AN AUTOMATIC WATER-SENSING START SWITCH FOR A MANNING S4000 SAMPLER (NOTE)

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The Manning S4000 automatic water sampler, like many others, operates in two modes—time sequential and flow proportional. Both of these modes are of limited use in studies of urban hydrology. Because the occurrence of storms cannot be predicted, the time mode cannot be used unless an operator is present to start the sampler. When the flow-proportional mode is used, the size of the storm dictates how frequently samples are taken, and much detail is lost from small storms.

The chemical content of the initial flood wave is of most interest, as relatively little change occurs in the chemistry of the receding water. Thus, to sample this flood wave adequately without manual switching, a water-sensing switch was developed to start the Manning S4000 sampler as soon as the stormwater reached the sampling point.

To start a Manning S4000 sampler in the time mode, the control is switched from OFF to TIME and the MANUAL CYCLE button pressed. This sequence is important. If the control switch is left in the TIME position, the sampler will start randomly somewhere through the preset time period. If the MANUAL CYCLE button is held down, the sampler will continue to cycle and will eventually be damaged. The water-sensing start switch (Fig. 1) was designed to switch the control to TIME and briefly close the MANUAL CYCLE switch when the stormwater shorts the probe contacts together.

When the sampler is installed, the frequency of sampling is set on the sequence timer, and the controller left switched to OFF. The water-sensing probe, which consists of two stiff tinned wires attached to a length of thin, flexible coaxial cable, is suspended just above the bottom of the stormwater pipe so that the contacts will be shorted together as soon as the flood wave arrives. Because the cable is flexible the contacts can move with the flood wave and do not get broken off.

Closure of these contacts will switch Q1 on and hence the relay which closes the MANUAL CYCLE switch. After a slight delay preset by R3 and C, Q4 switches on and activates the SCR (Q3) which in turn switches Q2 off and Q5 on. With Q2 off, the relay releases the MANUAL CYCLE switch; further closing of the probe contacts can then have no effect. The FET (Q5) has an extremely high 'off' resistance and low 'on' resistance as wired. This is essential for the CMOS circuitry in the controller. Q5 keeps the control switch in the TIME mode until all the samples are collected or the reset switch SW1 is opened. Without the time delay created by R3 and C, the switching is too fast to allow the relay contacts time to close.

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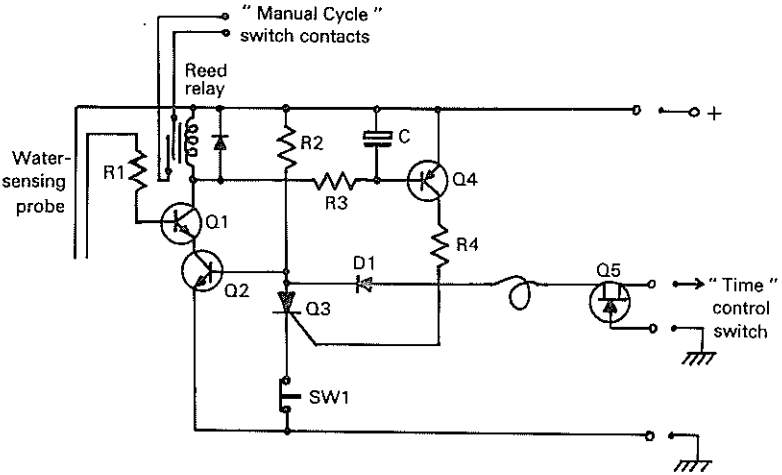

FIG. 1—Circuit diagram for water-sensing start switch. Components: R1–27 k Ω; R2–1.8 kΩ; R3, 4–4.7 kΩ; C– 25 μF 12 V elect.; SW1–single pole press-to-open; Relay–DIL 12 V (with diode) N.O., S.P.S.T.; Q1, 2–TIS 92; Q3–2N5060; Q4–TIS 93; Q5–2N3819; D1–1N914.

The circuit was mounted inside the control box of the Manning S4000 sampler on a small sub-board. The FET (Q5) was soldered directly to contacts of the control switch with the gate to ground and the drain to the TIME terminal of this switch. The remaining layout was not critical. The cable to the water-sensing probe was let through the side of the control box and sealed with a rubber grommet.