cycloheximide (chx) was added; cells were kept in darkness or were illuminated with blue light (LED lamp, 465 nm, 30 µmol m\(^{-2}\) s\(^{-1}\)) for the rest of the experiment. Samples were taken at the indicated time points and subjected to alkaline lysis followed by immunoblotting. Antibodies against tRFP and Tub1 or Por1 (loading controls) were used for detection (negative control: C). B) Conditions as in A. Derivatives of plasmid pDS112 (P_{ADH1}-GFP-3myc-psd) were analyzed. Immunoblotting was performed with antibodies against myc and Tub1. C) Stability of the psd module and its variants exposed to blue light with an intensity of 5 µmol m\(^{-2}\) s\(^{-1}\). Other conditions as in A.
Figure S3
Quantification of psd-module variant behavior. Curves are the means of protein amounts obtained from at least four independent measurements (error bars: s.e.m.; representative immunoblots are shown in Figure S2 A, B, and C). The half-lives (in minutes±standard error) for each condition are shown next to each curve.
Figure S4
The impact of the cysteine within the cODC1 degron on psd module variant stability. The cysteine of cODC1 is the main determinant of psd module variant degradation in all tested cases (wild type construct, K121M N128Y, K92R E132A E155G, K121M N128Y G138A, and G138A V142A R154G E155S). The variants were expressed in yeast cells (plasmid based) and subjected to cycloheximide chases (as described for Figure S2A) under blue-light illumination (30 μmol m⁻² s⁻¹). Left side: representative immunoblots; right side: quantification of psd module variant behavior. Four independent measurements were performed for each variant, (error bars: s.e.m.).
Equations used for the *in silico* analysis of psd module variants. Values for the conversion rate constants $k_{\text{dark}}$, $k_{\text{degENDO}}$, $k_{\text{degLOV}}$, $k_{\text{leak}}$ are given in Table 2; other values can be found in the description of the simulations in the methods section. A) Equations used to simulate reaction of psd module variants towards light. B) Equations used for simulation of cycloheximide chase analysis and parameter estimations.

Figure S5

A
\[ \frac{d[PSD_{\text{dark}}]}{dt} = +k_{\text{pp1.translation rate}}[pp1\_mRNA] +k_{\text{dark}}[PSD_{\text{id}}] -k_{\text{hv}}[PSD_{\text{dark}}] -k_{\text{degENDO}}[PSD_{\text{dark}}] -k_{\text{leak}}[PSD_{\text{dark}}] \]

\[ \frac{d[PSD_{\text{id}}]}{dt} = -k_{\text{dark}}[PSD_{\text{id}}] +k_{\text{hv}}[PSD_{\text{dark}}] -k_{\text{degENDO}}[PSD_{\text{id}}] +k_{\text{degLOV}}[PSD_{\text{id}}] -k_{\text{leak}}[PSD_{\text{dark}}] \]

\[ \frac{d[pp1\_mRNA]}{dt} = +[\text{psd}] -k_{\text{pp1.translation rate}}[pp1\_mRNA] \]

B
\[ \frac{d[PSD_{\text{dark}}]}{dt} = +k_{\text{dark}}[PSD_{\text{id}}] -k_{\text{hv}}[PSD_{\text{dark}}] -k_{\text{degENDO}}[PSD_{\text{dark}}] -k_{\text{leak}}[PSD_{\text{dark}}] \]

