Instructions for the 4-20mA Unit

DO NOT REMOVE FRONT PANEL WITHOUT REVIEWING INSTRUCTIONS FIRST. DAMAGE TO DISPLAY(S) MAY RESULT.

Please read entire instruction before proceeding with installation or operation of the 4-20mA unit.

4-20mA Option
On Board

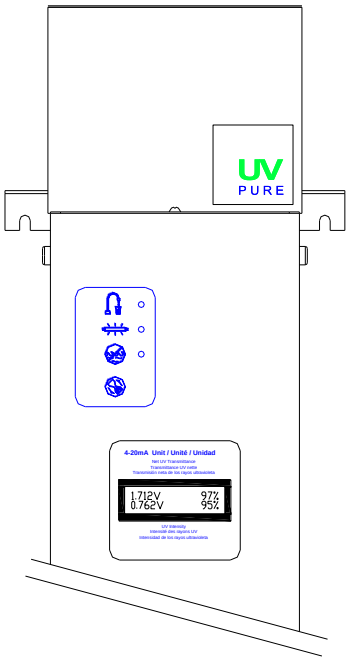

Figure 1

Applications

The Crossfire Technology® embedded within the Hallett units (See Figure 3), allows for both a UV Intensity and Net UV Transmittance (UVT) signal to be provided. The 4-20mA option provides these two analog signals. It is a transmitter utilizing an external power supply that can be used with any device that requires a 4-20mA signal for logging purposes or for process control. The device is installed On Board (see Figure 1) but used only for Hallett 30s.

Product Features

1. **LCD Display** - A 2.5" LCD display is a standard feature indicating both input values and transmitted values – see Figure 1
2. **UV Intensity Output** – A signal proportional to the UV intensity of the UV lamp is transmitted.
3. **Net UV Transmittance (UVT) Output** – A signal proportional to the Net UV Transmittance of the water is transmitted.
4. **Factory Calibrated** – Both span and offsets are preset for immediate field use.
5. **Mounted On Board** – The 4-20mA unit is typically installed within the Hallett 30 unit with the display located on the front panel - see Figures 1 & 2.

Specifications

Operating Range:
- 4-20mA loop output, 0-2.5Vdc input

Loop Voltage (*supplied by others. One power supply per loop or isolation required between loops*)
-10Vdc minimum, 35Vdc maximum

Load Resistance:
- Max. 650 Ω @ 23 Volts, 35V maximum

Accuracy:
- 2% F.S. (full scale) for UV Intensity†
- 5% F.S. (full scale) for UVT†

Output Response Time:
- 1 second ††

Operating Temperature Range:
- 40°F to 100°F, 5°C to 40°C

Electrical:
- reverse polarity protection
- over-voltage protection

Connections:
- Spring cage terminals for output

† The accuracy depends on condition of Hallett unit. See Note on Net UV Transmittance in Operation Section.

†† The display is updated every second however during a cleaning cycle of the Hallett unit, the output is held steady. See Net UV Transmittance in Operation Section.

Installation

The output connections for the 4-20mA transmitted signals are to be done on the spring cage terminals located the end of the circuit board – See Figure 2. Insert the wire into the terminal by pressing the lever forward. The output wires can range from 14-26 AWG but usage of a shielded pair is recommended.

There is a knockout located on the bottom of the Hallett unit for cable entry. There is also one #8 stud on the inside of the front cover to help secure signal cable. To remove the Front cover for access to terminals, see last section of this document.

