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Irrigation techniques — Remote monitoring and control for irrigation —

Part 2:
Tests

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry,* Subcommittee SC 18, *Irrigation and drainage equipment and systems.*

This document is intended to be used in conjunction with ISO 21622-1.

A list of all parts in the ISO 21622 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document specifies the tests required to ensure the functionalities defined in the other parts of the ISO 21622 series.

The purpose of the evaluation of the remote unit is intended to provide an opinion to serve as a guide to determine the overall functionality and operability of a remote control system.

This document concerns the remotes of remote control systems for irrigated areas.

Irrigation techniques — Remote monitoring and control for irrigation —

Part 2: Tests

1 Scope

This document specifies the tests necessary to assess the functionality and robustness of remote units used in irrigation remote control systems.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
control centre
CC
place to centralise the communications of all remote units

Note 1 to entry: It is usually accompanied by a system for monitoring remote equipment

3.1.2
remote unit
RU
microprocessor-based device that allows information to be obtained from an environment and sent remotely to where it can be processed

3.1.3
solenoid valve
SV
remote controllable element which, after receiving a signal from the remote unit, changes its status by allowing or not allowing the passage of water

3.1.4
nominal pressure
NP
working pressure of a hydraulic element

3.1.5
water passage detector
WPD
element confirming the passage of water through a volumetric valve

3.1.6
limit switch detector
LSD
element that ensures that a volumetric valve opens fully

3.1.7
active pulse time
T_{ON}
time a pulse emitter is sending an active signal

3.1.8
inactive pulse time
T_{OFF}
time during which a pulse emitter does not send any signal

3.2 Symbols

T	time
T_{CNA}	maximum time for the counter to detect opening of SVs
T_{CNC}	maximum time for the counter to detect SV closure
T_{FCA}	maximum time for LSD to detect opening of volumetric valve
T_{FCC}	maximum time for LSD to detect volumetric valve closing
T_{OFF}	inactive pulse time
T_{ON}	active pulse time
T_{PAA}	maximum time for WPD to detect opening of volumetric valve
T_{PAC}	maximum time for WPD to detect volumetric valve closure
V_{MIN}	minimum operating voltage of the remote unit
V_{NOM}	nominal operating voltage of the remote unit
V_{MAX}	maximum operating voltage of the remote unit
V_{OP}	full operating voltage

4 Functionality

4.1 General

The functionality tests detailed in this clause are intended to verify that the data provided by the manufacturers in the questionnaire (see Annex A) agree with the data obtained in the laboratory tests detailed in this document.

After each and every functionality test performed, it shall be verified that the remote unit is still operational, fulfilling the basic functions, as defined by the manufacturer in the questionnaire (see

Annex A), by checking it at the nominal voltage (V_{NOM}) of the equipment, unless otherwise stated by the manufacturer.

The manufacturer shall indicate which basic functions the remote unit shall maintain, but as a minimum, it shall comply with the following:

— counter reading;

— solenoid valve actuation (opening and closing);

— maintains;

  — time;

  — counter readings;

  — programming.

These verifications shall be defined by the manufacturer of the remote unit as they depend on the characteristics of the remote unit.

Of all the tests indicated in the document, only those that apply shall be carried out, depending on the characteristics of the equipment to be tested [characteristics defined by the manufacturer through the questionnaire (see Annex A)].

All tests described in Clause 4 should be conducted by a laboratory conforming to ISO 17025.

Acceptance criteria

The test shall be considered satisfactory if the variation between the values indicated by the manufacturer and the values obtained in the laboratory tests does not exceed:

— ±5 % of the value indicated by the manufacturer in the questionnaire (see Annex A) for the data of:

  consumption, voltage, current, short-circuit and open-circuit resistance and on the lowest and highest analogue signal value (added to the margin of error described by the manufacturer);

— ±10 % of the value indicated by the manufacturer in the questionnaire (see Annex A) in:

  frequency and duration of pulses (to be recorded).

