Installation and Setting up Instructions for the
Type 920
Auto Sequencer

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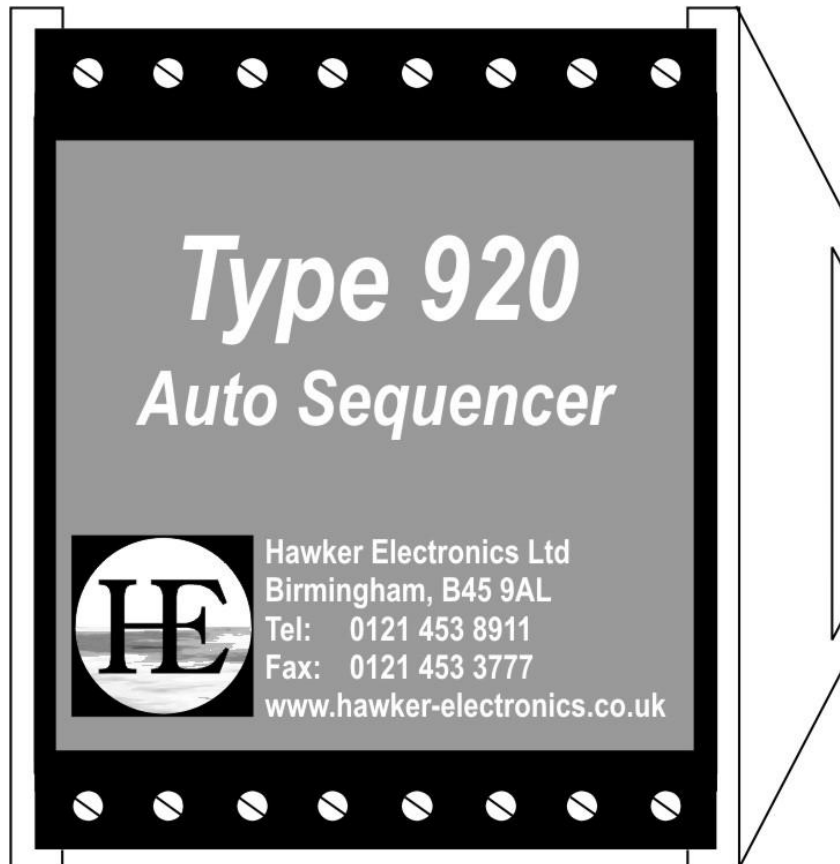
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1. General Description

The Type 920 is a two channel auto sequence controller which accepts a signal from a vessel mounted sensor and operates individual relays anywhere over its input range. The output relays are used to drive a two pump system for pumping out auto sequencing applications commonly referred to as duty and assist, and duty and standby.

Typical applications include:

Duty only, basic application pumping out, alternating between two pumps,
Duty and standby, standby pump is a backup in the event of duty pump failing,
Duty and assist, each pump is sized for around half of the required flow rate, this gives equal wear and tear on pumps.

Additional 920s can be used with the input signal wired in series to provide extra sequencing functions and the 920 can be used with the 900 trip amplifier for additional control or alarm.

When in 'run' mode the 4 digit LCD gives a real time reading of the signal from the input sensor whilst the facia buttons provide shortcuts that display or alter various parameters. When in 'Programme' mode the LCD provides the user with a menu system to precisely set the relay ON/OFF points and adjust several other parameters.

Important Information
This equipment should only be specified, installed and commissioned by suitably qualified persons. This product contains no user serviceable parts, removing the product from its enclosure, modification or using other than outlined in the manufacturers guidelines in any way invalidates the warranty and safety features. The electrical installation should comply with local regulations. Ensure the correct instructions are used for the version being fitted.

2. Mounting, electrical installation and connection

The 920 can be mounted using the Snap fastener DIN rail or by screw fastenings using the hole slots on the lower left and upper right external corners of the enclosure. The product is intended to be mounted with the power terminals at the bottom of the enclosure. An air gap of 10mm minimum should be available around the enclosure perimeter for proper air circulation to prevent overheating.

The 920 should not be mounted close to heat sources; electrical noisy apparatus e.g. welding machines and inverter drives; locations subject to strong vibrations or shocks; dusty or corrosive gas environments; outdoors in direct sunlight or high humidity areas.

The crossed out bin symbol placed on this product label reminds you of the need to dispose of the product correctly at the end of its life.

