

MINISENSOR4-MCU-D™ USER MANUAL

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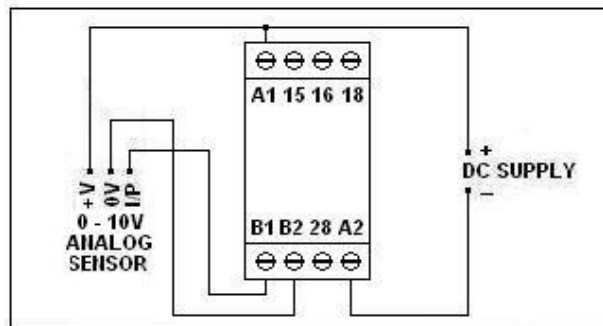
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It is advisable to connect up the MINISENSOR4-MCU- and check/confirm operation before any reprogramming is carried out.

The unit is factory set to: **LED display** **ANALOGUE input status (0 to 100%)**
 Range T1 **Single setpoint, relay and optocoupler outputs ganged and in phase**
 Input **0 – 10Vdc**
 STARTMODE **0 Outputs active (on) below setpoint**

INITIAL CONNECTIONS

Connect the DC supply and a 0 -10V analogue sensor +ve, 0V and open collector connections to the two 4 way screw terminal blocks as shown in the diagram below:



If no 0 – 10V sensor is available use none, one and then two (in series) AA batteries across B1 and B2 terminals in the tests below.

1.0 INITIAL TESTING

Set the input voltage to zero.

Set the setpoint potentiometer fully clockwise.

Switch on the DC power supply to the unit.

The module will power up with a **2 second startup delay** and the green **STATUS** LED will illuminate.

The LED will then blink on (25ms) every 2 seconds to indicate a **NO INPUT** condition.

The relay and **OUTPUT2** LED (optocoupler output) will also activate to signal a **below setpoint condition**.

Slowly increase the (0 – 10V) analogue input voltage (one AA battery = 16%).

The LED blinking rate will increase to every 0.8 seconds indicating **0 to 20% INPUT detected**.

Increase the (0 – 10V) analogue input voltage further (two AA batteries = 32%).

The LED changes to **flashing** (0.8 seconds) every 2 seconds indicating **20 to 40% INPUT detected**.

Slowly turn the setpoint potentiometer anticlockwise until the relay and the **OUTPUT2** LED deactivate.
The setpoint is now set to slightly less than present analogue input.

Switch off the DC power supply to the unit.

Remove all four red setup jumper links.

The unit is now tested and functioning correctly.

2.0 SETTING UP YOUR APPLICATION

The MINISENSOR4-MCU-D provides comprehensive single and twin setpoint dual output control features and can be easily configured for your particular application. The green **STATUS** LED is provided for diagnostic purposes and can be set up to indicate input level or control status. Simply follow the step by step process below to set up your application:

2.1 SMARTCYCLE™ CONTROL APPLICATIONS (T range T4)

In this mode the relay and optocoupler outputs implement automatic control sequencing between the lower and upper setpoints. This can be used for maximum/minimum pressure, drain/fill level or in/out position control applications. Skip this section if your application does not require this mode of operation.

2.1.1 Automatic fill cycle mode

In this SMARTCYCLE™ mode the relay automatically activates a motor/pump/valve etc to increase the pressure/ level/position and analogue sensor input from the lower setpoint to the upper setpoint. The cycle stops at the upper setpoint and restarts only when the sensor input falls back to the lower setpoint. A typical example is an automatic tank fill application.

The table below shows the relay and optocoupler states above and below the setpoints:

STARTMODE = 0		< LOWER SETPOINT >	< UPPER SETPOINT >	
INPUT INCREASING		ON →	ON →	OFF
	RELAY			
INPUT DECREASING		ON	← OFF	← OFF
INPUT INCREASING		OFF →	OFF →	ON
	OPTO			
INPUT DECREASING		OFF	← ON	← ON

If this mode suits your application go to section 2.5 DUAL SETPOINT SETUP

2.1.2 Automatic empty cycle mode

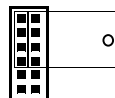
In this SMARTCYCLE™ mode the relay automatically activates a motor/pump/valve etc to decrease the pressure/ level/position and analogue sensor input from the upper setpoint to the lower setpoint. The cycle stops at the lower setpoint and restarts only when the sensor input rises back to the upper setpoint. A typical example is an automatic tank drain application.

