`\xunit=`*dimen*
`\xunit+=`*dimen*

Set the horizontal units for the coordinate system used when typesetting modifications on a Figure or Graph.

```
\xunit=5mm
\Graph{1cm}{5mm}
\Dot (0,.5) \Dot (1,.5) \Dot (2,.5)
\endGraph
```


`\ygrid=`*dimen* — `1cm`
`\ygrid+=`*dimen*

Set the default distance between the horizontal gridlines of a Diagram. Sets `\yscale=1`.

`\yrange=`*integer* — 1

Set the vertical units for the coordinate system used when typesetting modifications on a Figure or Graph by dividing the default unit by *integer*. See `\xrange`.

`\yscale=`*number* — 1

Scale `\ygrid` by *number*. See `\xscale`.

`\yunit=`*dimen*
`\yunit+=`*dimen*

Set the vertical units for the coordinate system used when typesetting modifications on a Figure or Graph. See `\xunit`.

26. Examples

The `Dash`, `Dashto` and `Mono` cell types in some of these examples use the `arrsy10` font: See §14 and `\arrsy` in §25. Also, `\bb` invokes the bbm family of fonts.

```
$$
\grid=.75cm
\Diagram
A'          &       & \rTo ^{f'} &        & B'                          \\
            & \rdTo <a \dh{2pt}& &        &          & \rdTo _b          \\
\dTo <{g'} &       & A          &        & \dTo <{h'} :{.25}
                                            \rTo ^f :{.25} \br
                                                     &          & B       \\
                                                                         \\
C'          &       & \rTo ^{k'} :{.75} \dTo <g :{.25} \br
                                 &        & D'       &          & \dTo >h \\
            & \rdTo _c \dh{.5pt}&&        &          & \rdTo _d          \\
            &       & C          &        & \rTo ^k &          & D       \\
\endDiagram
$$
```

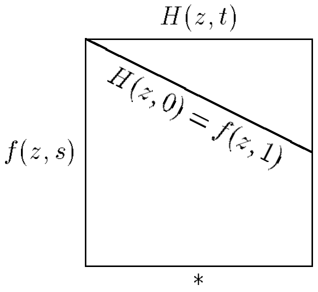
$$
\begin{tikzcd}
A' \arrow[rrr, "f'"] \arrow[dr, "a"'] \arrow[dd, "g'"'] & & & B' \arrow[dr, "b"] \arrow[dd, "h'"'] & \\
& A \arrow[rrr, "f"] \arrow[dd, "g"'] & & & B \arrow[dd, "h"] \\
C' \arrow[rrr, "k'"] \arrow[dr, "c"'] & & & D' \arrow[dr, "d"] & \\
& C \arrow[rrr, "k"] & & & D
\end{tikzcd}
$$

G. Bredon, *Introduction to Compact Transformation Groups*, page 75.

```
$$
\Dg
F\times K\times U      & \rTo ^{\rm proj}      &             & K\times U         \\
\dTo                   &                       &             & \dTo >{\rm proj} \\
F\times_K (K\times U) & {} \approx F\times U & \rTo ^{\rm proj}& U               \\
\endDg
$$
```

$$
\begin{tikzcd}
F \times K \times U \arrow[rr, "\mathrm{proj}"] \arrow[d] & & K \times U \arrow[d, "\mathrm{proj}"] \\
F \times_K (K \times U) & \approx F \times U \arrow[r, "\mathrm{proj}"] & U
\end{tikzcd}
$$

```
$$
\joined \let\labelstyle\textstyle
\Graph{3cm,2}{3cm,4}
\Line (0,0) (0,4) <{f(z,s)}
\Line (0,4) (2,4) ^{H(z,t)}
\Line (0,0) (2,0) _{*}
\Line (2,0) (2,4)
\Line (0,4) (2,2) _{\;\;H(z,0) = f(z,1)} \ro
\endGraph
\qquad\qquad
H'(z,t,s) =
\cases{f(z,2s/(2-t))& if $0\le 2s\le 2 - t$\cr
       \cr
       H(z,2s - 2 + t)& if $2 - t\le 2s\le 2$\cr}
$$
```



$$H'(z,t,s) = \begin{cases} f(z,2s/(2-t)) & \text{if } 0 \le 2s \le 2-t \\ \\ H(z,2s-2+t) & \text{if } 2-t \le 2s \le 2 \end{cases}$$

```
$$
\def\mod{\mathrel{\big/}}
\Dg
{\rm Spin}(3) &        &       &       & SU(2)       \\
              & \rdTo  &       & \ldTo               \\
              &        & SO(3)                       \\
              &        & \dTo                        \\
& O(3)\mod O(1)^3 = {} & SO(3)\mod(O(1)^3\cap SO(3)) \\
\endDg
$$
```

$$\begin{tikzcd}[column sep=small] \mathrm{Spin}(3) \arrow[dr] & & SU(2) \arrow[dl] \\ & SO(3) \arrow[d] & \\ & O(3) \mathrel{\big/} O(1)^3 = SO(3) \mathrel{\big/} (O(1)^3 \cap SO(3)) & \end{tikzcd}$$

