# SIGNAL PASSED AT DANGER MONITOR SPAD1

In the modern rail network, at chosen locations, signals at danger are protected with additional signals some distance after the protected signal. If the protected signal is passed when it is showing a red danger aspect, the SPAD signal operates.

When the SPAD signal operates, it has a central red aspect which is steadily illuminated. The aspects above and below flash on and off simultaneously.
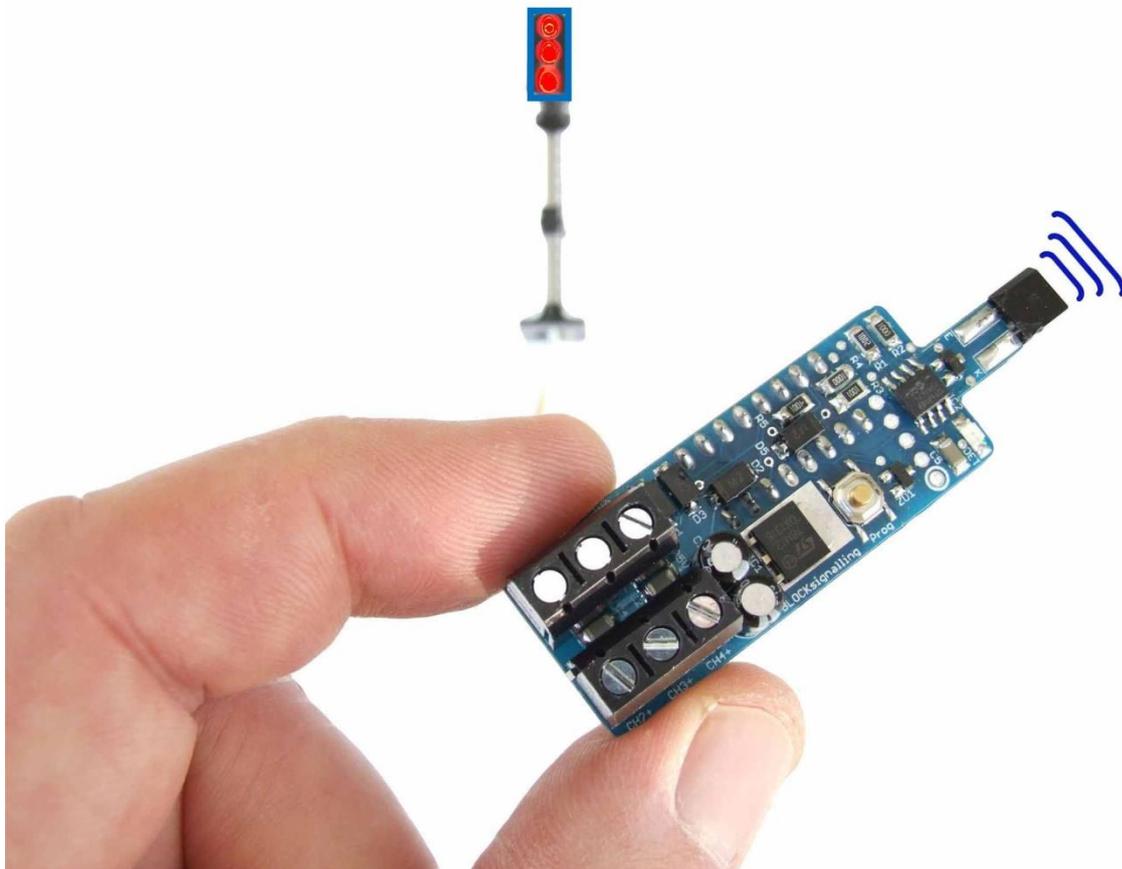
Now you can provide the same protection on your own layout.

The BLOCKsignalling SPAD1 module is a detector which monitors the protected signal and when the signal is showing a red danger aspect the SPAD1 module watches for trains passing the signal.

If a train is detected passing over the sensor on the SPAD1, it operates the SPAD signal as described above.