The table below shows the relay and optocoupler states above and below the setpoints:

STARTMODE = 1		< LOWER SETPOINT >	< UPPER SETPOINT >	
INPUT DECREASING		OFF	← ON	← ON
	RELAY			
INPUT INCREASING		OFF →	OFF →	ON
INPUT DECREASING		ON	← OFF	← OFF
	OPTO			
INPUT INCREASING		ON →	ON →	OFF

If this mode suits your application set STARTMODE =1

Insert the programming plug - facing right
 - offset, upper (STARTMODE)
 - onto the vertical left hand **SET UP** header



Switch on the power to the unit.

The LED will illuminate continuously to indicate **STARTMODE = 1** set.

Switch off the power and remove the programming plug.

Repeat procedure to return to STARTMODE = 0.

The LED will blink on continuously to indicate **STARTMODE = 0** reset.

Switch off the power and remove the programming plug.

Now go to section 2.5 DUAL SETPOINT SETUP.

2.2 SINGLE SETPOINT CONTROL APPLICATIONS (T range T1)

In this mode the relay and optocoupler outputs are controlled by a single setpoint, the setpoint% potentiometer setting. Skip this section if this control mode does not suit your application.

2.2.1 Single setpoint same switching polarity

The table below shows the relay and optocoupler states above and below the single setpoint (**OUTPUT jumper link left**).

RANGE T1		< SETPOINT >	
	RELAY	ON	OFF
STARTMODE = 0			
	OPTO	ON	OFF
	RELAY	OFF	ON
STARTMODE = 1			
	OPTO	OFF	ON

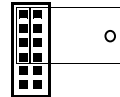
2.2.2 Single setpoint opposite switching polarity

The table below shows the relay and optocoupler states above and below the single setpoint (**OUTPUT jumper link right**).

RANGE T1R		< SETPOINT >	
	RELAY	ON	OFF
STARTMODE = 0			
	OPTO	OFF	ON
	RELAY	OFF	ON
STARTMODE = 1			
	OPTO	ON	OFF

Set up the STARTMODE to match your application control states as follows:

Insert the programming plug - facing right
 - offset, upper (STARTMODE)
 - onto the vertical left hand 6 pin **SET UP** header



Switch on the power to the unit.

The LED will **illuminate** continuously to indicate **STARTMODE = 1** set.

Switch off the power and **remove** the programming plug.

Repeat procedure to return to STARTMODE = 0.

The LED will **blink on** continuously to indicate **STARTMODE = 0** reset.

Switch off the power and **remove** the programming plug.

Now go to section 2.6 COMPLETING YOUR APPLICATION INSTALLATION.

2.3 DUAL SETPOINT CONTROL APPLICATIONS (T ranges T2 & T3)

In this mode the relay and optocoupler outputs are controlled by a two setpoints, the upper setpoint% and the lower setpoint% set by the setpoint% potentiometer. The relay output is **always** controlled by one setpoint, the optocoupler output is always controlled by the other setpoint. Skip this section if this control mode does not suit your application.

2.3.1 Dual setpoint, relay output controlled by upper setpoint, optocoupler output by lower setpoint same and opposite switching polarity (T range T2)

The table below shows the relay and optocoupler states above and below the setpoints (**OUTPUT jumper link left**).

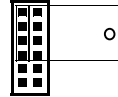
RANGE T2		< LOWER SETPOINT >	< UPPER SETPOINT >	
	RELAY	ON	ON	OFF
STARTMODE = 0				
	OPTO	ON	OFF	OFF
	RELAY	OFF	OFF	ON
STARTMODE = 1				
	OPTO	OFF	ON	ON

The table below shows the relay and optocoupler states above and below the setpoints (**OUTPUT** jumper link right).

RANGE T2R	< LOWER SETPOINT > < UPPER SETPOINT >			
	RELAY	ON	ON	OFF
STARTMODE = 0				
	OPTO	OFF	ON	ON
	RELAY	OFF	OFF	ON
STARTMODE = 1				
	OPTO	ON	OFF	OFF

Set up the STARTMODE to match your application control states as follows:

Insert the programming plug - facing right
 - offset, upper (STARTMODE)
 - onto the vertical left hand **SET UP** header



Switch on the power to the unit.