Maintenance is not required for this product other than periodic testing if demanded by the application. External cleaning can be performed using a mild detergent, care should be taken not to clean the product with aggressive substances that may damage the enclosure, terminals or labels. Cleaning should be performed with the power disconnected.

2.1 Connection

The 920 is available as a DC or AC version (factory set). The lower terminal block is for connection of the users power supply input to the product and the 920 volt free relay contact outputs. The upper terminal is the connection to the input sensor.

The power and relay cables can be either single cores or multicore, this product does not require an earth connection. All cables should be rated electrically suitable (see data specifications) and mechanically robust enough for the application. The input sensor cable will normally be pre-fitted to the sensor itself, if this cable is screened the screen can be connected to the signal 0V terminal if required, the screen should be connected at one end only and if possible at the controller end.

The power supply to the 920 should be via a local external isolator and fuse. This is also applicable to the relay contacts especially when switching hazardous voltages. This enables the 920 to be safely disconnected if required, as well as providing over current protection.

⚠ Caution risk of danger symbol. This symbol if shown on the product label indicates the terminals marked 'supply' and 'relay' may contain hazardous voltages, depending on the model and users application. Identify and Isolate before connecting or disconnecting.

The installation should comply with local regulations.

Fig 1 Wiring connection

Always confirm the connections with the products terminal block label before connecting as positions may vary depending on model. The 920 is available as an DC or AC powered version which is specified on order.
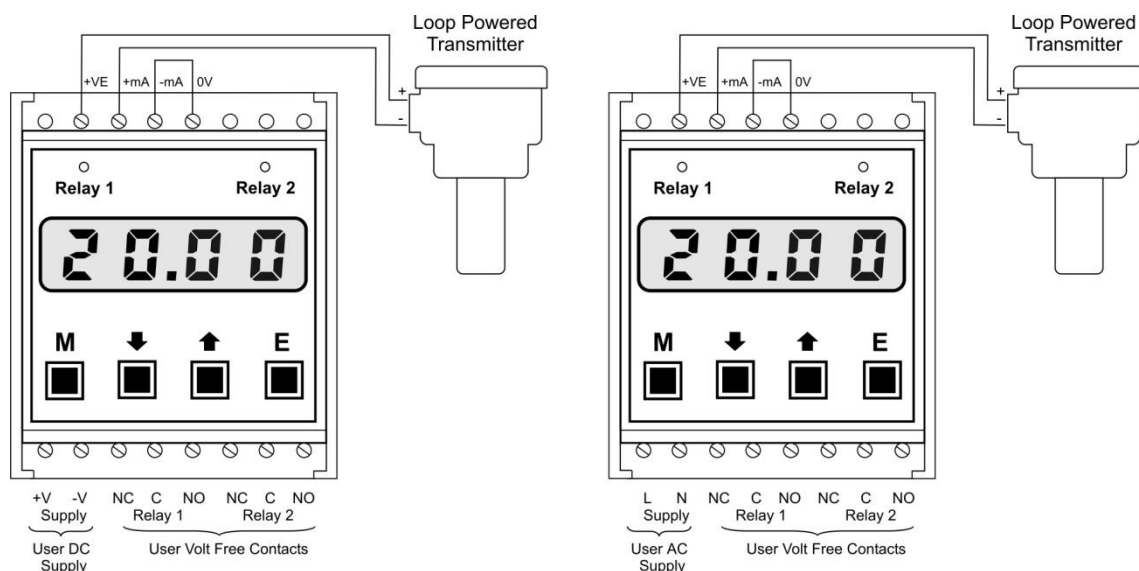
Although not essential it is recommended to connect the initial duty pump to relay 1 contacts and the assist to relay 2, this makes the logic easier to understand during commissioning etc. For more demanding applications that require additional relay outputs multiple 920s or a combination of 920 and 900 trip amplifiers can be used by connecting the transmitter loop in series as follows.
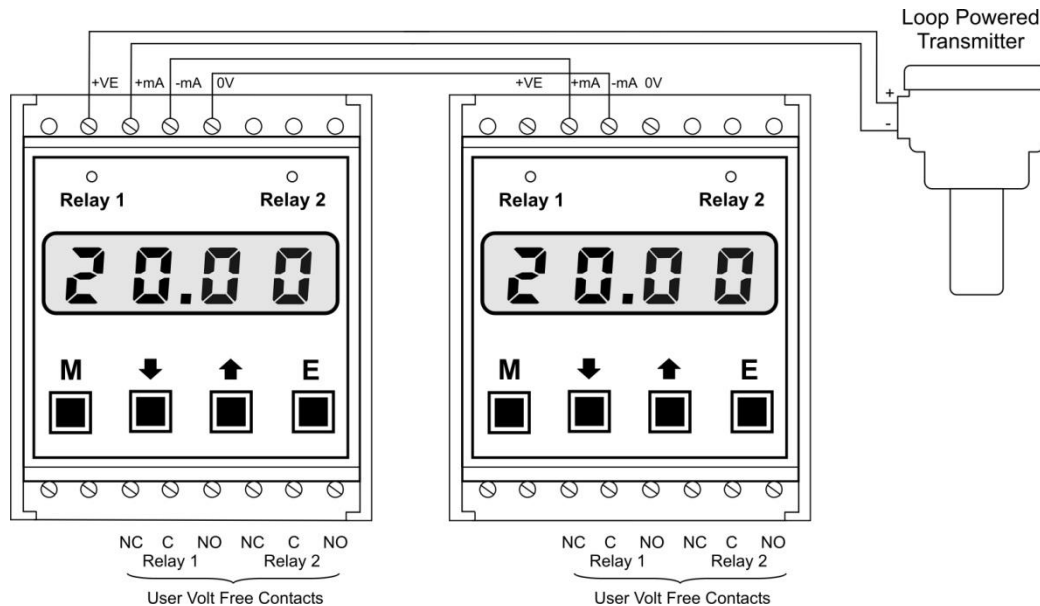
3. Application for Pumping Out modes