S. Mac Lane, *Categories for the Working Mathematician*, page 109.

```
$$
\def\cod{{\rm cod}\,} \def\dom{{\rm dom}\,}
\cellwidth+=2mm
\Dg
& F & _{\cod u} & \rEq       & F & _{\cod u} &     &              & F_i               \\
& \uTo >{p_u} & &            & \uTo &        &     & \ruTo <{p_i} \tx{-5pt} &
                                                                  \uDashto >{\mu_i} \\
{\mit\Pi}_{u:j\to k}F_k = {\mit\Pi}_u &
  F & _{\cod u} & \lTo ^f \up{3pt} \lTo _g \up{-3pt}
                             & {\mit\Pi}_i & & F_i & \lDashto ^e & d               \\
& \dTo >{p_u} & &            & \dTo >{p_{\dom u}}                                 \\
& F & _{\cod u} & \lTo ^{Fu} & F & _{\dom u}                                       \\
\endDg
$$
```

$$
\begin{tikzcd}
F_{\mathrm{cod}\,u} \arrow[r, phantom, "="] & F_{\mathrm{cod}\,u} & F_i \\
\Pi_{u:j\to k}F_k = \Pi_u F_{\mathrm{cod}\,u} \arrow[u, "p_u"'] \arrow[d, "p_u"'] & \Pi_i F_i \arrow[l, shift right, "f"'] \arrow[l, shift left, "g"] \arrow[u] \arrow[ur, "p_i"] \arrow[d, "p_{\mathrm{dom}\,u}"'] & d \arrow[l, dashed, "e"'] \arrow[u, dashed, "\mu_i"'] \\
F_{\mathrm{cod}\,u} & F_{\mathrm{dom}\,u} \arrow[l, "Fu"'] &
\end{tikzcd}
$$

S. Mac Lane, *Categories for the Working Mathematician*, page 117.

```
$$
\Dg
u           & \rTo ^{e_1}   & v       & & \rTo \up{3pt} ^f \rTo \up{-3pt} _g & d    \\
\uDashto >s &               & \dTo >e &                   &                 & \uTo \\
w           & \rTo ^{ee_1s} & w       & {} = {\mit\Pi}k_i & \rTo            & k_i  \\
\endDg
$$
```

$$
\begin{tikzcd}
u \arrow[r, "e_1"] & v \arrow[rr, shift left, "f"] \arrow[rr, shift right, "g"'] \arrow[d, "e"] & & d \\
w \arrow[u, dashed, "s"] \arrow[r, "ee_1s"] & w = \Pi k_i \arrow[rr] & & k_i \arrow[u]
\end{tikzcd}
$$

S. Mac Lane and I. Moerdijk, *Sheaves In Geometry and Logic*, page 232.

```
$$
\cellwidth+=3mm
\Dg
Y      & \rMono ^y & A                  & \rLine \jh & \stop                \\
\dEpi  &           & \dEpi              &            & \mx{-1cm}            \\
D      & \rMono ^d & i_A(A)             &            & \dLine >{\eta_A} \jn \\
\dMono &           & \dMono                                                 \\
X      & \rMono _x & \overline{i_A(A)} & \lTo \jt   & \stop                \\
\endDg
$$
```

$$
\begin{tikzcd}
Y \arrow[r, tail, "y"] \arrow[d, two heads] & A \arrow[d, two heads] \arrow[dd, bend left=60, "\eta_A"] \\
D \arrow[r, tail, "d"] \arrow[d, tail] & i_A(A) \arrow[d, tail] \\
X \arrow[r, tail, "x"'] & \overline{i_A(A)}
\end{tikzcd}
$$