The LED will **illuminate** continuously to indicate **STARTMODE = 1** set.

Switch off the power and **remove** the programming plug.

Repeat procedure to return to STARTMODE = 0.

The LED will **blink on** continuously to indicate **STARTMODE = 0** reset.

Switch off the power and **remove** the programming plug.

Now **go to section 2.5 DUAL SETPOINT SETUP**.

2.3.2 Dual setpoint, optocoupler output controlled by upper setpoint, relay output by lower setpoint same and opposite switching polarity (T range T3)

The table below shows the relay and optocoupler states above and below the setpoints (**OUTPUT** jumper link left).

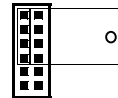
RANGE T3	< LOWER SETPOINT > < UPPER SETPOINT >			
	RELAY	ON	OFF	OFF
STARTMODE = 0				
	OPTO	ON	ON	OFF
	RELAY	OFF	ON	ON
STARTMODE = 1				
	OPTO	OFF	OFF	ON

The table below shows the relay and optocoupler states above and below the setpoints (**OUTPUT** jumper link right).

RANGE T3R	< LOWER SETPOINT > < UPPER SETPOINT >			
	RELAY	ON	OFF	OFF
STARTMODE = 0				
	OPTO	OFF	OFF	ON
	RELAY	OFF	ON	ON
STARTMODE = 1				
	OPTO	ON	ON	OFF

Set up the STARTMODE to match your application control states as follows:

Insert the programming plug - facing right
 - offset, upper (STARTMODE)
 - onto the vertical left hand **SET UP** header



Switch on the power to the unit.

The LED will **illuminate** continuously to indicate **STARTMODE = 1** set.

Switch off the power and **remove** the programming plug.

Repeat procedure to return to STARTMODE = 0.

The LED will **blink on** continuously to indicate **STARTMODE = 0** reset.

Switch off the power and **remove** the programming plug.

Now **go to section 2.5 DUAL SETPOINT SETUP**.

2.4 FULLY PROGRAMMABLE DUAL SETPOINT CONTROL APPLICATIONS (T range T4)

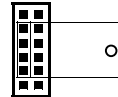
In this mode the relay and optocoupler outputs are also controlled by a two setpoints, the upper setpoint% and the lower setpoint% set by the setpoint% potentiometer. Both the relay and optocoupler outputs can be controlled by either setpoint. The relay and optocoupler output states are **fully user programmable**.

To use this feature, switch on the power and wait for the green LED to blink continuously (no input). Wait one second, then switch off the power. **User programming is now enabled**.

Now complete the table below with the relay and opto on/off status for your application and program the unit.

RANGE T4	A < LOWER SETPOINT > B < UPPER SETPOINT > C			
	RELAY			
	OPTO			

Then insert the programming plug - facing right
 - centralised (MYTIME)
 - onto the vertical left hand 6 pin **SET UP** header



Rotate the setpoint potentiometer **fully anticlockwise & switch on** the power.

The LED will blink continuously to indicate **ready to program**.

- Skip setting 1** Rotate potentiometer fully clockwise, then on **the first flash** rotate potentiometer fully anticlockwise (BandSetNumber skipped).
- Skip setting 2** Rotate potentiometer fully clockwise, then on **the first flash** rotate potentiometer fully anticlockwise (display skipped).
- 'A' sector program relay** Rotate potentiometer fully clockwise, then on **the first flash** rotate potentiometer fully anticlockwise (**RELAY OFF**).
 or
 Rotate potentiometer fully clockwise, then on **the second flash** rotate potentiometer fully anticlockwise (**RELAY ON**).
- 'A' sector program opto** Rotate potentiometer fully clockwise, then on **the first flash** rotate potentiometer fully anticlockwise (**OPTOCOUPLER OFF**).
 or
 Rotate potentiometer fully clockwise, then on **the second flash** rotate potentiometer fully anticlockwise (**OPTOCOUPLER ON**).
- 'B' & 'C' sectors** Repeat 'A' sector above.