a) Basic Auto Sequencer with Assist set to OFF

The Duty pump will start pumping out when a high level is reached and stop when a low level is reached using pre programmed Set points 1 as the reference. This process repeats but alternating Pump 1 and Pump 2 as the Duty pump. In this mode only set points 1 are available to programme in the menu.

This basic auto sequencer is generally used where equal wear and tear is required on both pumps so each pump will take turns as the duty pump. This is often chosen where the end user chooses to replace or maintain both pumps at specific intervals as the hour usage will be the same.

b) Auto Sequencer with the Assist set to ON, and the Duty Inhibit set to OFF

This assist mode is often required if the duty pump is not able to cope with demand or has failed.

The Duty pump will start pumping out when a high level is reached and stop when a low level reached using pre programmed Set points 1 as the reference. If the level continues to rise after the Duty High level is reached and the Assist ON set point is reached the Assist pump will operate. Both Duty and Assist will turn OFF when the level falls to the Duty OFF

set point. The OFF point in this mode is common to both Duty and Assist. This process repeats but alternating pump 1 and pump 2 as Duty and Assist, e.g. 1st cycle pump 1 is Duty and pump 2 Assist, 2nd cycle pump 2 is Duty and pump 1 Assist. In assist mode set point 2 ON must be ≥ SP1 ON.

c)   Auto Sequencer with the Assist set to ON and Duty Inhibit set to ON

This is the same as (b) above when the Assist Pump operates, it automatically stops the duty pump.
An example of where this may be chosen is if the Assist pump is an expensive larger pump with greater capacity and is used to stop an overfill and the user wants to preserve its life.

Pumping OUT
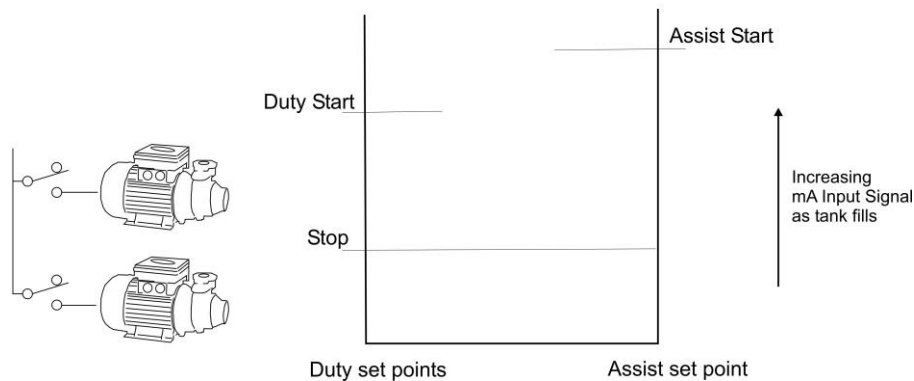
The basic operation outlined in this section can be extended by selecting additional parameters in the software menu (see section 5), this greatly increases the 920 functionality.

