RD01
Rain Detector

User Manual

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CSL 789

Guarantee

This equipment is guaranteed against defects in materials and workmanship. This guarantee applies for twelve months from date of delivery. We will repair or replace products which prove to be defective during the guarantee period provided they are returned to us prepaid. The guarantee will not apply to:

- Equipment which has been modified or altered in any way without the written permission of Campbell Scientific
- Batteries
- Any product which has been subjected to misuse, neglect, acts of God or damage in transit.

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RD01 Rain Detector

1. Description

The RD01 is a rain detector based on the principle of measuring the capacitance of the material present on a sensing element. The capacitance of the sensor element, set at an angle, changes according to the accumulation of raindrops on the sensor surface.

An integral heater keeps it free of frost and condensation, and helps speed drying to detect the end of a rain event. The heater will also activate at low temperatures to detect snow fall by melting it. An external circular windshield, protects the element from damage and improves its sensitivity to light rain.

The instrument has three different outputs:

1. "Rain ON/OFF" output, which detects whether it is raining/snowing (ON) or not (OFF), which can be used to control a relay coil or similar devices. This is an open-collector output.

2. Analogue voltage output (calibrated, 0-1V) which indicates the precipitation rate.

3. A 1,5…6KHz frequency output (not calibrated), which provide an indication of current precipitation intensity.

The ON/OFF output has a delay circuit that indicates the "end of a rain" event with a 5 minute delay, so that the "end of rain" is not indicated too soon in the event of light or intermittent rain.

The heater can be disabled when power consumption is critical. To do it, set the Heater OFF input on 0V. The sensor will still detect rain in this state but will not melt ice nor detect the end of a rain event so quickly.

2. Wiring

The RD01 can be used with all Campbell Scientific dataloggers. Wiring colours and connections between the sensor and datalogger are shown in Table 1.

Table 1. RD01 Datalogger Wiring Details (Analogue)

Colour	Description	Wiring (SE)
Red	Vin +12Vdc	12V
Blue	Rain On/Off	See below*
Green	Heater Off	Control Port
Yellow	Analogue Out	SE Channel
White	Frequency Out	Not normally used
Black	Ground	AG/⏚
Grey	Heater ground	G

*For Rain on/off connect the blue wire to a control port and insert a 10k resistor between the control port and 5V.

3. Installation and Maintenance

Place the detector clear from all buildings, trees, etc… taking care that no object is over the detector. The supplied bracket will accommodate any 30 to 50mm diameter horizontal or vertical post

A standard 5m cable is supplied with an IP68 connector to connect the cable to the bottom of the instrument: the colours of the leads and the relating functions are listed above. To ensure good noise immunity, we recommend connecting the cable braid to the earth and keeping the heater and the electronics earth leads separate.

Clean the sensor regularly with a cotton bud soaked in distilled water; in case of more substantial dirt, mild cleansers can be used in moderation.

The sensor is fragile, the sensor element is a thin ceramic disk. Handle it with care!