The LED will then switch off to indicate **programming complete. SMARTCYCLE App erased and replaced by user programmed App.**

Switch off the power and **remove** the programming plug.

2.5 DUAL SETPOINT SETUP

You now need to set up the relationship between the upper setpoint% and lower setpoint% for your application. The **lower setpoint** is locked to the potentiometer adjusted **upper setpoint**. It can be programmed from 5% below the upper setpoint to 90% below the upper setpoint in 1 to 18, 5% steps called BandSetNumbers. **The BandSetNumber is factory set to 10**. This sets the lower setpoint to 50% below the upper setpoint potentiometer setting.

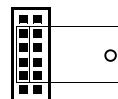
The formula for calculating the BandSetNumber is as follows:

$$\text{BandSetNumber} = \frac{\text{upper setpoint\%} - \text{lower setpoint\%}}{5}$$

e.g. If your application requires an **83%** (of the sensor full scale output) upper setpoint and a **24%** lower setpoint (59% below upper setpoint) then the **BandSetNumber** is

$$= \frac{83 - 24}{5} = 11.8 \text{ round up to } \mathbf{12} \text{ (60\% below upper setpoint)}$$

Insert the programming plug - facing right
 - centralised (MYTIME)
 - onto the vertical left hand 6 pin **SET UP** header



Rotate the setpoint potentiometer **fully anticlockwise**.

Switch on the the power to the unit.

The LED will blink continuously to indicate **ready to program**.

Rotate potentiometer fully clockwise to start counting in the calculated BandSetNumber (12 in the above example). The LED will flash quite slowly for each count. **Remember digital counting starts at zero not one.**

Count the flashes 0,1,2 then on 12 (in the example) rotate potentiometer fully anticlockwise to **store 12**.

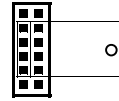
Switch off the power and remove the programming plug.

2.6 COMPLETING YOUR APPLICATION INSTALLATION

The unit is now ready for final set up and installation testing:

1 Check your final BandSetNumber and display set up.

- Insert** the programming plug - facing right
 - centralised (MYTIME)
 - onto the vertical left hand 6 pin **SET UP** header



Rotate the setpoint potentiometer **fully clockwise**.

Switch on the power to the unit and wait 3 seconds (STATUS LED on).

Rotate the setpoint potentiometer **fully anticlockwise**.

The unit will now automatically count out the BandSetNumber on the LED. **Remember digital counting starts at zero not one.** So in the above example (12 stored)

BandSet digit Count the flashes 0,1,2,3,4,5,6,7,8,9,10,11 & **12** , done.

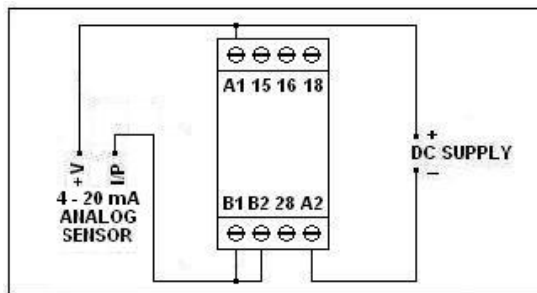
Wait 3 seconds

The unit will now automatically count out the DisplaySet on the LED.

DisplaySet digit Count the flashes **0** **analogue input display set.**
 or
 Count the flashes 0,**1** **control state display set.**

Switch off the power to the unit and remove the programming plug.

2 Setup 4 – 20mA or 0 – 20mA input sensor connections shown below



0 – 20mA operation Select **LOOP** jumper link out right and skip to 3 below.

4 – 20mA operation **Insert** the red shorting plug, centralised onto the vertical left hand side 6 pin **SET UP** header.



Switch on the power to the unit.

The LED will **illuminate** continuously to indicate 4 – 20mA input programmed.

Switch off the power and **remove** the red shorting plug.

Select **LOOP** jumper link out right.

Repeat procedure, if required, to reset 0 – 10V input.

The LED will **blink on** continuously to indicate 0 – 10V input programmed.

Switch off the power and **remove** the red shorting plug.

Select **LOOP** jumper link in left.

3 Set up T range T1 - T2 jumper link in left, T3 jumper link in left, OUTPUT jumper link in left. T1R - T2 jumper link in left, T3 jumper link in left, OUTPUT jumper link out right.

