Installation guide

# PIG-relays

## Overview

In the past a major limitation of the CS Technologies access/alarm system has been the number of relays available for control of devices. Because the system was originally designed as a four-door controller up to four relays fitted to the controller itself could be triggered, but adding additional relays was a problem.

There are of course 4-way and 16-way relay expansion boards available but these share inputs with readers and so it is difficult to mix readers and expansion boards without knowing which inputs are available. But the fundamental issue still remained, that the firmware was not designed to allow operation of extra relays in all circumstances.

This has all changed now. It is possible to use any relay anywhere in the program, and in particular as well as 4- and 16-way expansion boards the firmware now also supports the use of PIGs for triggering and operation of relays (as well as high security monitoring of inputs). This makes the system extremely flexible and powerful, and allows utilisation of the full range of relay options, particularly relating to alarm area operation.

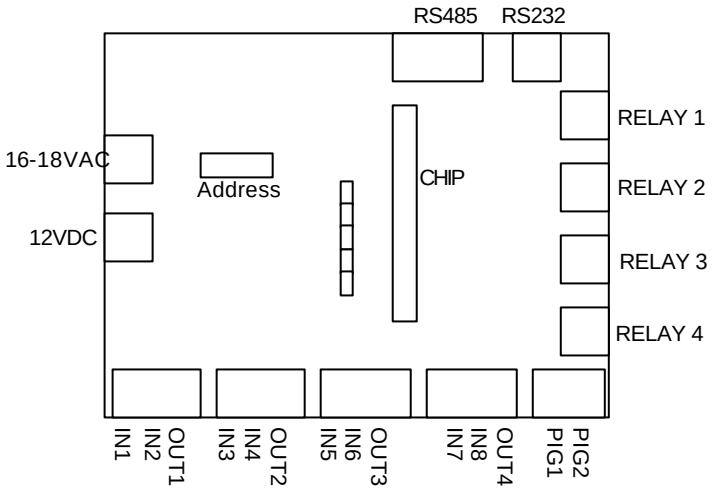
The new features are currently available in a small range of firmware; this document is focused on Wiegand PIG firmware revision 112 (WPN0112.CST) and associated PC3 revision 91.

## Hardware description

### Controller

As always the controller is the basis for the system. The firmware in the controller is WPN0112.CST. The controller supports up to four wiegand readers as well as PIG buses. The system is completely configurable as to the number of readers and pig buses available. It can range from no readers and 14 pig buses (or 7 boosted pig buses) through to four readers and two pig buses (or 1 boosted pig bus) depending on configuration.

Wiegand readers are connected to the input ports and the links LK8, 17, 18, 19 and 20 set as per usual.




### PIGs

Pigs (or Point Identification Gadgets) are an innovative high security device which allow multiple devices to be linked to a single 'bus' and each individually monitored and/or controlled. They are 'supervised' digitally meaning that any attempt to tamper with the devices will cause an alarm, and this tampering will always be detected. Pigs connect to the controller linked together on a 'pig bus'. The pig bus generally consists of 0V, +5V and an input or output port on the controller, as shown overleaf. There are different types of PIGs available – single port (PIG1) and dual-port (PIG2) pigs, a 32-input board (PIGPEN32), a relay output board (PIGOUT), a combined input/output board (PIG3) and PIG-RELAYs which can be driven by PIG1's or PIG2's or PIG3's. All these items are described further below.

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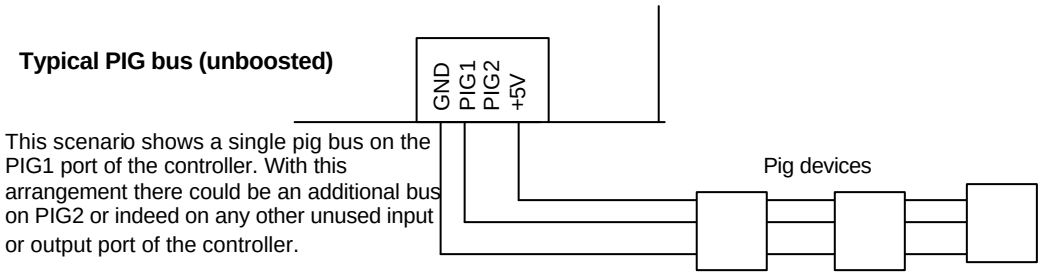
Note that when relying on PIGs for supervision of wiring it is important to remember that as with any supervised system the wiring between the controller and the supervising device (i.e. the pig) is protected but the wiring between the actual alarm device and the PIG is not. Accordingly it is desirable to protect this cabling and ensure that its length is minimised if it is desired to have a fully supervised system.