The sequencer requires an input sensor whose output increases as the tank fills e.g. 4mA empty and 20mA full.

4.   Software Menu and programming

There are two modes of operation

run mode   This is the normal working operation identified by the decimal point blinking, ON for approx 4s then OFF for 1s.

prog mode   Programme mode is entered to set the user adjustable options.

The menu is accessed by pressing and holding the 'M' key for approximately 5seconds.
Sub menus are accessed by pressing 'E' from the main menu.
The UP/DOWN keys are used to scroll through values or toggle options.
Enter is used to get to a sub menu or confirm a change, the LCD will briefly show 'done' after a change has been made.
Pressing 'M' will go back one step on the menu system, each time pressed.

Programming is simple with several configurable Main Menu options and an exit.

Display	Description	
'duOn'	Duty ON point.	This is the value that Duty Relay will energise.
'duOf'	Duty OFF point.	This is the value that Duty Relay will de-energise.
'ASon'	Assist ON point.	This is the value that Assist Relay will energise.
'APup'	Assist Pump ON/OFF	Assist Pump ON or OFF.
'dinh'	Duty Inhibit ON/OFF	If ON kills the Duty pump when the Assist starts
'Hold'	Duty Hold ON/OFF	If ON, will HOLD the Duty pump so bypassing auto selection. Used for manual intervention and diagnostics.
'SuAP'	Swap ON/OFF	If ON will swap duty and assist pumps. Used for manual intervention and diagnostics.
'LSd'	LSD ON or OFF	Least Significant Digit for the LCD only. The Default is ON.
'Cntr'	Counter	Counts the times Duty and Assist have operated
'Fin'	Finished Programming	Press Enter exits programme mode and returns to run mode

Selecting some of the Main Menu options above will reveal other sub menus.

Duty ON Point   'duON'
This is the point the Duty will turn ON. It should be greater than the Duty OFF point and less than the Assist ON point (if used).

Duty OFF Point   'duOF'
This is the point the Duty and Assist Pump (if using Assist) will turn OFF. It should be less than the Duty ON point.

Assist On Point   'ASon'
This is the point the Assist will turn ON. It should be greater than the Duty ON point.
This will only be available if the Assist pump is turned ON, see next menu below.

Assist Pump ON/OFF   'APuP'
Entering this menu will enable or disable the Assist pump. Use the 'UP' key to toggle ON/OFF and enter to confirm selection.

Duty Inhibit   'dinh'
Entering this menu will enable or disable the Duty pump when the Assist pump operates.
Use the 'UP' key to toggle ON/OFF and enter to confirm selection.

Hold   'Hold'
Entering this menu will put the current Duty pump on Hold. This pump will now be the duty pump indefinitely unless changed back to OFF. Use the 'UP' key to toggle ON/OFF and enter to confirm selection.

Swap   'SuaP'

Entering this menu will permit the manual swapping of the duty and assist pumps. Press 'E' the display will show 'SurE' then press 'E' again to swap. The effect is immediate and the unit will automatically return to 'run' mode. Note this works in any part of the sequencing cycle.

LSD   'LSd'

Least Significant Digit. The real time input signal display default is 4 digits and when the relay ON/OFF points are programmed it is always to 4 digits. This gives the best possible resolution and control of the relays, i.e. their ON/OFF operation will be exactly as programmed to the least significant digit (to 00.01mA).

However sometimes due to application turbulence it may be less of a distraction to display only 3 digits, this is achieved by turning the LSD OFF (UP key toggles in the programme menu). Under these conditions it must be remembered that the relays will still operate at the programmed values and not the 3 digit value. This only effects the display and not the relay set points.