T2 - T2 jumper link out right, T3 jumper link in left, OUTPUT jumper link in left.
 T2R - T2 jumper link out right, T3 jumper link in left, OUTPUT jumper link out right.

T3 - T2 jumper link in left, T3 jumper link out right, OUTPUT jumper link in left.
 T3R - T2 jumper link in left, T3 jumper link out right, OUTPUT jumper link out right.

T4 - T2 jumper link out right, T3 jumper link out right, OUTPUT jumper link in left.

4 DIN rail mount unit.

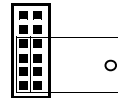
5 Install the analogue sensor and the power, relay and optocoupler connections.

- 6 **Set** the setpoint% potentiometer to your application upper setpoint% (e.g. 83%)
(Note if a 60% control band has been programmed the lower setpoint% will be 83 – 60 = 23%)
- 7 **Switch on** the system power and wait one second.
- 8 Your dual/single setpoint system will now operate as per your setup.
- 9 The **STATUS** LED will progress through the sensor input levels for the application.
 - 0 to 20% input blinking on every 0.8 seconds
 - 20 to 40% input flashing on every 2 seconds
 - 40 to 60% input flashing on every 0.8 seconds
 - 60 to 80% input blinking off every 0.8 seconds
 - 80 to 100% input on continuously
 - >100% input triple flash, 4 second flash cycle warning.
- 10 Adjust the setpoint% potentiometer, if necessary, to optimise the upper setpoint% and lower setpoint% settings for your application.
- 11 And finally if you wish to protect your set up against unauthorised adjustment:

Switch off the power to the unit.

Temporarily remove all SET UP jumper links.

Insert the programming plug - facing right
 - offset, lower (LOCKPOT)
 - onto the vertical left hand 6 pin **SET UP** header



Switch on the power to the unit.

The LED will **illuminate** continuously to indicate setpoint% setting is now **locked**.

Switch off the power and **remove** the programming plug.

Repeat procedure, if required, to unlock potentiometer.

The LED will **flash** every two seconds to indicate potentiometer is now **unlocked**.

Switch off the power and **remove** the programming plug.

Replace all jumper links into their previous positions.

- 12 **Record** your final set up details on the configuration label on the side of the unit:

MINISENSOR4-MCU-D			
PARAMETER	FACTORY	CURRENT SETTINGS	
INPUT	0 - 10V	0 - 10V	4 - 20mA
DISPLAY MODE	ANALOGUE	ANALOGUE	CONTROL
RANGE SET	T1	T1	T2 T3 T4
OUTPUT LINK	LEFT	LEFT	RIGHT
STARTMODE =	0	0	1
UPPER SETPOINT	50%	%	
BANDSET	10	0 2 4 6 8 10 12 14 16 18 1 3 5 7 9 11 13 15 17	
LOWER SETPOINT	-----%	%	
LOCKPOT	OFF	ON	OFF
DATE:		SIGNED:	

Installation is now complete.

2.7 PULSE WIDTH MODULATION OUTPUT APPLICATIONS

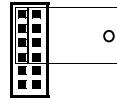
The unit can also be setup to provide a 50Hz, 0 to 100% duty cycle output pulse train representation of the analogue input voltage/current. In this mode the optocoupler is set to PWM output and the relay assigned to a single setpoint.

The table below shows the relay and optocoupler states above and below the setpoints

RANGE T4R	SETPOINT	
	<	>
STARTMODE = 0	RELAY ON	OFF
	OPTO PWM	PWM
STARTMODE = 1	RELAY OFF	ON
	OPTO PWM	PWM

Set up the STARTMODE to match your application control states as follows:

Insert the programming plug - facing right
 - offset, upper (STARTMODE)
 - onto the vertical left hand 6 pin SET UP header



Switch on the power to the unit.

The LED will illuminate continuously to indicate STARTMODE = 1 set.

Switch off the power and remove the programming plug.