\[ \frac{d[PSD_{\text{id}}]}{dt} = -k_{\text{dark}}[PSD_{\text{id}}] +k_{\text{hv}}[PSD_{\text{dark}}] -k_{\text{degENDO}}[PSD_{\text{id}}] -k_{\text{degLOV}}[PSD_{\text{id}}] +k_{\text{leak}}[PSD_{\text{dark}}] \]
Parameter estimation to the experimental data of the psd module variants. The conversion constants $k_{\text{dark}}$, $k_{\text{leak}}$, $k_{\text{degLOV}}$, and $k_{\text{degENDO}}$ were adapted to reproduce the experimental data. For the psd module, $k_{\text{dark}}$ and $k_{\text{leak}}$ were taken from the literature and $k_{\text{degLOV}}$ as well as $k_{\text{degENDO}}$ were adjusted. Parameter estimation using the 5 µmol m$^{-2}$ s$^{-1}$ data required to adjust the $k_{h\nu}$ value slightly for the psd module.
Figure S7
Influence of increased \( k_{\text{degLOV}} \) and decreased \( k_{\text{dark}} \) on psd module behavior. A) Simulation of the wild type psd module using the parameters obtained by parameter estimation. B) Simulation with increased \( k_{\text{degLOV}} \), other parameters as in A). C) Simulations with decreased \( k_{\text{dark}} \), other parameters as in A). The simulations demonstrate the impact of the parameters. Qualitatively, the graph with increased \( k_{\text{degLOV}} \) is similar to the results obtained by cycloheximide chases for the variants K92R E132A N148D E155G or K92R E132A N148D E155G, whereas the graph with decreased \( k_{\text{dark}} \) resembles the variants V19I, K121M N128Y, K121M N128Y G138A, K92R E132A E155G or G138A V142A R154G E155S (see Figure S2).
Figure S8
Mathematical-based parameter estimation has higher accuracy than human parameter assumption. Comparison between parameters derived by TinkerCell cycloheximide chase simulations (blue curve) and parameter estimation (red curve) for the psd module variant K92R E132A E139N N148D E155G.
Figure S9
Growth rate measurements of wild type cells and cells expressing psd module variants. Yeast cells (ESM356-1) carrying either an empty plasmid (pRS315), the psd module variant K121M N128Y G138A (pDS142) or K92R E132A E155G (pDS143) were grown in darkness or under blue-light illumination (465 nm 30 µmol m⁻² s⁻¹) for 8 hours. The optical density at 600 nm (OD₆₀₀) of the cultures was measured at the indicated time points (error bars: standard deviation, n=4).
Table S1: List of mutated LOV2 domain residues

| Name              | Residue in full length phototropin1 of *Arabidopsis thaliana* |
|-------------------|---------------------------------------------------------------|
| Wild type psd module | M460 to P616-MSCAQESITSLYKKAGSENLYFQ (cODC1)                   |
| V19I              | V478I                                                         |
| K92R E132A E155G  | K551R E591A E614G                                            |
| K92R E132A N148D E155G | K551R E591A N607D E614G                                      |
| K92R E132A E139N N148D E155G | K551R E591A E598N N607D E614G                                |
| K121M N128Y       | K580M N587Y                                                  |
| K121M N128Y G138A | K580M N587Y G597A                                            |
| K121M N128Y N148E | K580M N587Y G597A N607E                                      |
| E132D E139K       | E591D E598K                                                  |
| E137D             | E596D                                                        |
| E137D E151D       | E596D E610D                                                  |
| G138A             | G597A                                                        |
| G138A V142A R154G E155S | G597A V601A R613G E614S                                    |
| G138A N148E       | G597A N607E                                                  |
| G138A R154G E155S | G597A R613G E614S                                            |
| E139N             | E598N                                                        |
| V142G             | V601A                                                        |
| N148E             | N607E                                                        |
| N148E R154G E155S | N607E R613G E614S                                            |
| E151D             | E610D                                                        |
| R154G E155S       | R613G E614S                                                  |
| ΔL156 ΔP157       | ΔL615 ΔP616                                                  |
| degODC            | M460 to P616-MSCAQESGMDRHPAACASARINV (murine cODC)            |
| CACA              | M460 to P616-MSCACACAQESITSLYKKAGSENLYFQ (cODC1-CACA)         |
| CACACACA          | M460 to P616-MSCACACAQESITSLYKKAGSENLYFQ (cODC1-CACACA)      |
Table S2: Conversion rate constants of psd module variants obtained by parameter estimation.

