

The DIII-D magnetic diagnostic system

E.J. Strait

General Atomics, P.O. Box 85608, San Diego, California 92186-5608

e-mail: strait@fusion.gat.com

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Abstract. External measurements of the magnetic field surrounding a hot, magnetically confined plasma yield important information about the state of the plasma, since the external field is generated in part by electric currents within the plasma itself. Therefore, magnetic diagnostics are an essential part of both the operation and the physics experiments in tokamaks and other magnetic confinement devices. The magnetic diagnostic system of the DIII-D tokamak includes approximately 250 inductive sensors of various types: axisymmetric poloidal flux loops, diamagnetic flux loops, magnetic probes and saddle loops for measurement of local magnetic field, and Rogowski loops for measurement of coil currents and plasma current. The primary uses of the data include plasma shape and position control with a real-time digital control system, post-discharge equilibrium reconstruction, spectrum analysis in time and space of plasma instabilities, and direct feedback control of slowly growing instabilities. The sensors, instrumentation, calibration, applications, and operating experience are described.