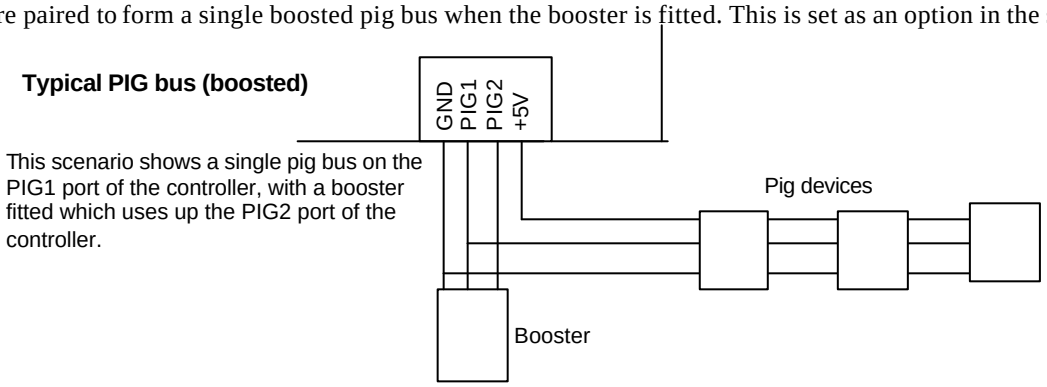
**Typical PIG bus (unboosted)**




## PIG-booster

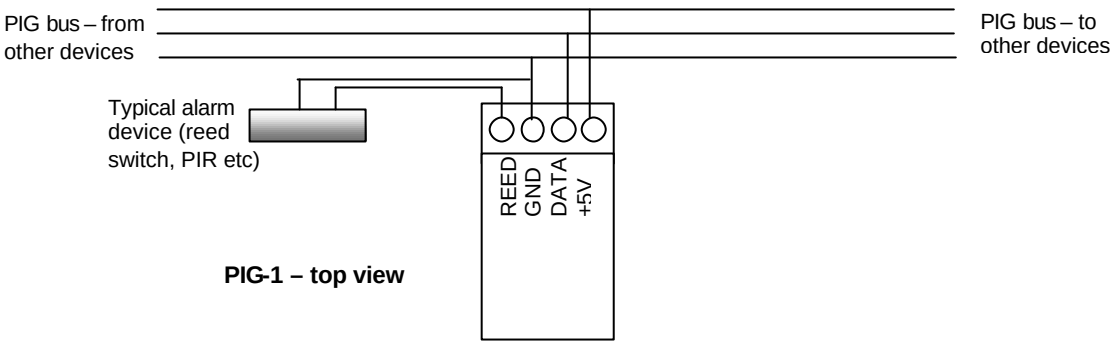
The PIG-booster is a 'slew rate limiter' which reduces reflections on the pig bus and improves performance particularly on a long run. A basic PIG bus consists of three wires – 0V, +5V and a data line as shown above; the data line can be any of the input or output pins on the controller. Because of the reflections there are significant distance limitations on a basic bus like this. To boost the length a PIG-booster is fitted; this takes up an additional data line and significantly improves the performance of the pig bus. When a booster is fitted an option in the software allows this to be recorded; ports are 'paired' together when using a booster – for example PIG1 and PIG2 are paired to form a single boosted pig bus when the booster is fitted. This is set as an option in the software.