4.2 Power tests

4.2.1 Consumption

4.2.1.1 Purpose of the test

The purpose of these tests is to measure the power consumption of the remote unit in its different operating modes and compare it with the data provided by the manufacturer. The manufacturer shall provide information on the power used by its equipment, its operating range (nominal, minimum and maximum voltage) and, where applicable, on the built-in protections and alarms.

4.2.1.2 Preparation

In order to measure the consumption of the remote unit, the part corresponding to the communications module shall be separated, as far as possible, into each of the states in which it may be. The manufacturer shall provide in the questionnaire (see Annex A) a definition and a way to enter each of the possible states to enable the measurements to be carried out.

EXAMPLE Sleeping, standby, receiving, transmitting.

In all tests in this subclause, the power consumption shall be measured for each of its power modes. Upon completion of each test, the test sequence shall be performed to verify the correct operation of the remote unit.

4.2.1.3 Test procedure

4.2.1.3.1 Consumption at nominal full operating voltage (V_{OP}) in the different operating modes defined by the manufacturer

a) Power the remote unit by connecting an external adjustable power supply to the corresponding power input of the equipment under test.

b) Adjust the power supply until the nominal full operating voltage indicated by the manufacturer in the questionnaire (see Annex A) is reached.

c) Measure the power consumption in each of the remote unit's operating modes, as specified by the manufacturer.

4.2.1.3.2 Power consumption at the minimum full operating voltage (V_{OP}) in the idle operating mode defined by the manufacturer

a) Power the remote unit by connecting an external, adjustable power supply to the corresponding power input.

b) Adjust the power supply until it reaches the minimum full operating voltage specified by the manufacturer

c) Measure the power consumption in the idle operating mode defined by the manufacturer.

4.2.1.3.3 Consumption at maximum full operating voltage (V_{OP}) in idle mode as defined by the manufacturer

a) Power the remote unit by connecting an external adjustable power supply to the corresponding power input.

b) Adjust the power supply to the maximum operating voltage specified by the manufacturer.

c) Measure the power consumption in the idle operating mode defined by the manufacturer.

4.2.1.4 Acceptance criteria

All tests in this subclause shall be considered satisfactory if the variation between the values indicated by the manufacturer and the values obtained in the laboratory measurement does not exceed ±5 % of the consumption specified by the manufacturer in the questionnaire (see Annex A).

4.2.2 Power loss

4.2.2.1 Purpose of the test

The aim of the group of tests described in this subclause is to check that the sudden loss of power to the remote unit does not lead to a loss of critical values, such as irrigation schedules and counter values.

When power is restored, the remote unit shall continue to operate according to the manufacturer's instructions.

4.2.2.2 Scheduled irrigation test Case A — Test procedure

a) Schedule irrigation of sufficient duration (as defined by the manufacturer in their remote unit operating manual) to perform this test.

b) Switch off the power to the remote unit at least 3 min before the irrigation programme starts.

c) Re-power after 1 min, ensuring that there is sufficient time for the remote to fully reset and become fully operational, before scheduled irrigation begins.

d) Record the actions carried out by the remote:

— Execution of irrigation: YES/NO

  — YES: record the delay time, if any, execution of the irrigation and the duration of the irrigation.

— Alarm generation: YES/NO

  — YES: record the type of alarm.

4.2.2.3 Scheduled irrigation test Case B — Test procedure

a) Schedule irrigation of sufficient duration (as defined by the manufacturer in their remote unit operating manual) to perform this test.

b) Remove power to the remote unit at least 1 min before irrigation begins.

c) Re-power 1 min after the programmed start of irrigation.

d) Record the actions carried out by the remote:

— Execution of irrigation: YES/NO

  — YES: record the delay time, if any, in the execution of the irrigation and the duration of the irrigation.

— Alarm generation: YES/NO

  — YES: record the type of alarm.

