**TABLE 8.15-1 (continued)**

| | | |
|---|---|---|
| | $+ [ABD] + [ACD]$<br>$+ [ABS] + [ACS]$<br>$+ [ADS] - [AB] - [AC]$<br>$- [AD] - [AS] + [A]$ | $p(n-1)(q-1)(r-1)(u-1)$ |
| 26 | $SS_{total} = [ABCDS] - [X]$ | $npqru - 1$ |

## 8.16 COMPUTATIONAL PROCEDURES FOR TYPE SPF-*pr.qu* DESIGN

A type SPF-*pr.qu* design represents an extension of analysis procedures described for type *pr.q* and *p.qr* designs. A block diagram of this design appears in Figure 8.16-1 The structural model for the design is

$$X_{ijklm} = \mu + \alpha_i + \gamma_k + \alpha\gamma_{ik} + \pi_{m(ik)} + \beta_j + \alpha\beta_{ij} + \beta\gamma_{jk} + \alpha\beta\gamma_{ijk} + \beta\pi_{jm(ik)} + \delta_l + \alpha\delta_{il} + \gamma\delta_{kl} + \alpha\gamma\delta_{ikl} + \delta\pi_{lm(ik)} + \beta\delta_{jl} + \alpha\beta\delta_{ijl} + \beta\gamma\delta_{ikl} + \alpha\beta\gamma\delta_{ijkl} + \beta\delta\pi_{jlm(ik)} + \varepsilon_{o(ijklm)}$$

| | $b_1 d_1$ | $b_1 d_2$ | $b_2 d_1$ | $b_2 d_2$ |
|---|---|---|---|---|
| $ac_{11}$ | $s_1$ | $s_1$ | $s_1$ | $s_1$ |
| $ac_{12}$ | $s_2$ | $s_2$ | $s_2$ | $s_2$ |
| $ac_{21}$ | $s_3$ | $s_3$ | $s_3$ | $s_3$ |
| $ac_{22}$ | $s_4$ | $s_4$ | $s_4$ | $s_4$ |

**Figure 8.16-1 Block diagram of type SPF-22 22 design**

The computational formulas for the design, degrees of freedom, and $F$ ratios for Model III appear in Table 8.16-1. The meaning of the terms should be clear from previous examples.

**TABLE 8.16-1 Computational Formulas for Type SPF-*pr qu* Design and *F* Ratios**

| | *Computational Formulas* | df | *F ratio (A, B, C and D Fixed Effects Subjects Random)* |
|---|---|---|---|
| 1 | $SS_{between\ sub_j} = [ACS] - [X]$ | $npr - 1$ | |
| 2 | $SS_A = [A] - [X]$ | $p - 1$ | $\left[\frac{2}{5}\right]$ |
| 3 | $SS_C = [C] - [X]$ | $r - 1$ | $\left[\frac{3}{5}\right]$ |