**Typical PIG bus (boosted)**




## PIG-1

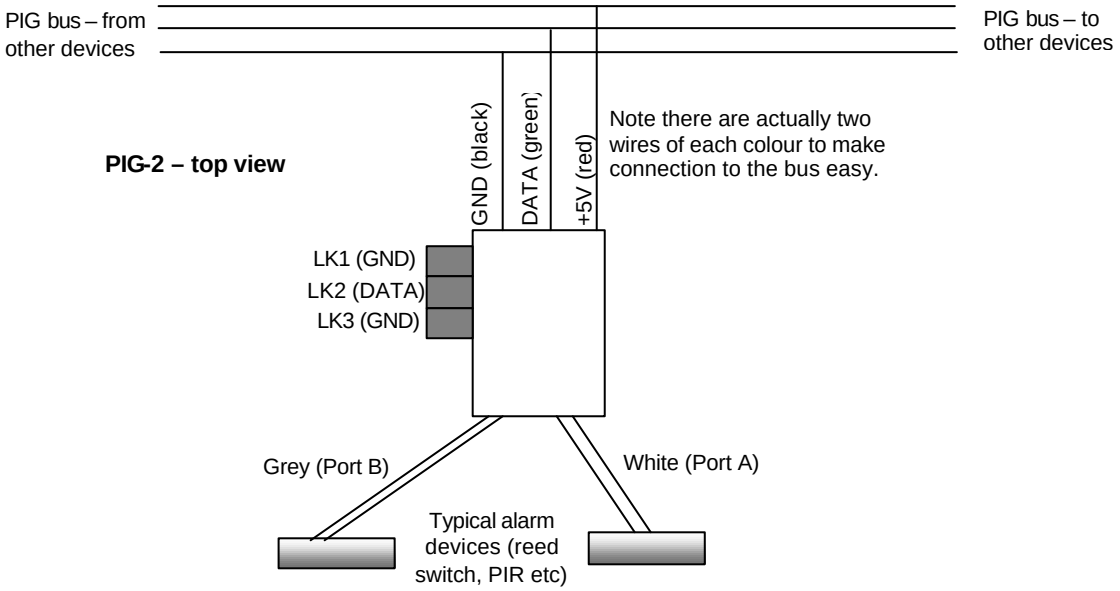
The PIG-1 is a single input PIG. It is low in cost, easy to terminate and can be used to monitor a single device, or in combination with a PIG-RELAY be used to drive a single output.
Disadvantages of the PIG1 are that there is no LED indication of its status, and it is slightly slower to read than PIG-2 devices. The PIG1 has four screw terminals – GND, +5V, DATA (which connects to the bus) and REED which is used for the connection of the device to be sensed or the relay to be controlled.
Current consumption of a PIG-1 is about 2mA.




**PIG-1 – top view**

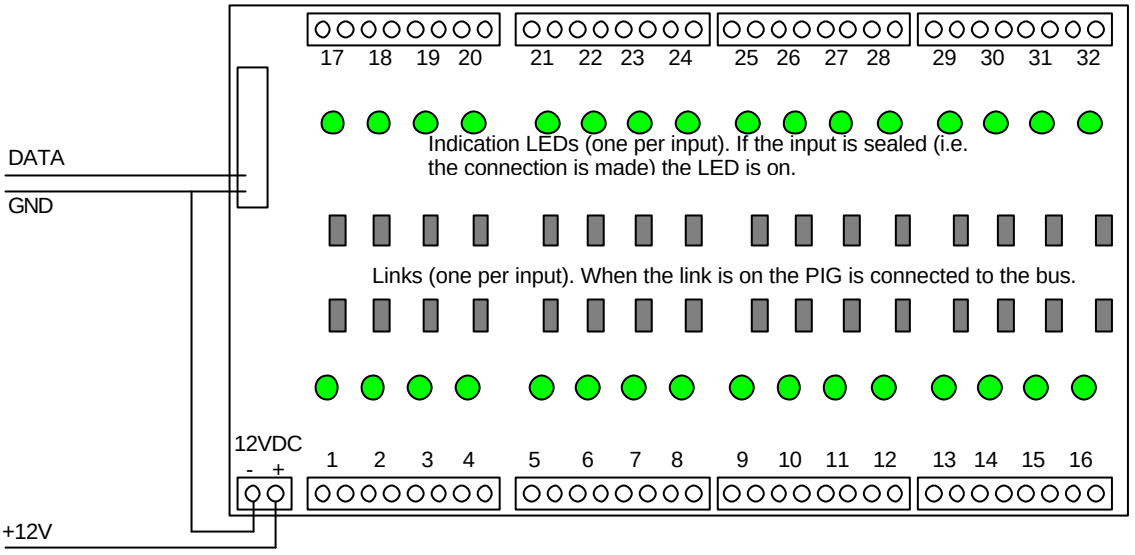
## PIG-2

The PIG-2 uses a different chip which allows monitoring of two inputs. The chip used can be scanned very fast; the PIG-2 also incorporates indication LEDs to show connection of power and the status of its two inputs.
The PIG-2 is connected using flying leads; leads are provided for connections IN and OUT on the bus to make wiring easy. It also incorporates links which allow disconnection of the pig from the bus without having to reterminate the device.
Current consumption of the PIG-2 is about 3mA when all LEDs are on. Very early versions of the PIG-2 used different LED circuitry; if the LEDs are bright then the PIG-2 will be this old type which has a current consumption of about 20mA when all LEDs are on.