The SPAD signal continues flashing whilst the train is over the sensor. Once the train clears the sensor, the flashing ceases after 2 cycles (all settings are adjustable if required).
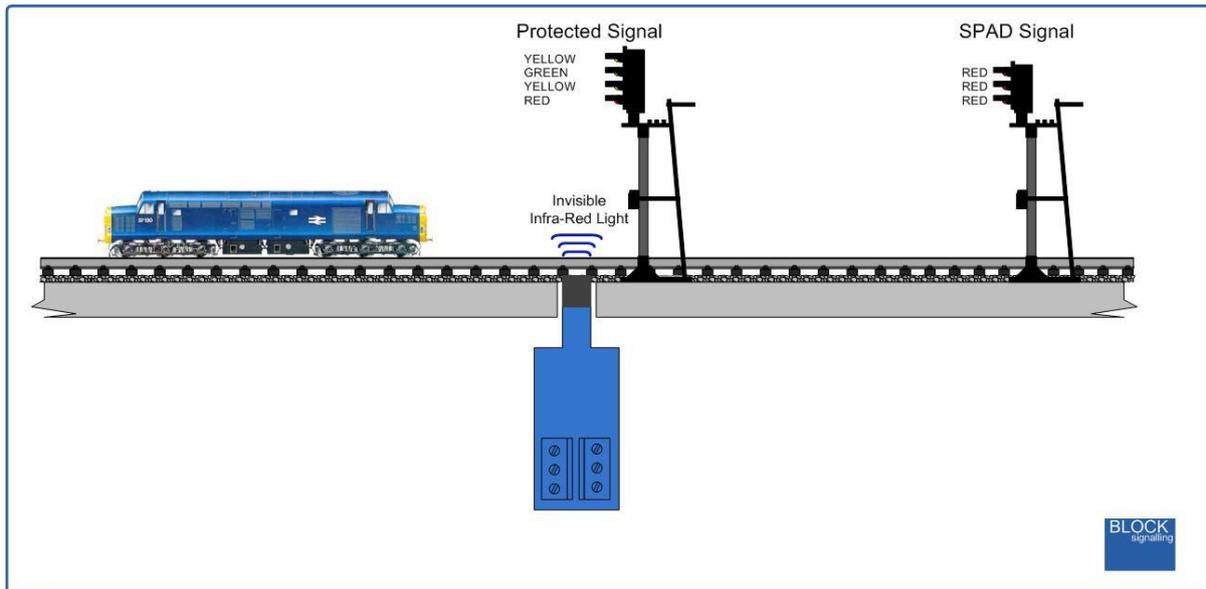
Power Supply

The module operates from a wide input voltage range (8V to 25V DC, 10V to 16V AC, or can be powered from a DCC feed).

If using DC, take care to connect with the correct polarity. If connected incorrectly no damage will be caused, but the module will not operate.

Please double check all wiring before applying power, as incorrect wiring can damage the unit.

Connecting Up

The module has six terminals.

Vin   This is one side of the AC or DCC supply input feeding the module (or the positive feed if a DC supply is being used)

GND   This is the other side of the AC or DCC supply input feeding the module (or the negative feed if a DC supply is being used). It is also the SPAD signal common wire.

CH1+   This is the positive feed to the SPAD signal red flashing aspects

CH2+   This is the positive feed to the SPAD signal steady red aspect

IN-   This connects to the negative connection of the protected signal red aspect

IN+   This connects to the positive connection of the protected signal red aspect

Resistors are built into the module, so no external resistors are necessary.