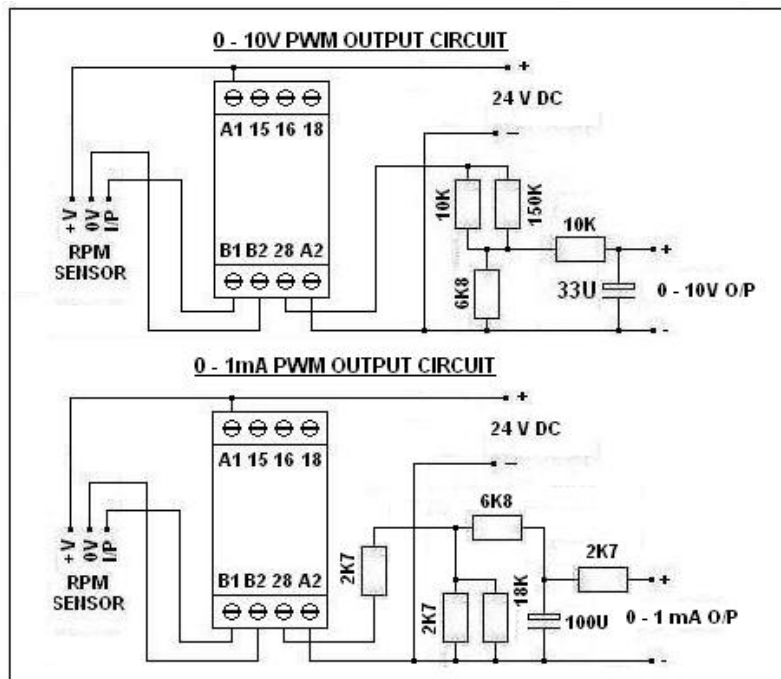
Repeat procedure to return to STARTMODE = 0.

The LED will blink on continuously to indicate STARTMODE = 0 reset.

Switch off the power and remove the programming plug.

Set up T range T4R - T2 jumper link out right, T3 jumper link out right, OUTPUT jumper link out right.

The PWM signal can easily be converted to a 0 – 10V/ 0 – 1mA analogue output.



Note: Output load 0 – 10V >= 1Mohm, 0 – 1mA <= 100 ohm.

2.8 USING OPEN COLLECTOR OR VOLT FREE CONTACT SWITCH SENSORS

NPN open collector or voltage free contact switch sensors can be used as an alternative to the single analogue sensor in many applications. Configure the system as follows:

Adjust the setpoint potentiometer to 75%.

Set the BandSetNumber to 10 (50% band) for dual setpoint applications only.

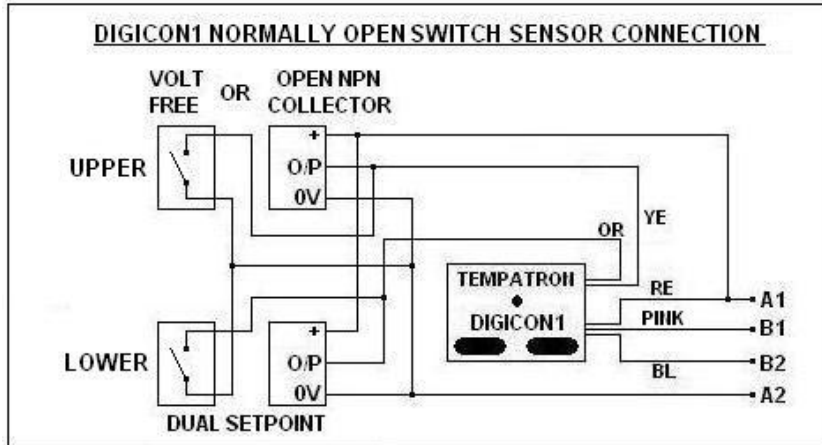
Activate LOCKPOT.

2.8.1 NORMALLY OPEN SENSORS

The sensors will be open (volt free contact) or off (open NPN collector) when the sensor input is below the lower switching point (e.g. both out of water).

AND

The sensors will be closed (volt free contact) or active on (open NPN collector) when the sensor input is above the upper switching point (e.g. both in water).