4-20mA Option
On Board

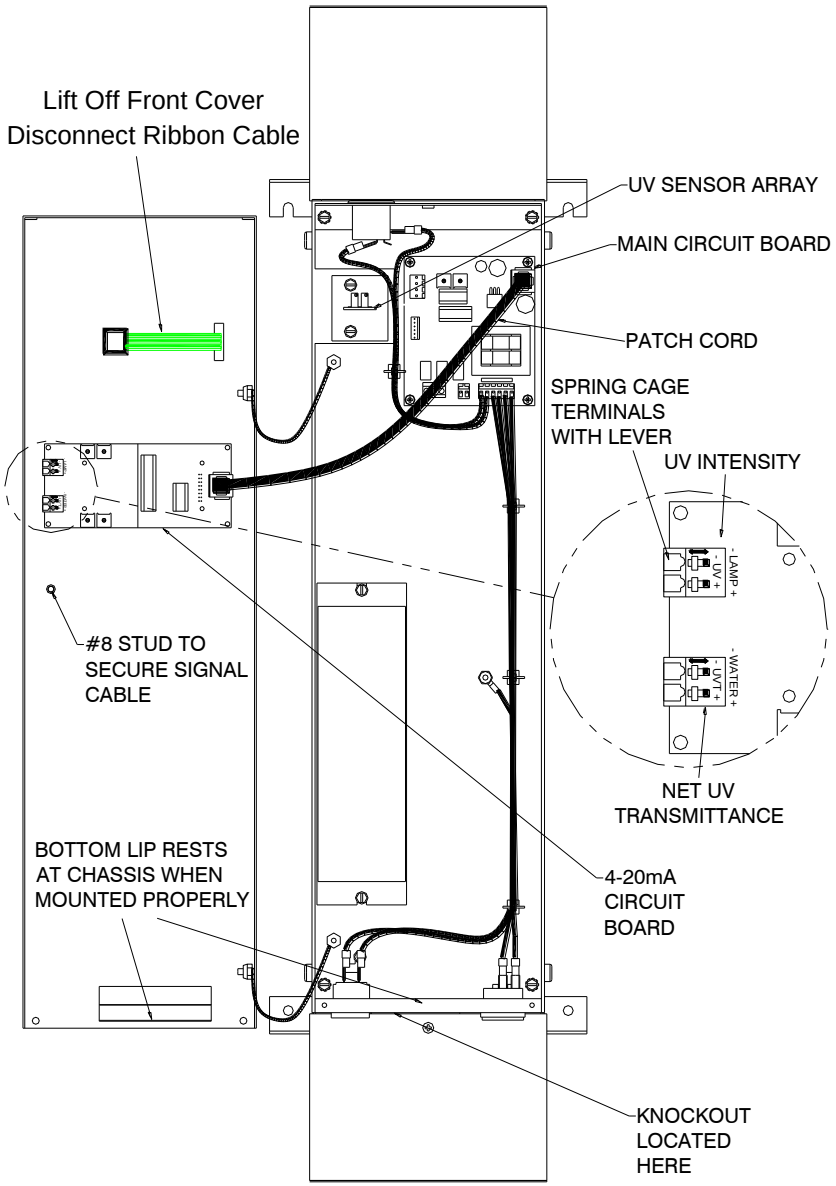

Figure 2

Operation

Cross section of UV Chamber

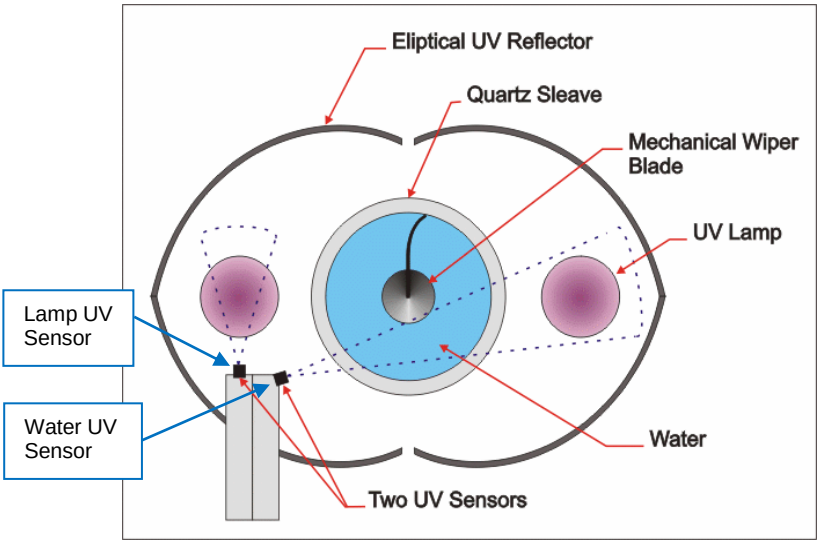

Figure 3

UV Intensity

The input signal range of Lamp UV sensor is 0-2.5 Vdc. This value represents a measurement of the UV intensity of the lamp. There are typical operating values for a lamp for either a Drinking Water or Non-Potable Water Application - see Chart 1.