4.2.2.4 Scheduled irrigation test Case C — Test procedure

a) Schedule irrigation of sufficient duration (as defined by the manufacturer in their remote unit operating manual) to perform this test.

b) Switch off the voltage at least 1 min before the scheduled irrigation starts.

c) Re-power at least 1 min after the end of the irrigation time.

d) Record the actions carried out by the remote:

— Execution of irrigation: YES/NO

  — YES: record the delay time, if any, in the execution of the irrigation and the duration of the irrigation.

— Alarm generation: YES/NO

  — YES: record the type of alarm.

4.2.2.5 Scheduled irrigation test Case D — Test procedure

a) Schedule irrigation of sufficient duration (as defined by the manufacturer in their remote unit operating manual) to perform this test.

b) Interrupt power supply after 1 min from the start of the programmed irrigation time.

c) Re-power, 1 min before the scheduled end time.

d) Record the actions carried out by the remote:

— Execution of irrigation: YES/NO

  — YES: record the delay time, if any, in the execution of the irrigation and the duration of the irrigation.

— Alarm generation: YES/NO

  — YES: record the type of alarm.

4.2.2.6 Scheduled irrigation test Case E — Test procedure

a) Schedule irrigation of sufficient duration (as defined by the manufacturer in their remote unit operating manual) to perform this test.

b) Interrupt the power supply 1 min before the scheduled irrigation end time.

c) Re-power 1 min after the scheduled end time.

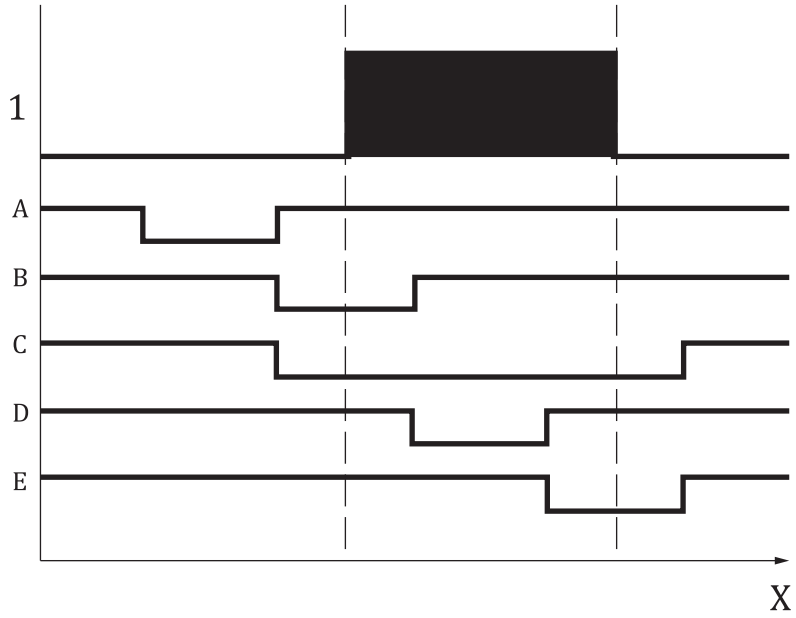
d) Record the actions carried out by the remote:

— Execution of irrigation: YES/NO

  — YES: record the delay time, if any, in the execution of the irrigation and the duration of the irrigation.

— Alarm generation: YES/NO

  — YES: record the type of alarm.



Key

X time
1 programme
A case A
B case B
C case C
D case D
E case E

Figure 1 — Scheduled irrigation

4.2.2.7 Counting pulse test with battery back up

4.2.2.7.1 General

This test shall only be performed if the remote unit has a backup power supply for the counter readings.

4.2.2.7.2 Test procedure

a) After reading the counter input (X) of the remote unit, switch off the power supply for 1 min.

b) During this time, send fifteen pulses spaced 4 s each (unless the manufacturer in the questionnaire (see Annex A) indicates a longer time spacing between pulses), to the input of the same counter (X) of the remote unit.

c) Check the count performed by the remote on the abovementioned input.

4.2.2.7.3 Acceptance criteria

The test shall be considered successful if the pulse count on all counter inputs is equal to the fifteen pulses sent.

Repeat this test as many times as there are counter inputs to the remote unit.