The connections to the monitored signal can be made either side of any resistors used, as the input accepts voltages in the range of 1.5 to 12V DC. If the connection is accidentally reversed, no damage will be caused.
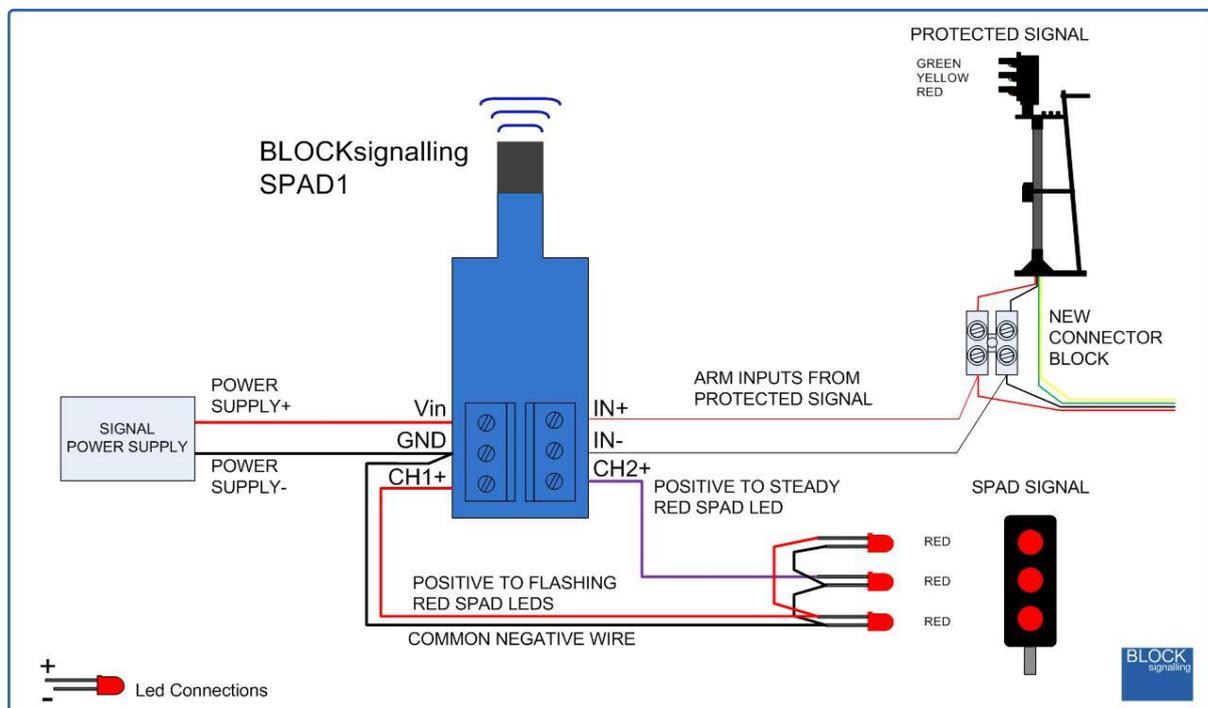
Operation

With the power switched on, the red led on the PCB should flicker once every 1/4 of a second. This shows the SPAD1 is in standby.

If the protected signal is switched to danger, the red led on the PCB should light and flicker rapidly. This shows the SPAD1 is now armed and after checking the sensor is clear of trains for a few seconds, becomes enabled and starts looking for trains. The sensor needs to be clear initially, otherwise the module would detect trains which have correctly passed the signal at green, causing the signal to set to danger.

If a new train now passes over the sensor, the SPAD signal will be triggered.

Whilst the train is over the sensor, the SPAD signal will continue flashing. A minimum of number of flashes is shown.

Once it is determined the train has completely cleared the sensor, there are additional flashes shown before the SPAD signal is disabled.

If the protected signal switches from danger back to another aspect before the SPAD1 is triggered, the SPAD1 will reset stop looking for trains.

If the SPAD1 is triggered, and the protected signal switches from danger back to another aspect, the SPAD1 will continue operate the SPAD signal as described above until the cycle is complete.

Programming

The module will operate the SPAD signal straight out of the packet.   There is no need to program the module unless you want to change aspects of its operation.