4. Programming

The following program shows two methods for reading the sensor with a Campbell Scientific logger. Firstly by measuring the analogue signal and secondly by reading the rain on/off state. The program scales the analogue signal to give a value between 0 (Dry) and 100 (Heavy Rain) and returns a true/false value for whether it is raining or not. To determine the rain on/off state a 10k resistor must be placed between the control port where the rain on/off wire is attached and 5V on the logger.

```
'Example CR1000 Program to measure the RD01 Rain Detector
'--------------------------------------------------------------
'This program shows how to measure the sensors analogue output
'and scale it from 0 (Dry) to 100 (Heavy Rain) along with measuring the
'rain on/off state.  Note that to use the rain on/off state you must have
'a 10k resistor fitted between 5V and the control port used to measure the
'rain on/off state.

'Ensure any settings are retained.
PreserveVariables

'These constants define which ports the sensor will be read on.
Const AnalogueMeasurementSEChannel = 1 'SE1
Const RainOnOffControlPort = 1 'C1
Const HeaterControlPort = 2 'C2

'This is the voltage threshold below which the heater will be turned off
Const HeaterThreshold = 11.5

'Defined heater states
Const HeaterOn = 1
Const HeaterOff = 0

'This variable contains the battery voltage
Public Batt_Volt
'This variable is used to determine when a change takes place between raining and not raining.
Dim PreviousRainingState As Boolean
'This variable is set to true when it is raining.
Public Raining As Boolean
'These variables hold the rain intensity reading 0 (Dry) - 100 (Heavy Rain)
Dim ScaledRainIntensityAsRead
Public RainIntensity
'The current heater state
Public HeaterState

'This table stores events as the raining state changes from raining to not raining and vice-versa.
DataTable(RainEvents,True,-1)
  Sample(1,Raining,Boolean) : FieldNames("Raining")
  Sample(1,RainIntensity,FP2) : FieldNames("RainIntensity")
EndTable

'This table stores rain information every minute.
DataTable(RainData,True,-1)
  DataInterval (0,1,Min,10)
  Sample(1,Raining,Boolean) : FieldNames("Raining")
  Average(1,Raining,Boolean,False) : FieldNames("Raining_1Min_AVG")
  Sample(1,RainIntensity,FP2) : FieldNames("RainIntensity")
  Average(1,RainIntensity,FP2,False) : FieldNames("RainIntensity_1Min_AVG")
EndTable

'Main Program
BeginProg
  'Initialise the raining state by reading the current value.
  Raining = NOT CheckPort(RainOnOffControlPort)
  PreviousRainingState = Raining
  'Main Scan - 1 Second Interval


  Scan(1,Sec,0,0)
    'Only enable the heater if the logger battery voltage is >= heater threshold (default 11.5V)
    'this will conserve battery power if the logger power levels start to fall.
    Battery(Batt_Volt)
    HeaterState = IIF(Batt_Volt < HeaterThreshold, HeaterOff, HeaterOn)
    PortSet(HeaterControlPort,HeaterState)
    'Measure the analogue output of the sensor to determine intensity
    '0 (Dry) to 100 (Heavy Rain)
    VoltSe(ScaledRainIntensityAsRead,1,mV5000,AnalogueMeasurementSEChannel,True,0,_50Hz,-0.1,100)
    Select Case ScaledRainIntensityAsRead
      Case Is < 0
        RainIntensity = 0
      Case Is > 100
        RainIntensity = 100
      Case Else
        RainIntensity = ScaledRainIntensityAsRead
    EndSelect
    'Check the current rain state - high - rain / low - dry
    'There is a 2 minute delay in the sensor so that a rain over condition can be detected.
    Raining = NOT CheckPort(RainOnOffControlPort)
    'Log an event for any change in the rain state
    If Raining <> PreviousRainingState Then
      'Raining state has changed so log the event
      CallTable(RainEvents)
      PreviousRainingState = Raining
    EndIf
    'Save regular data
    CallTable(RainData)
  NextScan
EndProg
```

5. Technical Data/Specifications

Sensor

Type:	Capacitive, with integrated heater
Sensor sensing area:	6.6cm^2
Angle of element:	30°
Sensitivity:	Min. wet area 0.05cm^2
ON delay/Trip delay (OFF>>ON):	< 0.1ms
OFF delay/Shut-off delay (ON>>OFF):	< 5 min
Dimensions:	Diam. x height ø107 x 70 mm
Weight:	450g
Cable length:	5m
Material:	BASF LURAN S777K

Electrical Features

Supply Voltage:	12Vdc ± 10%
Current Consumption:	130mA (typical) 230mA (max) 10mA (with heater disabled)
Sensor Power Consumption:	0.5 … 2.3W

Outputs

Rain ON/OFF:	Open by default, closed in case of rain. Max. Voltage 15V Max. Current 50mA
Analogue Output:	0…1V (0V = rain, 1V = dry sensor)
Frequency Output :	1500 … 6000Hz (wet … dry) Not calibrated

Operating Conditions

Operating Temperature -15 … +55°C
Storage Temperature -40 … +65°C

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