Drinking Water Values			Non-Potable Water Values		
Lamp Sensor	% displayed	mA value	Lamp Sensor	% displayed	mA value
0	0.0%	4.0	0	0.0%	4.0
0.05	6.3%	5.0	0.02	5.0%	4.8
0.1	12.5%	6.0	0.04	10.0%	5.6
0.15	18.8%	7.0	0.06	15.0%	6.4
0.2	25.0%	8.0	0.08	20.0%	7.2
0.25	31.3%	9.0	0.1	25.0%	8.0
0.3	37.5%	10.0	0.12	30.0%	8.8
0.35	43.8%	11.0	0.14	35.0%	9.6
0.4	50.0%	12.0	0.16	40.0%	10.4
0.45	56.3%	13.0	0.18	45.0%	11.2
0.5	62.5%	14.0	0.2	50.0%	12.0
0.55	68.8%	15.0	0.22	55.0%	12.8
0.6	75.0%	16.0	0.24	60.0%	13.6
0.65	81.3%	17.0	0.26	65.0%	14.4
0.7	87.5%	18.0	0.28	70.0%	15.2
0.75	93.8%	19.0	0.3	75.0%	16.0
0.8	100%	20.0	0.32	80.0%	16.8
0.85	100%	20.0	0.34	85.0%	17.6
0.9	100%	20.0	0.36	90.0%	18.4
0.95	100%	20.0	0.38	95.0%	19.2
			0.4	100%	20.0
			0.42	100%	20.0
			0.44	100%	20.0

Accuracy is +/-2% of Full Scale value

Chart 1

This value will be displayed on the **bottom** left hand side of the 4-20mA unit and is updated every second. The transmitted value is normalized from 0-100% and it is displayed on the bottom right hand of the 4-20mA unit. The 4-20mA signal is directly proportional to 0-100%.

Upon startup of new lamps, this value will be low (less than 100%) until the lamps reach full power. This may take several hours. After the initial burn in time, new lamps may display a value higher than the 0.8 Vdc or 0.4 Vdc depending on the application (up to 20% higher). This implies the UV lamp has exceptional UV output and this is no cause for concern and the transmitted output will continue to be 100%.

Warning and Alarm set points
There are two set points for a UV intensity fault on the Hallett unit. The signal must remain below the set point for at least 3-5 seconds before an alert is issued.

A UV Intensity warning is indicated by the green LED on, the valve (if supplied) remains open, the Hallett unit issues an audible alarm and flashes the red LED beside lamp graphic. A UV Intensity warning will occur when UV intensity signal drops below first set point – see Chart 2 for corresponding values for Drinking Water and Non-Potable Water applications.

A UV Intensity alarm is indicated by the green LED not on, the valve (if supplied) closes, the Hallett unit issues an audible alarm and turns on solid the red LED beside lamp graphic. A UV Intensity alarm will occur when UV intensity signal drops below the second setpoint – see Chart 2 for corresponding values for Drinking Water and Non-Potable Water applications.

	Drinking Water Values			**Non-Potable Water Values**		
	Lamp Sensor	% displayed	mA value	Lamp Sensor	% displayed	mA value
Alarm Setpoint	0.5	63%	14	0.24	60%	14
Warning Setpoint	0.55	69%	15	0.28	70%	15

Chart 2

Net UV Transmittance

The input signal range of the Water UV sensor is 0-2.5 Vdc. This value represents the UV Transmittance (UVT) of the water, the transmission of UV through the quartz sleeve and the combined UV output from the right hand UV lamp and reflector. With everything else constant, the net signal represents the UVT of the water, thus the Net UVT. Accurate measurements of the Net UVT of the water are based on a clean quartz sleeve. If the quartz cleanliness is not 100%, then the value displayed and transmitted will be somewhat lower that the actual UVT.

For a typical Hallett system, the range of the Water UV sensor will be from 0.9 to 1.5 Vdc for a Drinking Water application, and from 0.4 to 1.1 Vdc for a Non-Potable Water application. This voltage value will be displayed on the **top left** hand side of the 4-20mA unit. The transmitted value represents the Net UVT and it is a calculated value based on both the maximum Water UV sensor value and the Lamp UV sensor value – this method accounts for lamp aging (see note below about the cleaning system and maximum Water UV sensor value). The NET UVT is normalized from 0-100% and it is displayed on the **top right** hand side of the 4-20mA unit - see Chart 3.

Drinking Water & Non-Potable Water Values

Water Sensor	% displayed	mA value
*	0.0%	4.0
*	6.3%	5.0
*	12.5%	6.0
*	18.8%	7.0
*	25.0%	8.0
*	31.3%	9.0
*	37.5%	10.0
*	43.8%	11.0
*	50.0%	12.0
*	56.3%	13.0
*	62.5%	14.0
*	68.8%	15.0
*	75.0%	16.0
*	81.3%	17.0
*	87.5%	18.0
*	93.8%	19.0
*	100%	20.0

Chart 3

Operation For Drinking Water Applications (New for Ver. 1.3)

The accuracy is ± 5% within the range of 45-98% UV Transmittance.
Note, upon power up of the Hallett unit, the output may remain at zero for about 9 minutes. Afterwards, the display and transmitted value will be updated. After a power up, the LCD will display a flashing black rectangle indicating a power up has just occurred. After 5 minutes the rectangle on the LCD will flash and a cleaning cycle begins. Approximately 4 minutes after this, the device begins to transmit the updated Net UVT signal.