Programming is performed holding down the Push Button when switching on the power. The diagram at the end of this article shows all the programming options.
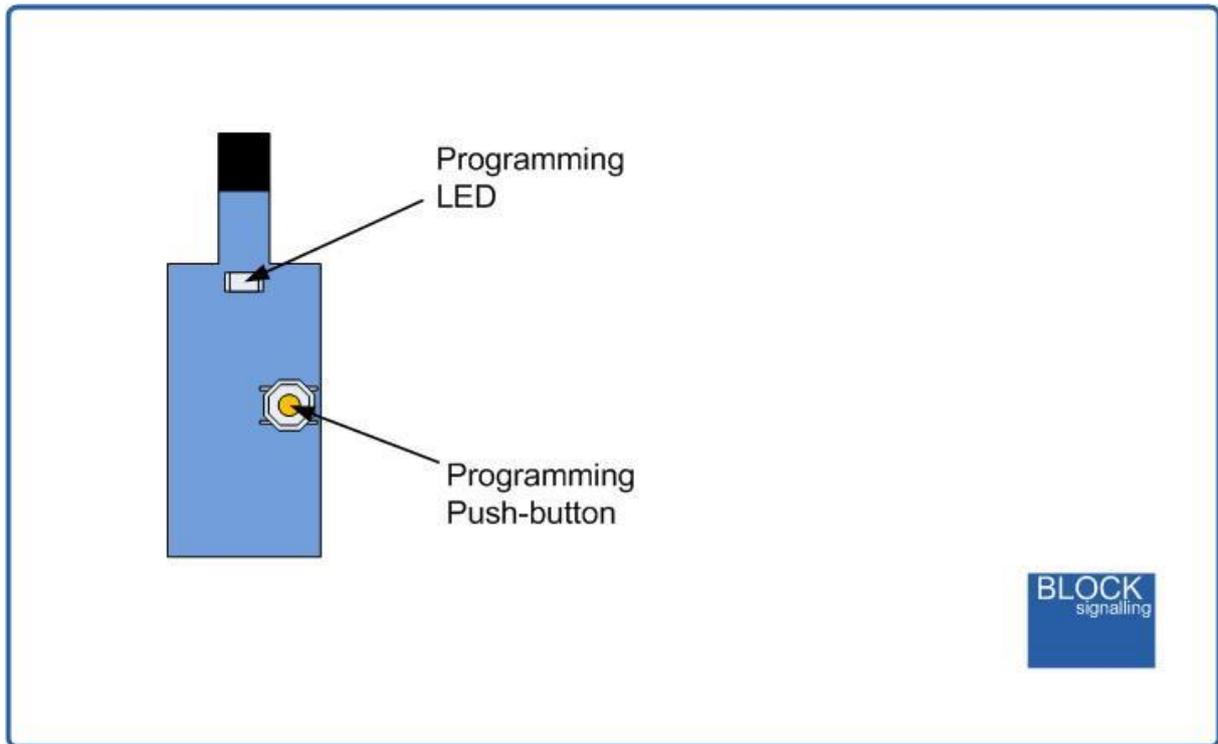
Programming the Mode

There are two modes of operation, Test Mode and Spad Mode.

Test mode is used to check the operation of the module after manufacture. It can also be used to check for the correct operation of the module if there is any doubt over its correct function.

Select the Test Mode by programming code 2/1 (see below). The module starts by testing the infra-red sensor. This test only lasts a maximum of 10 seconds. The red led on the PCB flashes at a rate dependent on the proximity of an object in front of the sensor. Moving a finger close to the sensor will result in the rate of flashing increasing.

Once a certain number of flashes have occurred, the leds of the spad signal will flash on and off. The test sequence is different from the normal spad signal operation.

Normal operating mode is set by programming code 2/2.

Programming the Minimum Flash Cycles

When the SPAD1 has been armed and triggered, the module operates the spad signal for a set number of cycles, before checking if the train is still present over the sensor.

The number of cycles is set by programming code 3, so if two cycles are required, program code 3/2.

Programming the Release Time

If the train remains over the sensor, the module continues to operate the Spad signal. Once the train clears the sensor, the module continues to check that the train has fully cleared.

To prevent the gaps between the carriages cause a false indication of a clear, you can set the time the sensor needs to be clear before the module accepts the train has passed. This is set in terms of cycles.

The number of cycles is set by programming code 4, so if three cycles are required before the module is sure the train has cleared the sensor, program code 4/3.

Programming the Final Flash Cycles

After the sensor has cleared and the release time has expired, you can set a final number of flash cycles.

The number of cycles is set by programming code 5, so if four cycles are required, program code 5/4.

Programming the Rate of Fading

Both the rate of dimming down and the rate of brightening up of the leds can be adjusted to either match filament lamps or led aspects.

The dimming rate is set by programming code 6. A value of 3 is a close match to a filament lamp and a value of 9 is close to that of an led.

To program a value of 3, program code 6/3.

The brightening rate is set by programming code 7. A value of 4 is a close match to a filament lamp and a value of 9 is close to that of an led.

To program a value of 4, program code 7/4.

