SAS Output from Example

```
                    General Linear Models Procedure

                 Number of observations in data set = 8

                 Repeated Measures Analysis of Variance
                   Repeated Measures Level Information

  Dependent Variable      VV1      VV2      VV3      VV4      VV5      VV6

    Level of VENTVOL        1        2        3        4        5        6

            Manova Test Criteria and Exact F Statistics for
                   the Hypothesis of no VENTVOL Effect
       H = Type III SS&CP Matrix for VENTVOL   E = Error SS&CP Matrix

                       S=1     M=1.5     N=0.5

  Statistic                    Value         F      Num DF    Den DF  Pr > F

  Wilks' Lambda             0.17008800    2.9276        5         3  0.2028
  Pillai's Trace            0.82991200    2.9276        5         3  0.2028
  Hotelling-Lawley Trace    4.87930953    2.9276        5         3  0.2028
  Roy's Greatest Root       4.87930953    2.9276        5         3  0.2028
```

- $F = \dfrac{n-t+1}{(n-1)(t-1)} T^2 = \dfrac{3}{35} T^2 = 2.9276$ has the $F_{5,3}$ distribution ($p = .2028$)

SAS Output from Example

```
                Manova Test Criteria and Exact F Statistics for
                      the Hypothesis of no HEIGHT Effect
            H = Type III SS&CP Matrix for HEIGHT   E = Error SS&CP Matrix


   Statistic                      Value          F       Num DF    Den DF  Pr > F
   Wilks' Lambda               0.20616620     21.8192        3        17  0.0001
   Pillai's Trace              0.79383380     21.8192        3        17  0.0001
   Hotelling-Lawley Trace      3.85045564     21.8192        3        17  0.0001
   Roy's Greatest Root         3.85045564     21.8192        3        17  0.0001


                  Analysis of Variance of Contrast Variables
            HEIGHT.N represents the nth degree polynomial contrast for HEIGHT


   Contrast Variable: HEIGHT.1
   Source               DF     Type III SS    Mean Square   F Value    Pr > F
   MEAN                  1      89.87040000    89.87040000    51.83     0.0001
   Error                19      32.94660000     1.73403158


   Contrast Variable: HEIGHT.2
   Source               DF     Type III SS    Mean Square   F Value    Pr > F
   MEAN                  1       0.00800000     0.00800000     0.04     0.8480
   Error                19       4.02700000     0.21194737


   Contrast Variable: HEIGHT.3
   Source               DF     Type III SS    Mean Square   F Value    Pr > F
   MEAN                  1       0.00010000     0.00010000     0.00     0.9823
   Error                19       3.74290000     0.19699474


                    M Matrix Describing Transformed Variables
                  H80              H85              H90              H95
   MVAR1           1               -1               -1               1
   MVAR2          -1                3               -3               1


                Manova Test Criteria and Exact F Statistics for
                   the Hypothesis of no Overall INTERCEPT Effect
                on the variables defined by the M Matrix Transformation
            H = Type III SS&CP Matrix for INTERCEPT   E = Error SS&CP Matrix


   Statistic                      Value          F       Num DF    Den DF  Pr > F
   Wilks' Lambda               0.99800451      0.0180        2        18  0.9822
   Pillai's Trace              0.00199549      0.0180        2        18  0.9822
   Hotelling-Lawley Trace      0.00199948      0.0180        2        18  0.9822
   Roy's Greatest Root         0.00199948      0.0180        2        18  0.9822
```

SAS Output

Multivariate Analysis of Variance

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall GENDER Effect
H = Type III SS&CP Matrix for GENDER   E = Error SS&CP Matrix

S=1   M=1   N=10

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.60230061	3.6317	4	22	0.0203
Pillai's Trace	0.39769939	3.6317	4	22	0.0203
Hotelling-Lawley Trace	0.66030051	3.6317	4	22	0.0203
Roy's Greatest Root	0.66030051	3.6317	4	22	0.0203

M Matrix Describing Transformed Variables

	D8	D10	D12	D14
MVAR1	-1	1	0	0
MVAR2	0	-1	1	0
MVAR3	0	0	-1	1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall GENDER Effect
on the variables defined by the M Matrix Transformation
H = Type III SS&CP Matrix for GENDER   E = Error SS&CP Matrix

S=1   M=0.5   N=10.5

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.73988739	2.6953	3	23	0.0696
Pillai's Trace	0.26011261	2.6953	3	23	0.0696
Hotelling-Lawley Trace	0.35155702	2.6953	3	23	0.0696
Roy's Greatest Root	0.35155702	2.6953	3	23	0.0696

- The statistic for testing H_0: $\mu_b = \mu_g$ is $F = \dfrac{n_1 + n_2 - t - 1}{(n_1 + n - 2)t} T^2 = \dfrac{22}{100} T^2 = 3.6317$ with $t = 4$ and $n_1 + n_2 - t - 1 = 22$ df

- The statistic for testing parallelism of the μ-profiles is

$$F = \frac{n_1 + n_2 - (t-1) - 1}{(n_1 + n - 2)(t-1)} T^2 = \frac{23}{75} T^2 = 2.6953$$

with $t - 1 = 3$ and $n_1 + n_2 - (t-1) - 1 = 23$ df