| Variant name | $k_{\text{dark}} \cdot 10^{-2}$ (min$^{-1}$) | $k_{\text{leak}} \cdot 10^{-2}$ (min$^{-1}$) | $k_{\text{degLOV}} \cdot 10^{-2}$ (min$^{-1}$) | $k_{\text{degENDO}} \cdot 10^{-2}$ (min$^{-1}$) |
|--------------|-------------------------------------------|-------------------------------------------|------------------------------------------|------------------------------------------|
| wild type psd module | 59 (lit.) | 1.513 (lit.) | 4.8±0.6 | 0.28±0.08 |
| V19I | 0.7±0.5 | 0.7±0.1 | 4.7±0.1 | 0.1±0.01 |
| K92R E132A E155G | 0.4±0.6 | 0.5±0.1 | 5.9±0.2 | 0.3±0.01 |
| K92R E132A N148D E155G | 41.2±10.1 | 4.1±1.9 | 7.6±0.7 | 0.25±0.04 |
| K92R E132A E139N N148D E155G | 35.2±2.9 | 5.4±1.2 | 7.2±0.2 | 0.25±0.05 |
| K121M N128Y | 6.6±8.9 | 1.5±1.2 | 6.7±0.6 | 1.1±0.02 |
| K121M N128Y G138A | 0.9±3.7 | 0.6±0.3 | 6.0±0.8 | 0.35±0.01 |
| K121M N128Y N148E | 132.5±40.1 | 0.19±0.16 | 5.6±0.4 | 0.93±0.07 |
| E132D E139K | 57.8±18.5 | 8.0±2.4 | 5.7±0.4 | 0.25±0.02 |
| E137D | 124.7±26.6 | 3.8±1.0 | 5.5±0.4 | 0.25±0.02 |
| E137D E151D | 86.7±97.8 | 15.1±9.9 | 5.0±2.2 | 0.4±0.05 |
| G138A | 39.1±9.2 | 3.9±2.1 | 4.1±0.4 | 0.25±0.03 |
| G138A V142A R154G E155S | 0.5±1.4 | 2.0±0.3 | 7.4±0.5 | 0.2±0.05 |
| G138A N148E | 837.3±178.5 | 22.3±13.2 | 5.6±0.5 | 0.25±0.02 |
| G138A R154G E155S | 33.7±14.5 | 6.9±4.1 | 10.1±0 | 1±0.03 |
| E139N | 37.9±8.1 | 3.7±0.6 | 7.1±0.7 | 0.25±0.05 |
| V142G | 46.1±30.3 | 27.0±13.3 | 5.5±0.7 | 0.25±0.03 |
| N148E | 271.0±66.4 | 8.1±5.1 | 5.6±0.6 | 0.25±0.03 |
| N148E R154G E155S | 189.3±23.8 | 0.05±0.7 | 10.4±0 | 0.97±0.07 |
| E151D | 98.6±3.0 | 3.9±99.4 | 4.7±2.1 | 0.4±0.04 |
| R154G E155S | 6.8±7.4 | 5.8±2.7 | 10.1±1.1 | 1±0.15 |
| ΔL156 ΔP157 | 284.0±263.2 | 10.4±6.5 | 3.4±2.1 | 0.3±0.03 |
| degCDC | 59 (lit.) | 1.513 (lit.) | 4.8±0.4 | 0.72±0.07 |
| CACA | 59 (lit.) | 1.513 (lit.) | 3.8±0.4 | 0.52±0.04 |
| CACACA | 59 (lit.) | 1.513 (lit.) | 5.3±0.7 | 0.74±0.1 |