Programming the Flash Rate

The flash rate is adjustable between 1 (fast) and 9 (slow).

The flashing rate is set by programming code 8, so if you require the slowest rate, set code 8/9.

Sensitivity Setting

The module is supplied with the sensitivity pre-set to suit most installations and should not need adjustment.

The sensitivity is factory set to 5, and can be adjusted from 1 to 10 (with 1 being the most sensitive and 10 being the least sensitive).

	Trigger Threshold					
	2	**3**	**4**	**5**	**6**	**7**
Aluminium Foil (shiny side)	170mm	125mm	100mm	95mm	90mm	85mm
A4 White Paper	100mm	65mm	50mm	45mm	40mm	35mm
Matt Black Card	55mm	35mm	30mm	25mm	20mm	15mm
Shiny Black Plastic	45mm	30mm	25mm	20mm	18mm	15mm

To change the sensitivity, program code 9, so if you wish to set the sensitivity to 6, program code 9/6.

Performing a factory reset will reset the sensitivity setting back to 5.

Programming the Maximum Led Brightness

The led brightness can be set between 1 (dimmest) and 7 (brightest).

To set the maximum brightness of the central led program code 10, so to set the brightest value program code 10/7.

To set the maximum brightness of the outer two leds program code 11, so to set the brightest value program code 11/7.

Setting the Enable Time

Conventionally, when a light signal is at green (clear) the train can advance past the signal. As the train passes the signal it will change automatically to red (danger) to prevent any following trains entering the section of track until the first train has fully cleared that section.

Now the signal is showing red, but a SPAD clearly should not be triggered by the first train. For this reason, once the signal switches to danger, the SPAD1 waits unit its sensor is clear for a period before looking for trains passing the signal at danger. The time the sensor needs to be clear before the SPAD detection is enabled is set by the Enable Time.

To set the enable time, program code 12, so to set an enable time of 4 seconds program code 12/4. The default is 4 seconds.

Factory Reset

To reset the module back to factory settings, switch off the power to the module and hold down the Push Button. Apply the power and continue holding the push button until 1 flash of the led is seen. At this point, release the button. You will see a long flash of five seconds.

The led will begin flashing again. When you have seen 1 flash press the button. You will see a long flash of five seconds and then 10 rapid flashes. The reset procedure is then complete and the module will restart running program 2 (Spad Mode). If you make a mistake programming, simply repeat the process.

Program Flow Diagram

The diagram below shows all the programming options.

