TWO STAR CALIBRATION ALGORITHM

This is the algorithm which lies behind the AWR initialization procedure:

putting h1 & h2 for the hour angle of star1 & star2
and
putting LST1 & LST2 for the local sidereal times at CAL1 & CAL2
and
putting RA1 & RA2 for the right ascensions of star1 & star2
and
putting dec1 & dec2 for the declinations of star1 & star2

we have:

$$h_1 = 15\left(LST_1 - RA_1\right) \quad LST_1 \text{ called from RTC}$$
$$h_2 = 15\left(LST_2 - RA_2\right) \quad LST_2 \text{ called from RTC}$$
$$h_{2-m} = 15\left(LST_2 - RA_{2m}\right)$$

$$c_1 = h_{2-m} - h_2 \qquad c_1 \geq RA_2 - RA_{2m} \ \left(LST \text{ values differ}\right)$$
$$c_2 = dec_{2m} - dec_2$$

where m is the sidereal time interval between CAL1 & CAL2

putting:

$$w = \cos h_1$$
$$x = \sin h_1$$
$$y = \cos h_2$$
$$z = \sin h_2$$
$$s = \tan dec_1$$
$$t = \tan dec_2$$

we perform the following transformations:

$$a_1 = \left(tz - sx\right) = \tan\phi_2 \sin h_2 - \tan\phi_1 \sin h_1$$
$$b_1 = \left(sw - ty\right) = \tan\phi_1 \cos h_1 - \tan\phi_2 \cos h_2$$
$$a_2 = \left(y - w\right) = \cos h_2 - \cos h_1$$
$$b_2 = \left(z - x\right) = \sin h_2 - \sin h_1$$

from which:

$$a_1 b_2 - a_2 b_1 = \left(\tan\phi_2 \sin h_2 - \tan\phi_1 \sin h_1\right)\left(\sin h_2 - \sin h_1\right) - \left(\cos h_2 - \cos h_1\right)\left(\tan\phi_1 \cos h_1 - \tan\phi_2 \cos h_2\right)$$

& the elevation and azimuth of the polar axis relative to the true pole may be derived:

$$M_{el} = \frac{c_1 b_2 - c_2 b_1}{a_1 b_2 - a_2 b_1}$$
$$M_{az} = \frac{a_1 c_2 - a_2 c_1}{a_1 b_2 - a_2 b_1}$$