Counter 'Cntr'

A totaliser which counts the number of operations of the 920 relays. Pressing 'E' goes to a sub menu, use the 'UP' key to toggle through 'ry1', 'ry2', 'reset'. Press 'E' when on RY1 or RY2 will show how many times this relay has operated, pressing 'E' when 'reset' is shown will display 'SUrE', to confirm the reset press 'E' again, this will reset both counters to zero. Press 'M' to go back to the main counter menu which will be acknowledged with a confirm message. The LCD is a 4 digit type so the maximum count is 9999 then it will roll through zero. Counter values are stored in non volatile memory are not be lost if power is removed. The counter memory can be used for a 100,000 minimum guaranteed operations before the memory cell loses the ability to store data. However, in practice typical values may be around 1,000,000.

For example assuming worst case of 100,000 memory operations:-

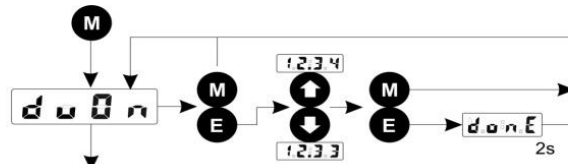An application that has 24 pumping cycles per day 365 days a year.
24 pumping cycles = 12 ops per pump in auto sequencing mode. 12x365=4380 ops per year so 100,000/4380 is 22 years worst case.

For information on programming the 920 see the **Menu Programming Flowchart** on the next page.
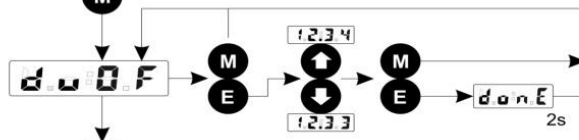
Menu Programming Flowchart

Press 'M' key for 5 seconds to access programme mode

Duty On Set point
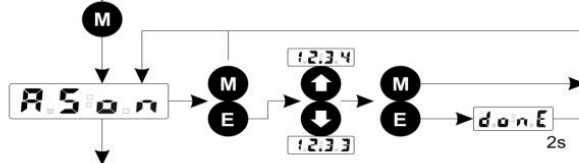Use UP/DOWN key to adjust value

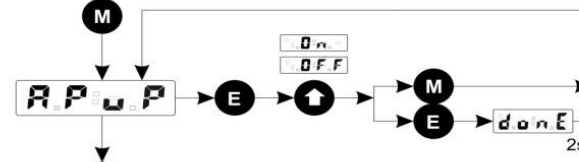**Duty Off Set point**
Use UP/DOWN key to adjust value

Assist On Set point
This menu only available if Assist pump is set to ON
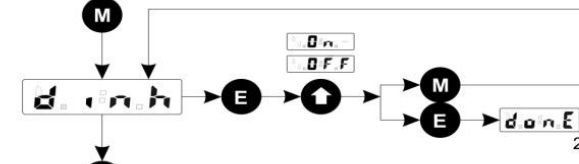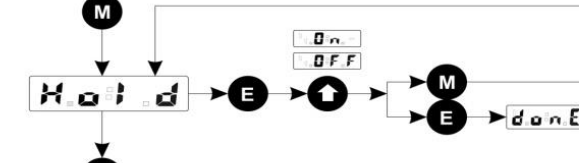Use UP/DOWN key to adjust value

Assist Pump ON or OFF
UP key toggles

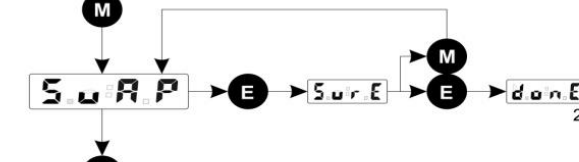**Duty Inhibit**
This menu only available if Assist pump is set to ON
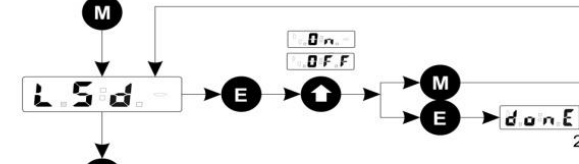UP key toggles

Hold Duty Pump ON or OFF
UP key toggles
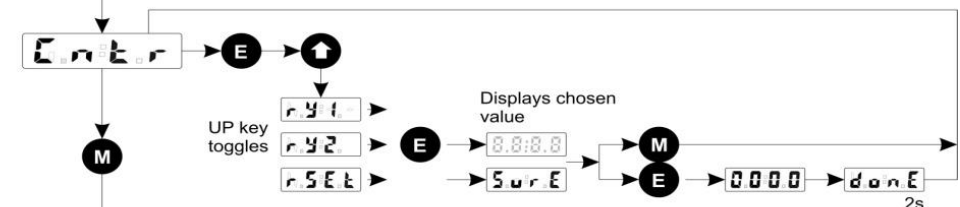
Swap Duty and Assist pumps
Exits programme mode back to run mode