4.2.2.8 Battery replacement test

4.2.2.8.1 Test procedure

a) Write down the counter value for each of the digital inputs of the remote unit.

   For devices that are able to run an irrigation schedule:

   Schedule an irrigation that is not to be run immediately.

b) Disconnect the main battery(ies), for 5 min, following the manufacturer's instructions.

c) Reconnect the main battery(ies), following the manufacturer's instructions.

d) Record the values maintained by the equipment.

4.2.2.8.2 Acceptance criteria

If a remote unit with battery backup is being tested the values shall be the same as recorded before the loss of power.

If testing a remote unit without battery backup the performance of the remote unit shall be in accordance with the manufacturer's specifications in the questionnaire (see Annex A).

4.3 Solenoid valve outputs

4.3.1 Opening/closing solenoid valves

4.3.1.1 Purpose of the test

The purpose of these tests is to check the behaviour of the remote units when acting on the solenoid valve (SV) outputs.

4.3.1.2 Test procedure

These tests consist of sending open and close commands through the circuit that triggers the solenoid.

Three types of test shall be simulated.

— Simulation of solenoid valve with resistors: the test shall be performed by connecting a physical resistor of the Ohms corresponding to that specified by the manufacturer of the remote unit.

— Real unpressurised SV test: the test shall be performed by connecting a commercial SV within the range of voltages and pulse widths specified by the remote unit manufacturer to the SV output of the remote unit.

— Test with real solenoid valve and nominal pressure (NP): the test is performed by connecting a commercial SV to the solenoid valve output of the remote unit, which shall be connected, in turn, to a hydraulic circuit.

In all 3 cases, send ten commands (5 openings and 5 closings) to each solenoid valve output of the remote unit.

If the remote unit can trigger solenoid valves of different voltages, it shall be tested with the most characteristic values of the market, according to the questionnaire (see Annex A), by adjusting the parameters in the remote unit.

4.3.1.3 Acceptance criteria

The test is considered valid when:

— the 5 openings/closings are confirmed in the manufacturer's control software in all cases;

— the actuation of the solenoid valve is confirmed in the case of the test without hydraulic pressure;

— the actuation of the SV is confirmed in the case of the test with a real solenoid valve and at NP, by the passage of water.

In all cases, after the tests have been carried out, the remote shall continue to operate as usual.

4.3.2 Voltage and current, simulating SV

4.3.2.1 Purpose of the test

The purpose of these tests is to check the voltage and power consumption values of the remote unit when opening and closing solenoid valves (SV).

These tests shall be carried out at the voltages and currents specified by the manufacturer.

4.3.2.2 Test procedure

4.3.2.2.1 Maximum current for SV tripping at nominal operating voltage (V_{OP}) with trip voltage NOT configurable

a) Power the remote unit by connecting an external adjustable power supply to the corresponding power input of the remote unit under test.

b) Adjust the power supply until the nominal operating voltage indicated by the manufacturer is reached.

c) Perform solenoid valve opening and closing from the remote unit.

d) Measure the tripping voltage and the maximum current (discarding the first 100 ms of the measurement in case of AC solenoid so, the inrush current is not taken into account) delivered by the remote unit through the corresponding solenoid valve output. A shunt 100 times smaller than the simulated solenoid valve connected in series shall be used for the measurement.

4.3.2.2.2 Maximum current for SV tripping at nominal operating voltage with configurable minimum trip voltage

This test shall only be performed if the remote unit has configurable solenoid valve voltage.

a) Power the remote unit by connecting an external adjustable power supply to the corresponding power input.

b) Adjust the power supply until the nominal operating voltage indicated by the manufacturer is reached.

c) Set the minimum solenoid valve trip voltage on the remote unit.

d) Perform the opening and closing from the remote unit.

e) Measure the tripping voltage and the maximum current delivered by the remote unit through the corresponding solenoid valve output. For the peak current measurement, a resistor of calculated value shall be connected and measured in a shunt at least 100 times smaller than the simulated SV, connected in series.