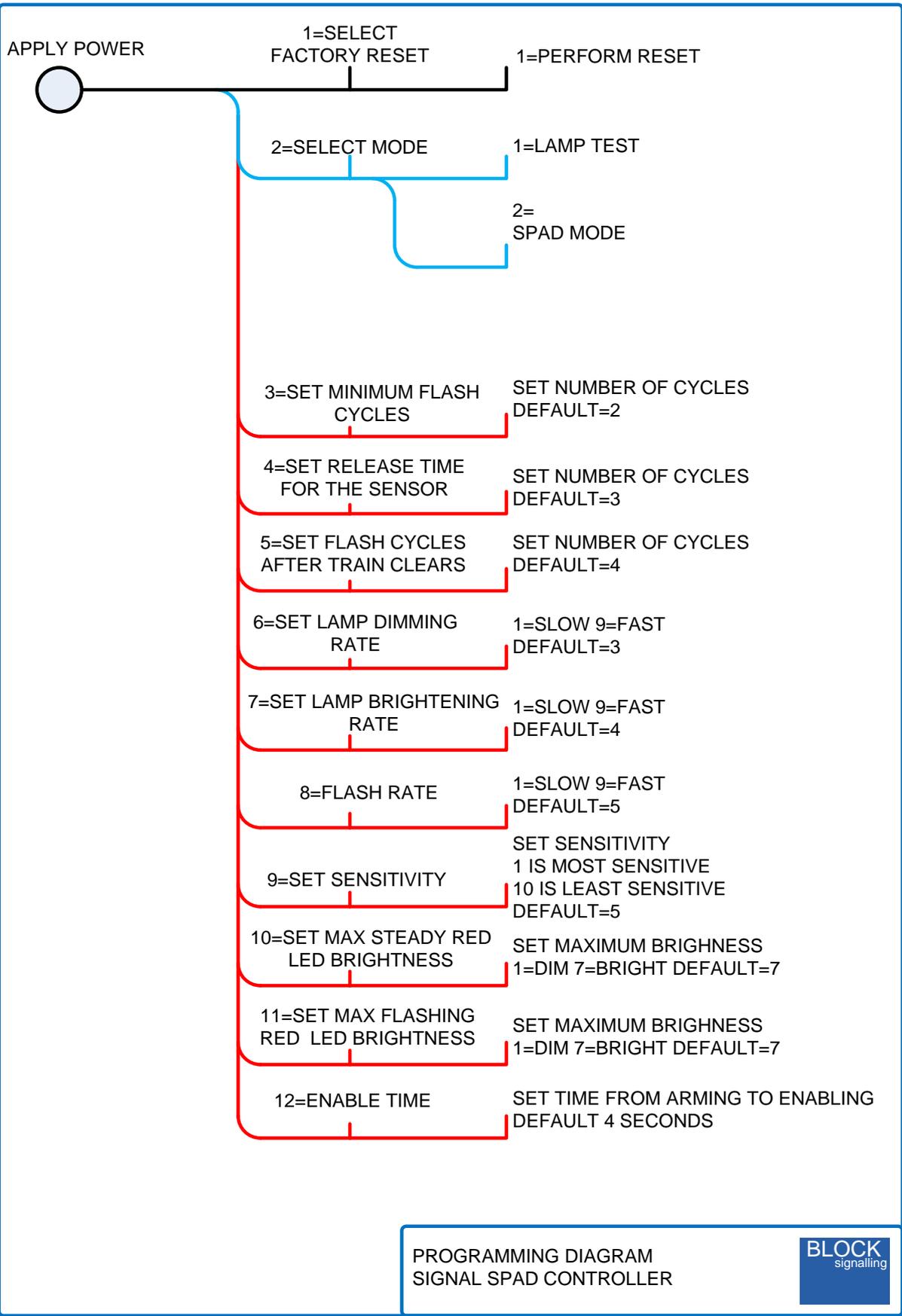Programming is performed by holding down the Push Button when switching on the power.

The red led on the PCB flashes at 1 second intervals. When the required number of flashes is seen (see later for the list of possible choices) the button is released to store the first value. At this point the led comes on for five seconds to confirm the value is stored.

The led then starts flashing again, and this time the button needs to be pressed to store the second value.

Once the two values to be stored are entered, the led flashes 10 times rapidly, and the module starts operating.

Most values entered can range between 1 and 255 (see below for limits). If more are seen, or the programming is aborted by switching off, then the programming must be repeated.

Following the diagram is a detailed explanation of all the settings.

APPLY POWER

1=SELECT FACTORY RESET — 1=PERFORM RESET

2=SELECT MODE — 1=LAMP TEST

2= SPAD MODE

3=SET MINIMUM FLASH CYCLES — SET NUMBER OF CYCLES DEFAULT=2

4=SET RELEASE TIME FOR THE SENSOR — SET NUMBER OF CYCLES DEFAULT=3

5=SET FLASH CYCLES AFTER TRAIN CLEARS — SET NUMBER OF CYCLES DEFAULT=4

6=SET LAMP DIMMING RATE — 1=SLOW 9=FAST DEFAULT=3

7=SET LAMP BRIGHTENING RATE — 1=SLOW 9=FAST DEFAULT=4

8=FLASH RATE — 1=SLOW 9=FAST DEFAULT=5

9=SET SENSITIVITY — SET SENSITIVITY 1 IS MOST SENSITIVE 10 IS LEAST SENSITIVE DEFAULT=5

10=SET MAX STEADY RED LED BRIGHTNESS — SET MAXIMUM BRIGHNESS 1=DIM 7=BRIGHT DEFAULT=7

11=SET MAX FLASHING RED LED BRIGHTNESS — SET MAXIMUM BRIGHNESS 1=DIM 7=BRIGHT DEFAULT=7

12=ENABLE TIME — SET TIME FROM ARMING TO ENABLING DEFAULT 4 SECONDS

PROGRAMMING DIAGRAM
SIGNAL SPAD CONTROLLER

BLOCK signalling