OPERATING INSTRUCTIONS FOR AN ELECTRONIC TENSIOMETER
IRROMETER MODEL MLT-RSU (~$180)

by: Derek R. Pinnock

INTRODUCTION

Coarse textured growing media used in containers (peat:perlite, etc.) are depleted of plant available water at relatively low tensions (8 to 20 kPa). Commonly, the porous cups of tensiometers have bubbling pressures of 100 kPa, which are adequate for fine-textured mineral soils but have inadequate response time to control irrigation in a container. The Irrometer MLT-RSU uses a porous cup with a bubbling pressure of 50 kPa. The lower bubbling pressure makes it better suited for typical greenhouse growing media because it is has a faster response.

The MLT-RSU uses an electronic pressure transducer instead of the usual analog pressure gauge to measure the water potential of the media. Connecting the transducer to a datalogger makes it possible to irrigate at a selected tension instead of time period resulting in much higher irrigation efficiency. The Crop Physiology Laboratory has purchased one MLT-RSU tensiometer in the range 0 to -16 and two in the 0 to -32 kPa range. The range of each is inscribed on the back or top of the transducer. Do not to operate the tensiometer outside of these ranges, it may damage the transducer.

MAINTENANCE

When not in use, the porous cup should be covered in its plastic bag and PVC protective cover it was shipped in. This bag helps to keep the cup from drying out.

To maintain the tensiometer, first fill the body with Irrometer fluid, which is green in color making it easier to determine the amount of water in the tensiometer. The Irrometer fluid is made by adding one or two drops of Irrometer fluid concentrate to 0.25 liters of deionized water. The solution will be light green in color. Second, remove the air from the tensiometer. This is accomplished by inserting the syringe, half full of Irrometer fluid, into the top of the tensiometer so it seats on the o-ring. With the tensiometer at a 45^{o} angle, pull gently on the syringe until full scale for the specific transducer is reached (-16 or -32 kPa). Then release the suction slowly. Repeat several times. Third, fill the tensiometer to the top with fluid and replace the cap. Do not over tighten.

WIRING

The MLT-RSU has a 4 to 20 mA output. To translate the loop current to voltage a precision resistor must be inserted on the ground side. This has already been done with all three of the MLT-RSU's at the CPL. Here are the conversions for the 0 to –16 kPa range:

To determine the size of resistor to get a 2500 mV output:

Resistance = mV/Amps
2500 mV/20 A = 125ohms

The resistor translates the 4 to 20 mA output to a 500 to 2500 mV output for the range 0 to –16 kPa. So, the multiplier for the conversion from mV to kPa is:

16 kPa/2000mV = 0.008 kPa/mV mV*0.008 = kPa

An offset is needed to correct for the 500 mV at minimum output. The offset is:

at full scale: 2500 mV * -0.008 = -20
-20 + 4 = -16 kPa

at zero: 500 mV * -0.008 = -4
-4 + 4 = 0 kPa

This shows, for a tensiometer with a 0 to –16 kPa pressure range and 500 to 2500 mV output range, a multiplier of –0.008 (the value of the multiplier must be changed to a negative value to correspond with water potential) and an offset of 4 is needed.

OPERATION

The tensiometer is connected to the datalogger with three wires; red (12V input), clear (ground), and black (single-ended measurement). The input does not have to be exactly 12V, but it must be constant voltage. The tensiometer output of 500 to 2500 mV can be read by a single-ended instruction (P1).

Example 1. Sample CR10(T) Program for a MLT-RSU with 0 to -16 kPa operating range.

1: Volts (SE) (P1); measure tensiometer output (millivolts) and convert to kPa

1: 1	Reps
2: 25	2500 mV 60 Hz Rejection Range
3: 1	SE Channel
4: 1	Loc [kPa]
5: -0.008	Mult
6: 4	Offset