K. S. Brown, *Cohomology of Groups*, page 280.

```
$$
\let\^\widehat \let\~\widetilde
\flexible \columndist=1cm
\xgrid+=2mm \ygrid+=-2mm
\Diagram
        &         &         &        &H^0 \bTo(-1,-4) \hx{-2pt}
                                             &\cdots  &H^{n-1}  &H^n  &H^{n+1}  &H^{n+2} &\cdots \\
\mx{5mm}&         &         &        &\dTo   &        &\dTo     &\dEpi&\dBar    &\dBar &\mx{-2mm}\\
\cdots  &\^H^{-3} &\^H^{-2} &\^H^{-1}&\^H^0  &\cdots  &\^H^{n-1}&\^H^n&\^H^{n+1}&\^H^{n+2}&\cdots\\
        &\dBar    &\dBar    &\dInto  &\dTo   &        &\dTo \dx{-2mm}                          \\
\cdots  &\~H_{n+2}&\~H_{n+1}&\~H_n   &\~H_{n-1}&\cdots&\~H_0 \aTo(1,4) \hx{-2pt}              \\
\endDiagram
$$
```

$$
\begin{tikzcd}
 & & & & H^0 \arrow[d] & \cdots & H^{n-1} \arrow[d] & H^n \arrow[d, two heads] & H^{n+1} \arrow[d, equal] & H^{n+2} \arrow[d, equal] & \cdots \\
\cdots & \widehat{H}^{-3} \arrow[d, equal] & \widehat{H}^{-2} \arrow[d, equal] & \widehat{H}^{-1} \arrow[d, hook] & \widehat{H}^0 \arrow[d] & \cdots & \widehat{H}^{n-1} \arrow[d] & \widehat{H}^n & \widehat{H}^{n+1} & \widehat{H}^{n+2} & \cdots \\
\cdots & \widetilde{H}_{n+2} & \widetilde{H}_{n+1} & \widetilde{H}_n \arrow[uur] & \widetilde{H}_{n-1} & \cdots & \widetilde{H}_0 \arrow[uur] & & & &
\end{tikzcd}
$$

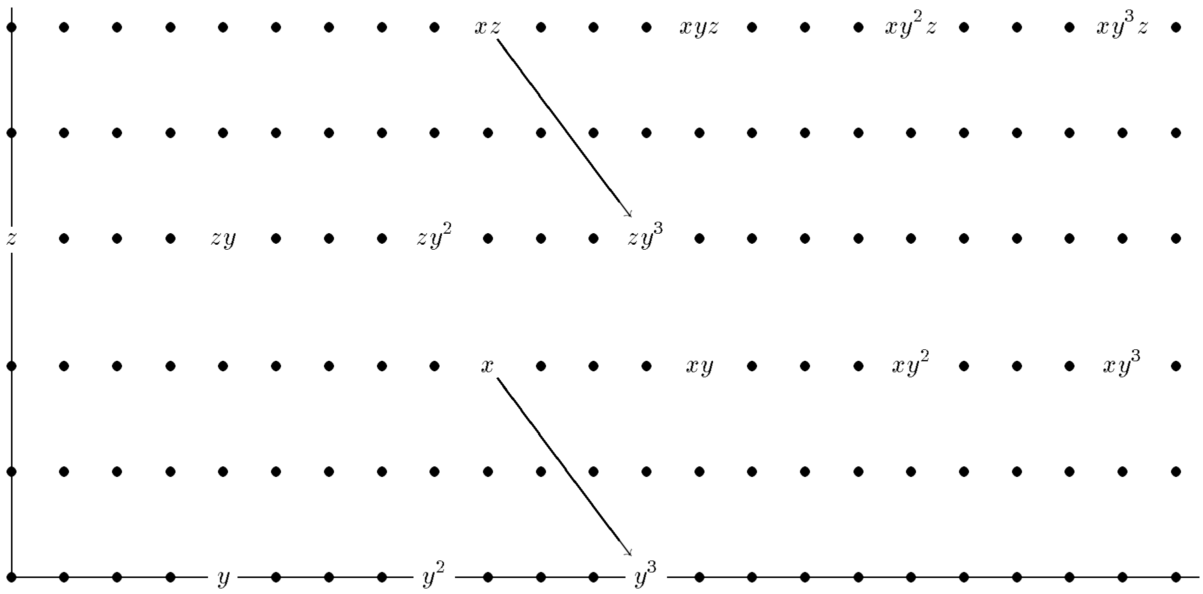
George W. Whitehead, *Elements of Homotopy Theory*, page 592.

```
$$
\def\T{{\bf T}} \def\S{{\bf S}}
\landscape \let\labelstyle\textstyle
\cellpush=10pt \xscale=2.2
\Diagram
       &                  & H_n(X^+\cup\T A^+, X^+) &
   \lTo ^{H_n(k_1)} &        & H_n(\T A^+,A^+)
                               \aTo (-3,-2) _{H_n(p_1)}
                               \aTo (3,-4) ^{\partial_1}                 \\
       &                  & \dTo >{H_n{q_1}}                             \\
       &                  & H_n(\S A^+,P)          &
                    &        & * \dx{.7}                                 \\
       & \ruTo _{H_n(q_4)} \tx{15pt}
                          & \uTo >{H_n(t)}                               \\
H_n(X^+\cup\T A^+,P) \aTo (2,4)  ^{H_n(j_1)} \tx{15pt}
                     \aTo (2,-4) _{H_n(j_2)} \tx{15pt}
       &   &   &    &        &   & H_{n-1}(A) &
                                     \rTo ^{H_{n-1}(i_A)} & H_{n-1}(A^+,P) \\
       & \rdTo ^{H_n(q_2)} \tx{15pt}
                          &                         & & & \ruTo          \\
       &                  & H_n(X^+/A^+,P)          &
  \lTo ^{P_n(X,A)}  & H_n(X,A)
                      \aTo (1,-2) >{H_n(i_X)}                            \\
       &                  & \uTo >{H_n(q_3)}                             \\
       &                  & H_n(X^+\cup\T A^+,\T A^+)&
  \lTo _{H_n(k_2)} & & H_n(X^+,A^+)
                       \aTo (3,4) _{\partial_2}
                       \aTo (-3,2) _{H_n(p_X)}                           \\
\endDiagram
$$
```