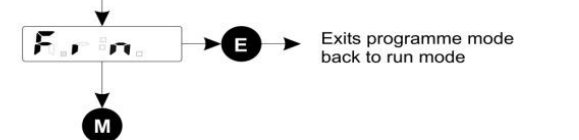**Least Significant Digit On or OFF**
UP key toggles

Relay Counters and Reset
UP key toggles
Displays chosen value

Finished programme mode
Exits programme mode back to run mode

8

4.1   Real time Displays whilst in Run Mode, Quick functions

Pressing 'UP' key will display the current Duty Pump relay if the LEDs are illuminated i.e. cycle started or the next pump to be the duty pump i.e. before the cycle starts. Indirectly if the Duty pump is identified then the Assist pump will also be known.

Following the Duty pump information if the 'HOLD' is set to ON the LCD will also display HOLD.

Releasing the 'UP' key will immediately return to 'run' mode.

This function does not alter the state of the output relays, whilst displaying.

Pressing the 'DOWN' key for approximately 5 seconds will force a software reset. This is advisable if changing the 920 programmable parameters mid cycle. This is the next best thing to a full power reset.

Button Functions in 'RUN' mode

Displays duty pump   Displays HOLD if HOLD is set to ON

Forces a software reset

Access to Programme mode
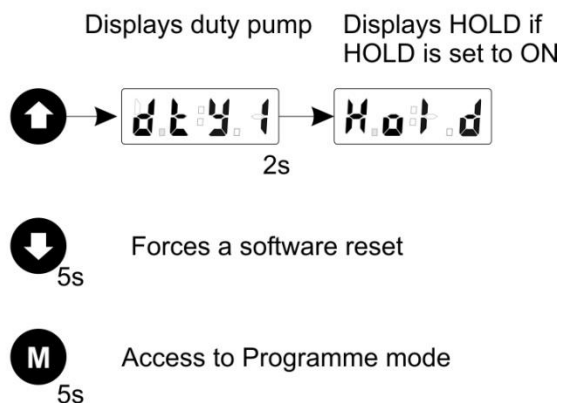
4.2   Additional notes on programming

When adjusting the ON/OFF points the counter rolls from min to max and visa versa this saves time.

The minimum programmable difference between a relay ON/OFF point is 0.01mA however a setting like this would required a very stable input. The minimum realistic input depends on the quality of signal from the input sensor and the application e.g. turbulence, tolerance, noise etc. This can most likely be established by observing the LCD real time input signal reading and making a note of the normal fluctuation then programming accordingly.

The counter uses a speed key function that increases the speed it is counting at if the UP or Down button is continually pressed for a few seconds or more. When the counter is getting close to the desired value release the key and then use individual presses and releases for precision adjustment.

Programmed parameters are stored in a non-volatile memory so will be retained if the 920 loses power.

The 920 stores the association of its internal relays (1 or 2) with the current duty and assist identification. On applying power after a power fail the correct relays will resume the duty and assist, however under most conditions it will be treated as the start of a new cycle.

Errors

'Err' message	This is only displayed when in run mode and there is a problem with the relay set points. Check that: - Duty OFF<DutyON, Assist ON > Duty ON. To fix the error enter programme mode and change the set point values.
dp not blinking	If the decimal point is not blinking the unit may have been unintentionally left in program mode. Press the 'M' key repeat until 'Fin' is displayed then press the 'E' key, this will exit programme mode. Alternatively momentarily turn the power OFF and back ON.

5.   Power Backup Systems

Uninterrupted systems can be implemented using a back up battery. If a back up system is required it would be normal to specify a DC powered model. The normal configuration is to use 18VDC to 24VDC derived from an AC power supply and a 12VDC external battery. When mains AC is present the 920 operates from the DC output from the mains AC power supply, when the mains AC fails the 920 operates from the battery. It is essential to put a diode such as a 1N4001 in series with each of the + supplies to the 920, see diagram. Optionally a solar panel could be used as well as a recharging system.
Note: If power fails then it may be the case where the relay contacts lose their voltage too. Backup systems are useful where supplies are from different sources or the 920 relays are used to drive other relays for control and indication.