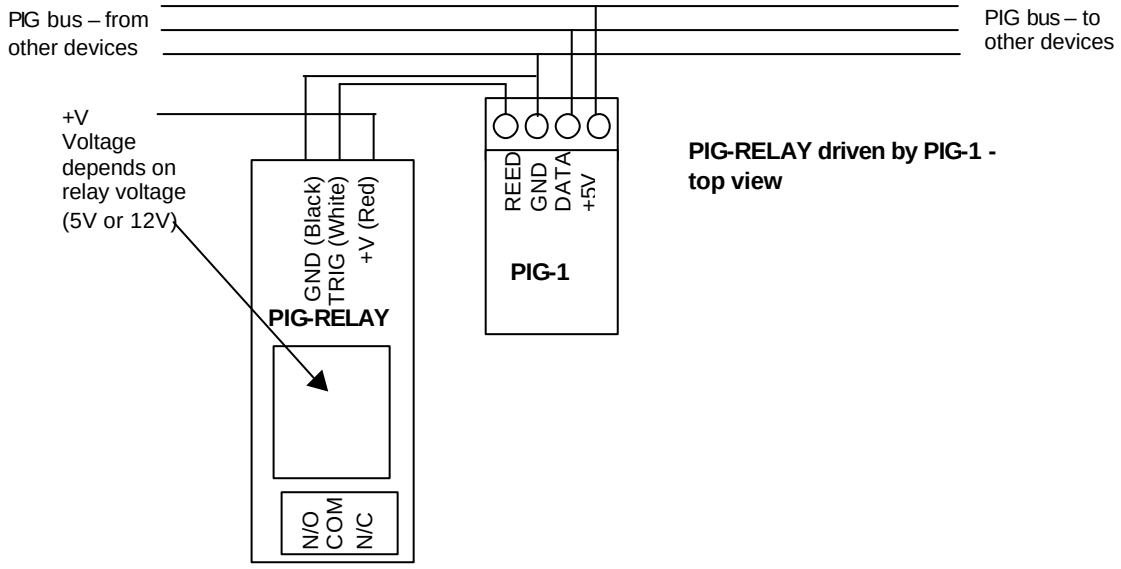

## PIGPEN-32

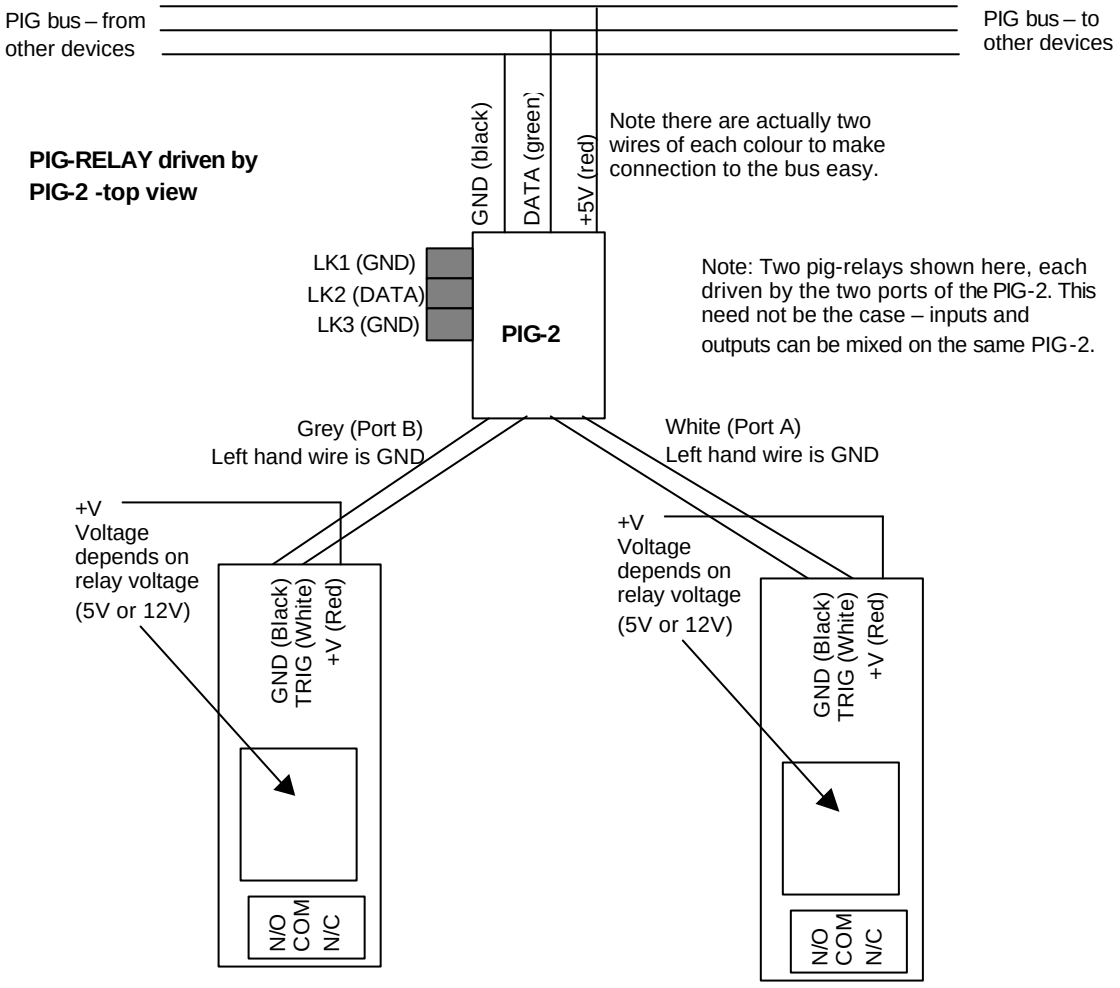
The PIGPEN-32 is basically 32 PIG-1's on a single board. It allows monitoring of up to 32 inputs. The PIGPEN-32 also incorporates indication LEDs to show the state of the inputs and links which enable individual inputs to be removed from the pig bus if necessary.
Unlike the PIG-1 and PIG-2 devices the PIGPEN-32 operates from +12VDC. Its current consumption is approximately 200mA.