$$
\begin{tikzcd}
 & H_n(X^+ \cup \mathbf{T}A^+, X^+) \arrow[d, "H_n q_1"] & & H_n(\mathbf{T}A^+, A^+) \arrow[ll, "H_n(k_1)"'] \arrow[dll, "H_n(p_1)"] \arrow[ddr, "\partial_1"] & \\
 & H_n(\mathbf{S}A^+, P) & & * & \\
H_n(X^+ \cup \mathbf{T}A^+, P) \arrow[uur, "H_n(j_1)"] \arrow[ur, "H_n(q_4)"'] \arrow[dr, "H_n(q_2)"] \arrow[ddr, "H_n(j_2)"'] & & & H_{n-1}(A) \arrow[r, "H_{n-1}(i_A)"] & H_{n-1}(A^+, P) \\
 & H_n(X^+/A^+, P) \arrow[uu, "H_n(t)"'] & H_n(X, A) \arrow[l, "P_n(X,A)"'] \arrow[ur] \arrow[dr, "H_n(i_X)"] & & \\
 & H_n(X^+ \cup \mathbf{T}A^+, \mathbf{T}A^+) \arrow[u, "H_n(q_3)"'] & & H_n(X^+, A^+) \arrow[ll, "H_n(k_2)"] \arrow[ull, "H_n(p_X)"] \arrow[uur, "\partial_2"'] &
\end{tikzcd}
$$

J. McCleary, *A User's to Spectral Sequences*, page 13.

```
$$
\dotted
\grid=7mm
\yscale=2
\Diagram
&&&&&&&&&xz&&&&xyz&&&&xy^2z&&&&xy^3z&\\
\\
z&&&&zy&&&&zy^2&&&&zy^3\\
\dy{-.2}
&&&&&&&&&x&&&&xy&&&&xy^2&&&&xy^3\\
\\
&&&&y&&&&y^2&&&&y^3\\
\Modify
\Line (0,0) (4,0) \dt{1pt}
\Line (4,0) (8,0)
\Line (8,0) (12,0)
\Line (12,0) (22.5,0)
\Line (0,0) (0,3) \dt{1pt}
\Line (0,3) (0,5.2)
\To (9,2) (12,0)
\To (9,5) (12,3)
\endDiagram
$$
```