The Hallett units have an automatic quartz cleaning device which normally activates for 3 minutes every 2.5 hours. It will also activate after a power interruption as described above. The green LED on the display pad will flash when the device is activated. If a Water Quality alarm situation arises, the cleaning cycle changes. Initially the wiper will cycle once every 5 minutes for 30 minutes, then the wiper will cycle twice every 60 minutes until the Water Quality alarm clears. During a cleaning cycle, the wiper device passes through the field of vision of the Water UV sensor, the value will vary (up to 0.6Vdc) as the wiper turns at 1 rpm within the quartz sleeve. Only the maximum value recorded during the wiping cycle is considered in the calculation of the UVT. The transmitted value of the UVT is hence frozen and then finally updated after the wiping cycle is completed (about 4 minutes from start of cycle). During this time, the solid rectangle on the LCD will reappear indicating this suspended state.

To update the 4-20mA unit with a new maximum value within the normal 2.5 hour period, press and hold the Reset button (hourglass symbol) on the front display for 1 second. This will initiate a cleaning cycle and engage the wiper.

Another note is that when the wiper comes to rest, it will do so randomly as long as the Water UV sensor value is greater than the Lamp UV sensor value (see Alarm set point below). Therefore the Water UV sensor value displayed will be usually different than the one used in the calculation. To observe the maximum value, initiate a cleaning cycle.

Operation For Non-Potable Water Applications

The accuracy is ± 5% within the range of 45-98% UV Transmittance.
Note, upon power up of the Hallett unit, the output will remain at zero for about 10-11 minutes. Afterwards, the display and transmitted value will be updated.

The Hallett units have an automatic quartz cleaning device which normally activates for 5 minutes every 4 hours. It will also activate after a power interruption or when the Water UV sensor value drops below the Lamp UV sensor value. Since the wiper of the cleaning device passes through the field of vision of the Water UV sensor, the value will vary (up to 0.6Vdc) as the wiper turns at 1 rpm within the quartz sleeve. Only the maximum value recorded during the wiping cycle is considered in the calculation of the UVT. The transmitted value of the UVT is hence frozen and then finally updated after the wiping cycle is completed (about 11 minutes from start of cycle).

To update the 4-20mA unit with a new maximum value within the normal 4 hour period, press and hold the Reset button (hourglass symbol) on the front display for 1 second. This will initiate a cleaning cycle and engage the wiper.

Another note is that when the wiper comes to rest, it will do so randomly as long as the Water UV sensor value is greater than the Lamp UV sensor value (see Alarm set point below). Therefore the Water UV sensor value displayed will be usually different than the one used in the calculation. To observe the maximum value, initiate a cleaning cycle.

For all water applications

Note about 4-20mA device detection of cleaning cycle – The 4-20mA device determines a wiper cycle is occurring when there is a sudden change in the water UV sensor value and this will freeze the transmitted NET UVT signal. Sometimes a drastic change to the water UVT will also cause the NET UVT signal to be frozen and then an update will follow afterwards. The updated value may not fall within the 5% accuracy range until another scheduled cleaning cycle occurs.

Water Quality Alarm set point Drinking Water Applications (New for Ver. 1.3)

A Water Quality alarm is indicated by the green LED not on, the valve (if supplied) closes, the Hallett unit issues an audible alarm and turns on solid the

red LED beside the water graphic. This occurs when the Water UV sensor value drops below the Lamp UV sensor value continuously for about 3-5 seconds. Since the wiper causes the water sensor signal to fluctuate, only a continuously low signal will cause an alarm. A continuously low signal represents a drop in UV Transmittance below the 75% threshold for Drinking Water applications.

Water Quality Alarm set point For Non-Potable Water Applications
A Water Quality alarm is indicated by the green LED not on, the valve (if supplied) closes, the Hallett unit issues an audible alarm and turns on solid the red LED beside the water graphic. This occurs when the Water UV sensor value drops below the Lamp UV sensor value continuously for 5 minutes. Since the wiper causes the water sensor signal to fluctuate, only a continuously low signal will cause an alarm. A continuously low signal represents a drop in UV Transmittance below the 40-50% threshold for Non-Potable Water applications.