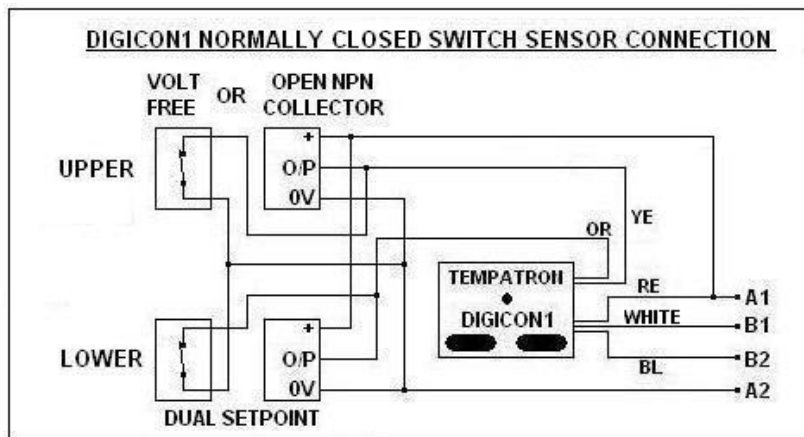


2.8.2 NORMALLY CLOSED SENSORS

The sensors will be closed (volt free contact) or active on (open NPN collector) when the sensor input is below the lower switching point (e.g. both out of water).

AND

The sensors will be open (volt free contact) or off (open NPN collector) when the sensor input is above the upper switching point (e.g. both in water).



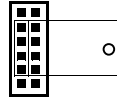
2.9 ALTERNATIVE STATUS DISPLAY FOR YOUR APPLICATION INSTALLATION

After you have completed and tested your application (including PWM feature, if required) you may wish to change the diagnostic status display indication. The factory set status display provides an indication of the present input%. The status display can be changed to indicate the present control state:

NO INPUT	LED blinking on every 2 seconds
INPUT < lower setpoint	LED blinking on every 0.8 seconds
INPUT > lower setpoint and < upper setpoint	LED on continuous (dual setpoint applications)
INPUT > upper setpoint	LED flashing on every 0.8 seconds
INPUT > 100%	LED triple flash, 4 second flash cycle warning

Remove all SET UP jumper links.

Insert the programming plug - facing right
- centralised (MYTIME)
- onto the vertical left hand 6 pin **SET UP** header



Rotate the setpoint potentiometer **fully anticlockwise** and **switch on** the power to the unit.

The LED will blink slowly to indicate **ready to program**.

Skip setting 1 Rotate potentiometer fully clockwise, then on the first flash rotate potentiometer fully anticlockwise to **activate factory setting 1**. Must now be reprogrammed.

The LED will fast blink to indicate **ready to program**.

Rotate potentiometer fully clockwise to start counting.

The LED will flash quite slowly for each count. **Remember digital counting starts at zero not one.**

Display set digit Count the flashes, 0 then **on 1** rotate potentiometer fully anticlockwise: **CONTROL DISPLAY PROGRAMMED**.

Switch off the power and **remove** the programming plug.

Note: To return to ANALOGUE INPUT DISPLAY, repeat procedure and count the flashes, **on 0** rotate potentiometer fully anticlockwise: **ANALOGUE INPUT DISPLAY RE-PROGRAMMED**.

NOW SKIP BACK TO SECTION 2.5 (DUAL SETPOINT SETUP) TO REPROGRAM YOUR UPPER SETPOINT% AND LOWER SETPOINT% LEVELS.

3.0 RETURNING TO FACTORY SETTINGS

When you start using the programmable features in the unit you can if necessary return to the factory settings and start again.

Simply:

Remove all SET UP jumper links.

Rotate the setpoint% potentiometer fully clockwise.

Insert a red jumper link - vertically
- centralised
- onto the vertical left hand 6 pin **SET UP** header



Switch on the power to the unit.

The LED will either **illuminate** continuously to indicate 4 – 20mA input programmed.

or

The LED will **blink on** continuously to indicate 0 – 10V input programmed.

Rotate the setpoint% potentiometer fully anticlockwise to switch off the LED.

Rotate the setpoint% potentiometer fully clockwise.

The LED will **flash on/off** continuously to indicate **RESET ACTIVATED**

Rotate the setpoint% potentiometer fully anticlockwise.

The LED will illuminate continuously to indicate **FACTORY SETTINGS restored**.

Switch off the power, **remove** the programming plug and **restore** jumper links to their **factory set** positions.

Tempatron: Eltime House, Hall Road, Maldon, Essex, CM9 4NF UK.

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