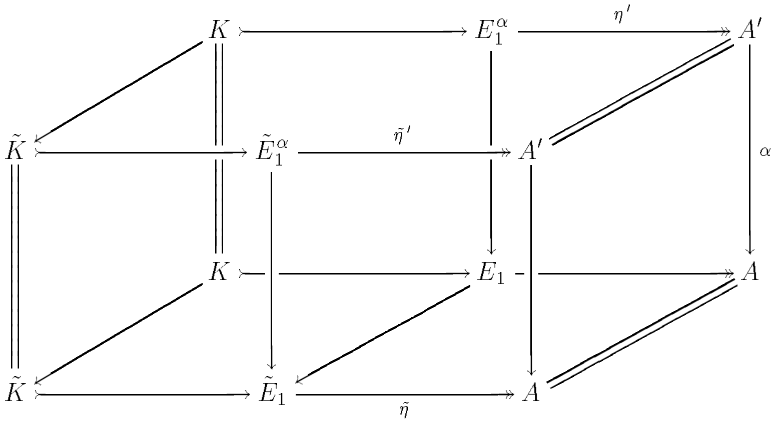
J. McCleary, *A User's to Spectral Sequences*, page 346.

```
$$
\cellpush+=5pt
\cellwidth+=2mm
\Dg
&&_{N+t'}X_p  & \rTo ^{g_{p+q}} & _N X_{p+q}  \\
&& \dFillcell{\;\cdots\;\rightarrowfill} &
                                & \dFillcell{\;\cdots\;\rightarrowfill} \\
                                                \\
&& _{N+t'}X_1 & \rTo ^{g_{q+1}} & _N X_{q+1}  \\
&& \dTo       &                 & \dTo        \\
S^{N+t+t'}X \aTo (2,5) ^{f_p} \tx{.7} \hx{5pt} & \rTo ^f &
   S^{N+t'}X  & \rTo ^{g_q}     & _N X_q      \\
                                                \\
&&            &                 & \dFillcell{\rightarrowfill\;\cdots\;\rightarrowfill} \\
                                                \\
&&            &                 & _N X_1      \\
&&            &                 & \dTo        \\
&&            &                 & S^N X \bTo (-2,6) <g \hx{.2} \\
\endDg
$$
```

$$
\begin{tikzcd}
 & {}_{N+t'}X_p \arrow[r, "g_{p+q}"] & {}_N X_{p+q} \\
 & \vdots \arrow[d] & \vdots \arrow[d] \\
 & {}_{N+t'}X_1 \arrow[r, "g_{q+1}"] \arrow[d] & {}_N X_{q+1} \arrow[d] \\
S^{N+t+t'}X \arrow[r, "f"] \arrow[uuur, "f_p"] & S^{N+t'}X \arrow[r, "g_q"] \arrow[dddr, "g"'] & {}_N X_q \arrow[d] \\
 & & \vdots \arrow[d] \\
 & & {}_N X_1 \arrow[d] \\
 & & S^N X
\end{tikzcd}
$$

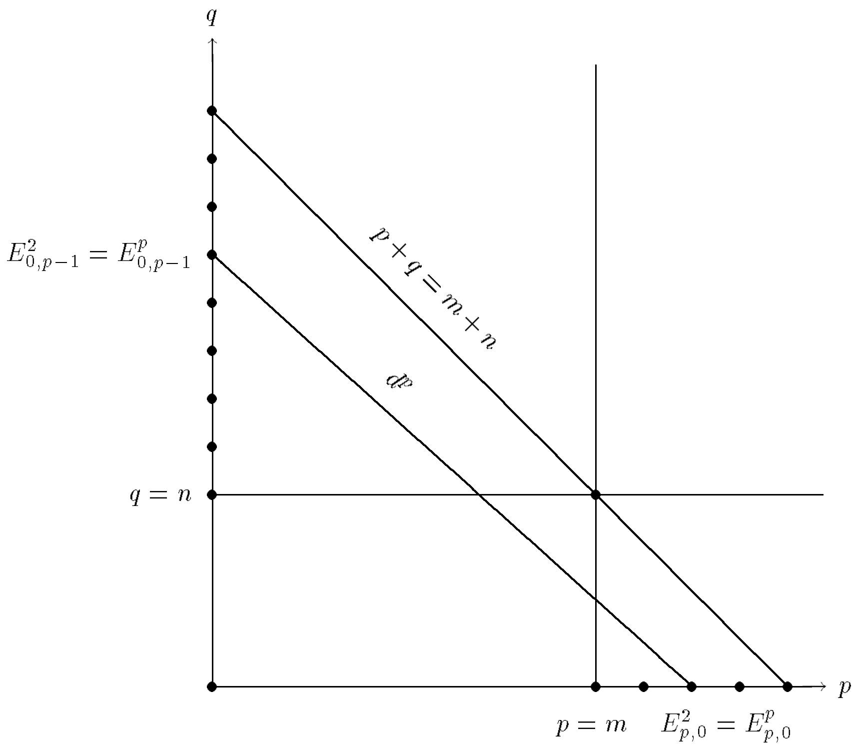
P. J. Hilton and U. Stammbach, *A Course in Homological Algebra*, page 149.

```
$$
\let~\tilde
\cellwidth+=17mm \columndist+=12mm
\gravitateleft
\Dg
  &      & K               & \rMono      && E_1^\alpha& \rEpi^{\eta'}&& A'       \\
  & \ldTo&                 &             &&           &      & \ruBar            \\
~K&      & \dBar\rMono\br& ~E_1^\alpha&& \dTo\rEpi^{~\eta'}\br&
                                                      A'                         \\
\dBar&   &                 &             &&           &      &    & \dTo>\alpha \\
  &      & K               & \rMono\dTo\br&& E_1\ax{2mm}& \rEpi\dTo\br&& A      \\
  & \ldTo&                 &      & \ldTo&           &      & \ldBar            \\
~K&      & \rMono          & ~E_1 & \rEpi_{~\eta}&   & A                         \\
\endDg
$$
```