UV Dose Display for Drinking Water Applications (New for Ver. 1.3 only)

The LCD can now display the predicted UV Dose for drinking water applications. The LCD alternates between the Net UVT / UVI values and the UV Dose every 5 seconds. If the 4-20mA device detects a cleaning cycle has started, the LCD will stop this alternating pattern and only show the sensor voltage values and Net UVT/UVI values – a solid rectangle will appear to indicate wiper movement detected.

Spare parts List

Item No.	Part Description	Drinking Water Part No.	Non-Potable Water Part No.
1	Main Circuit Board – for 4-20mA On Board Option	C100011S	C100017S
2	4-20mA Circuit Board **(Rev B)**	X100027N	X100050N
3	4-20mA Display	X100033	
4	Display Pad (3 LEDs and Reset button c/w green ribbon cable)	E100016	
5	Patch Cord for 4-20mA On Board Option (1.6ft-0.5m shielded)	150249	

INSTRUCTIONS FOR REMOVING FRONT PANEL

Please unplug the unit before starting. You will require a Philips screwdriver.

1. Begin by removing the *front* cover (with label & lights). This is accomplished by first removing the 2 screws below holding the front cover. Then remove the screw that secures the *top* cover. Remove the *top* cover. Gently remove the *front* cover and hold it a couple of inches off from the body – see Figure 5. **You must disconnect a thin green ribbon cable that powers the display lights – be careful not to damage this.** Reach in and disconnect the ribbon cable from the circuit board by grabbing the end **black** connector (never pull on the green cable itself). The *front* cover can then be moved a few more inches away from the body.

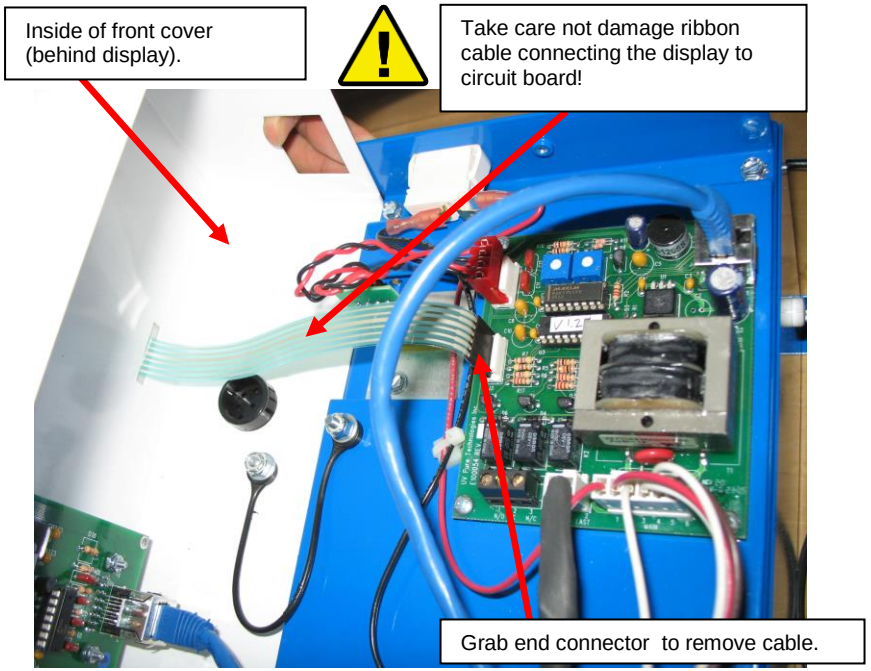

Figure 5

2. The front cover can now gently hang on the lanyards provided.
3. The patch cord can be left in place or disconnected by pinching the clip and pulling end out from the circuit board.
4. Proceed with wire installation, inspection or repair of unit as required.
5. When complete, replace the *front* cover by first installing the patch cord (if required) .
6. Next, reconnect the 6-pin green ribbon cable to the port marked 'DISPLAY' (ensure the black connector is aligned properly and no pins are missed). Place the *front* cover in its rest position. Ensure the all

cables are within boundary of front cover and that the bottom lip of the front cover is engaged onto the housing.

7. Replace the *top* cover and screw it down.
8. Secure two lower screws on front cover.
9. Plug in the unit.
10. Ensure that all three LEDs illuminate on the white display pad and the 4-20mA display powers up. (it is normal for Net UVT to read 0% on startup – see page 8).

UV Pure Technologies Inc.
60 Venture Drive, Unit 6
Toronto, Ontario
M1B 3S4
www.uvpure.com