Lit. indicates values calculated from literature that were kept fixed during the parameter estimations.
Table S3: Starting values for parameter estimation

| Variant name                        | $k_{\text{dark}} \cdot 10^{-2}$ (min$^{-1}$) | $k_{\text{leak}} \cdot 10^{-2}$ (min$^{-1}$) | $k_{\text{degLOV}} \cdot 10^{-2}$ (min$^{-1}$) | $k_{\text{degENDO}} \cdot 10^{-2}$ (min$^{-1}$) |
|-------------------------------------|---------------------------------------------|---------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| Wild type psd module                | 59 (fixed)                                  | 1.513 (fixed)                               | 5.64 (±10 %)                                    | 0.25 (±10 %)                                    |
| V191                                | 1 (±100 %)                                  | 0.7                                         | 4.76 (±10 %)                                    | 0.1 (±10 %)                                     |
| K92R E132A E155G                    | 1                                           | 1                                           | 6 (±10 %)                                       | 0.3 (±10 %)                                     |
| K92R E132A N148D E155G              | 30                                          | 3                                           | 7                                              | 0.25 (±10 %)                                    |
| K92R E132A E139N N148D E155G        | 220                                         | 3.27                                        | 7 (±10 %)                                       | 0.25 (±10 %)                                    |
| K121M N128Y                         | 10 (±50 %)                                  | 0.5                                         | 5.64 (±10 %)                                    | 1 (±10 %)                                       |
| K121M N128Y G138A                   | 3                                           | 1                                           | 6.74 (±40 %)                                    | 0.3 (±10 %)                                     |
| K121M N128Y N148E                   | 200                                         | 2 (±100 %)                                  | 5.64 (±10 %)                                    | 1 (±10 %)                                       |
| E132D E139K                         | 55                                          | 65                                          | 5.64 (±10 %)                                    | 0.25 (±10 %)                                    |
| E137D                               | 70                                          | 1.513                                       | 5.5 (±10 %)                                     | 0.25 (±10 %)                                    |
| E137D E151D                         | 80 (±100 %)                                 | 6                                           | 5.5                                            | 0.4 (±10 %)                                     |
| G138A                               | 100                                         | 1.92                                        | 5.64 (±10 %)                                    | 0.25 (±10 %)                                    |
| G138A V142A R154G E155S             | 3 (±40 %)                                   | 3                                           | 9                                              | 0.2 (±10 %)                                     |
| G138A N148E                         | 560                                         | 0.5                                         | 5.64 (±10 %)                                    | 0.25 (±10 %)                                    |
| G138A R154G E155S                   | 5                                           | 2.5                                         | 8 (±10 %)                                       | 1 (±10 %)                                       |
| E139N                               | 20                                          | 1.65                                        | 5.64 (±10 %)                                    | 0.25 (±10 %)                                    |
| V142G                               | 7                                           | 40                                          | 5.5 (±10 %)                                     | 0.25 (±10 %)                                    |
| N148E                               | 300                                         | 0.5                                         | 5.64 (±10 %)                                    | 0.25 (±10 %)                                    |
| N148E R154G E155S                   | 150                                         | 0.2 (±100 %)                                | 8 (±10 %)                                       | 1 (±10 %)                                       |
| E151D                               | 100 (±100 %)                                | 1.513                                       | 5.5                                            | 0.4 (±10 %)                                     |
| R154G E155S                         | 5                                           | 5                                           | 8                                              | 1 (±10 %)                                       |
| ΔL156 ΔP157                         | 280                                         | 0.2                                         | 4                                              | 0.3 (±10 %)                                     |
| degODC                              | 59 (fixed)                                  | 1.513 (fixed)                               | 5.5                                            | 0.65                                           |
| CACA                                | 59 (fixed)                                  | 1.513 (fixed)                               | 5.64                                           | 0.5 (±10 %)                                     |
| CACACA                              | 59 (fixed)                                  | 1.513 (fixed)                               | 7.5                                            | 0.5 (±10 %)                                     |