George W. Whitehead, *Elements of Homotopy Theory*, page 650.

```
$$
\cellpush=4pt
\let\labelstyle\textstyle
\lpad=1in \bpad=1cm
\Graph{4in,4}{3.5in,1in}
\To (0,0) (3.3,0)    \hd{p}
\To (0,0) (0,3.5)    \hd{q}
\Line (2,0) (2,3.25) \Line (0,1) (3.2,1) \Dot (2,1)
\Dot (0,0)
%
\Dot (2,0) \Dot (2.25,0) \Dot (2.5,0) \Dot (2.75,0) \Dot (3,0)
%
\Dot (0,1) \Dot (0,1.25) \Dot (0,1.5) \Dot (0,1.75)
\Dot (0,2) \Dot (0,2.25) \Dot (0,2.5) \Dot (0,2.75) \Dot (0,3)
%
\Line (0,2.25) (2.5,0)  ^{d^p} :{.35,5pt} \ro
\Line (0,3) (3,0)  ^{p + q = m + n} :{.35,5pt} \ro
%
\Math{q = n} (-.1,1) *1     \Math{E_{0,p-1}^2 = E_{0,p-1}^p} (-.1,2.25) *1
\Math{p = m} (2,-.2) *{.55} \Math{E_{p,0}^2 = E_{p,0}^p} (2.75,-.2) *{.6}
\endGraph
$$
```



```
$$
\rotatedlabels \let\labelstyle\textstyle \scale=2
\Diagram
 & & F(3,2) \aLine (1,-4) >{F(3,1,1)} :{.4} \br  \\
 & &        & \rdLine >{F(1,2,2)} \pt{right,.75} \\
 & &        &         & F(1,4)                   \\
F(2,3) \aDash (4,1) ^{F(1,1,3)} :{.4} \pp        \\
 & &        & F(4,1) \aLine (1,2) >{F(1,3,1)}    \\
\Modify
\Pt{top} (2,4) \Pt{b1} (0,1) \Pt{b2} (3,0)
\Pt{LeftF} (1.65,2) \Pt{BackF} (2,2.5)
\Pt{BottomF} (2.5,1) \Pt{RightF} (3.1,2.25)
\Nul  \pt{b1} \pt{b2}              \pt{bottom,.8}
\Nul  \pt{BottomF} \pt{bottom}     \pt{BottomL,2}
\Dash \pt{BottomF} \pt{bottom}     \tl\circ \dt{3pt}
\Line \pt{bottom} \pt{BottomL}     \hd{F(1,1,2,1)}
\Line \pt{b1} \pt{b2} _{F(2,2,1)}  \br
\Nul  \pt{b1} \pt{top}             \pt{left,.25} \pt{back,.75}
\Nul  \pt{BackF} \pt{back}         \pt{BackL,2}
\Nul  \pt{LeftF} \pt{left}         \pt{LeftL,2}
\Dash \pt{BackF} \pt{back}         \tl\circ \dt{3pt}
\Line \pt{back} \pt{BackL}         \hd{F(1,1,1,2)}
\Line \pt{b1} \pt{top} <{F(2,1,2)} \br
\Line \pt{LeftF} \pt{LeftL}        \tl\bullet \hd{F(2,1,1,1)} \jt \br
\Nul  \pt{RightF} \pt{right}       \pt{RightL,3}
\Line \pt{RightF} \pt{RightL}      \tl\bullet \hd{F(1,2,1,1)} \jt \br
\endDiagram
$$
```