The magnetogram inversion technique (MIT) utilizes the ground-based magnetometer data from the worldwide network and provides maps of ionospheric and field-aligned current (FAC). In this paper the MIT output is used for examining the development of the 27.08.2001 substorm. The MIT data allow deducing the electric circuit of the disturbed magnetosphere/ionosphere. The magnetospheric generators primarily supply the $R_1$ FACs in two hemispheres while the $R_2$ and $R_0$ FACs are formed by spreading of the $R_1$ current within the ionosphere so that the equality of $J(R_1) = J(R_2) + J(R_0)$ is held. However, during the event under consideration the periods exist when $J(R_1) > J(R_2)$ or $J(R_1) < J(R_2)$. We show that these inequalities are related to “overshielding” or “undershielding” conditions and propose the additional generators of the $R_2$ FAC responsible for these phenomena. The paper demonstrates the usefulness of the MIT for the analysis of magnetospheric response to solar wind perturbations.