The starting values for parameter estimation were obtained from TinkerCell simulations of cycloheximide chases. For each variant, parameters were chosen that approximated the experimental data. These parameters were then used for the parameter estimation. Values in brackets indicate the variability during parameter estimation, values lacking restriction were freely estimated.
### Table S4: plasmids used in this study

| Name   | Genotype                                                                 | Source               |
|--------|---------------------------------------------------------------------------|----------------------|
| pRS315 | LEU2 ARS209/CEN2 ori bla                                                  | [1]                  |
| pCT334 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1                              | [2]                  |
| pDS112 | pRS315 P<sub>ADH1</sub>-GFP-3myc-AtLOV2-cODC1                           | This study           |
| pDS133 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>FHM</sup>               | This study           |
| pDS143 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>K92R E132A E155G</sup> | This study           |
| pSU17  | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132A N148D E155G</sup> | This study           |
| pSU21  | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>V19I</sup>              | This study           |
| pSU23  | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>V19I</sup>              | This study           |
| pDS142 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>K92R M128Y</sup>         | This study           |
| pDS16  | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>K92R M128Y</sup>         | This study           |
| pSU19  | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132A E155K</sup>        | This study           |
| pDS124 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132A E155K</sup>        | This study           |
| pDS128 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132A N148E</sup>        | This study           |
| pDTS1  | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>G113A</sup>             | This study           |
| pDTS144| pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>G113A V142A R154G E155S</sup> | This study           |
| pCT341 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>G113A N148E</sup>        | This study           |
| pDTS140| pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>G113A R154G E155S</sup> | This study           |
| pSU18  | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132D E155K</sup>        | This study           |
| pDS139 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132D E155K</sup>        | This study           |
| pDTS140| pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132D E155K</sup>        | This study           |
| pSU19  | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132D E155K</sup>        | This study           |
| pSU20  | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132D E155K</sup>        | This study           |
| pDS125 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132D E155K</sup>        | This study           |
| pDTS12 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132D E155K</sup>        | This study           |
| pDTS4  | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>E132D E155K</sup>        | This study           |
| pDS132 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-deg<sub>ODC</sub>                  | This study           |
| pDS109 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>CAC</sup>               | This study           |
| pDS110 | pRS315 P<sub>ADH1</sub>-tagRFP-AtLOV2-cODC1<sup>CACAC</sup>             | This study           |
| pCT337 | tagRFP-AtLOV2-cODC1::kanMX ori bla                                       | [2]                  |
| pDS91  | tagRFP-AtLOV2-cODC1<sup>N148E</sup>::kanMX ori bla                     | This study           |
| pDS90  | pRS315 P<sub>TDH3</sub>-tagRFP-AtLOV2-cODC1                             | This study           |
| pSU9   | pRS315 P<sub>TDH3</sub>-tagRFP-AtLOV2-cODC1                              | This study           |
| pSU10  | pRS315 P<sub>TDH3</sub>-tagRFP-AtLOV2-cODC1<sup>K92R E132A N148D E155G</sup> | This study           |
| pDS87  | pRS315 P<sub>TDH3</sub>-tagRFP-AtLOV2-cODC1<sup>*160A</sup>             | [2]                  |
| pCT344 | pRS315 P<sub>TDH3</sub>-tagRFP-AtLOV2-cODC1<sup>K92R M128Y G113A C160A</sup> | This study           |
| pCT345 | pRS315 P<sub>TDH3</sub>-tagRFP-AtLOV2-cODC1<sup>K92R M128Y C160A</sup>   | This study           |
|    |    |    |    |
|----|----|----|----|
| pCT346 | pRS315 P$_{ADH1}$-tagRFP-AtLOV2-cODC1$^{K92R \ E112A \ E135G \ C160A}$ | This study |    |
| pCT347 | pRS315 P$_{ADH1}$-tagRFP-AtLOV2-cODC1$^{G138A \ V142A \ R154G \ E155S \ C160A}$ | This study |    |

**Supplementary references**

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