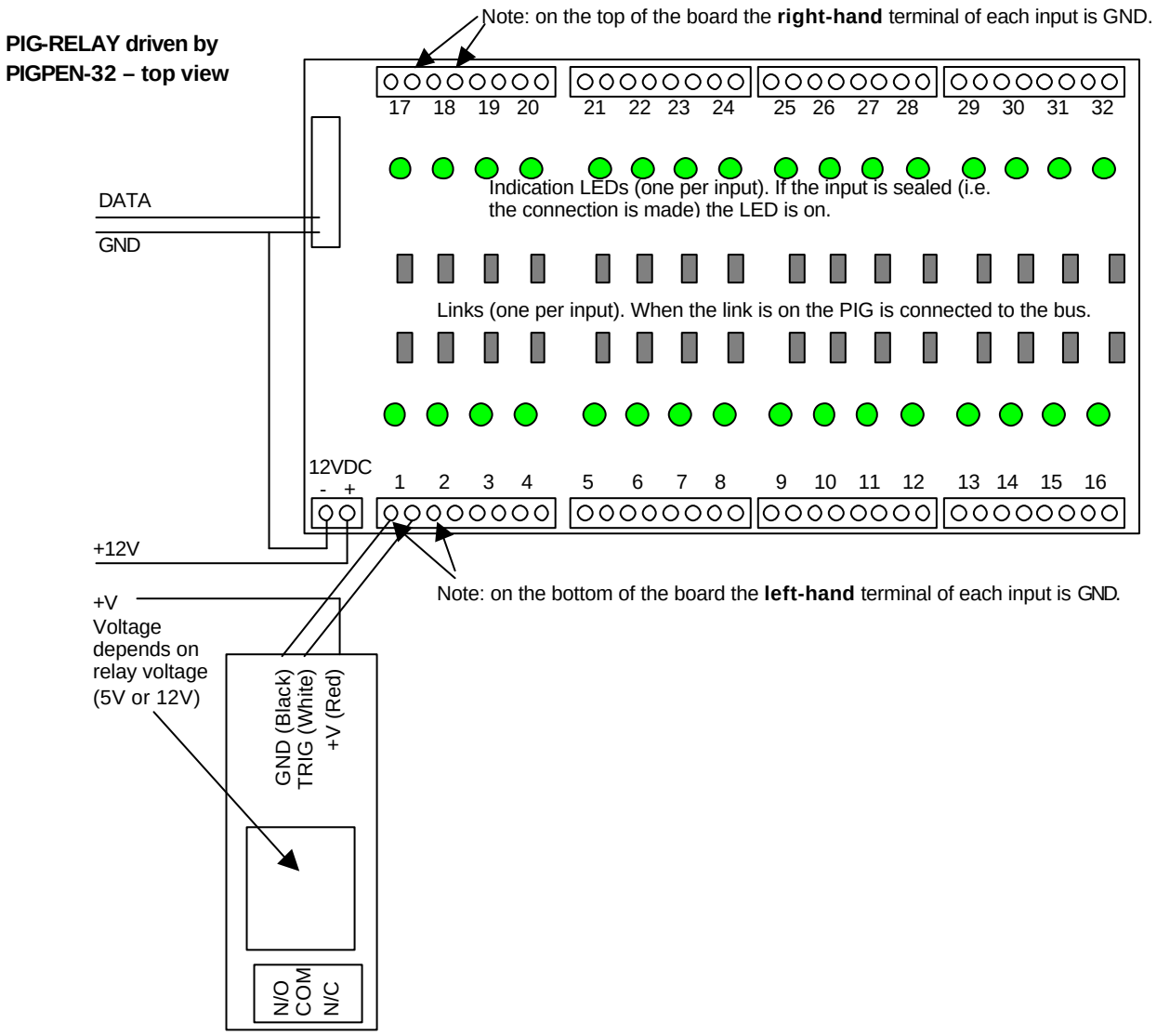


## PIG-RELAY

The PIG-RELAY or PIGRY is a single relay output device which is driven by either a PIG-1, PIG-2 or PIGPEN-32. It can be fitted with either a 12VDC or 5VDC relay, and provides clean C-form contacts rated at 5A 240VAC. The PIG-RELAY has a current consumption of about 70mA.

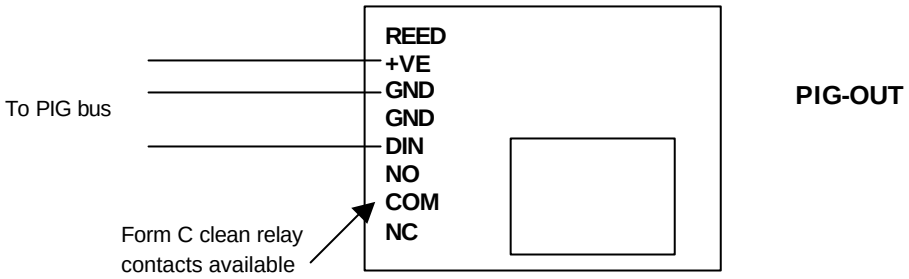





## PIG-OUT

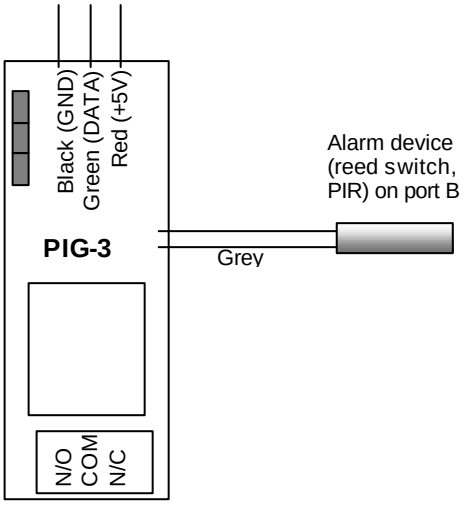
A PIG-OUT is a combined PIG-1 and relay. It provides a single output. The PIG-out is fitted with a 5V relay and its current consumption is about 70mA




**PIG-OUT**

## PIG-3

The PIG-3 combines a PIG-2 with an integrated relay on port A and an input on port B. Thus it provides a combined input and output in a convenient package.




## Other expansion boards

The firmware supports the use of 16-way input expansion boards, 16-way output expansion boards and 4-way output expansion boards too. When these devices are used they use up some of the inputs for readers/pig buses etc. See the document on the Alarmpig firmware for more details of the interactions between the expansion boards and the readers and other inputs.

## Power considerations

When operating multiple relays or pigs and other peripheral equipment (readers etc) from the controller you must consider the current supplied by the on-board power supply. The system can provide 5VDC at about 0.75A through the on-board regulator; if more current than this is required additional power supply will be required.

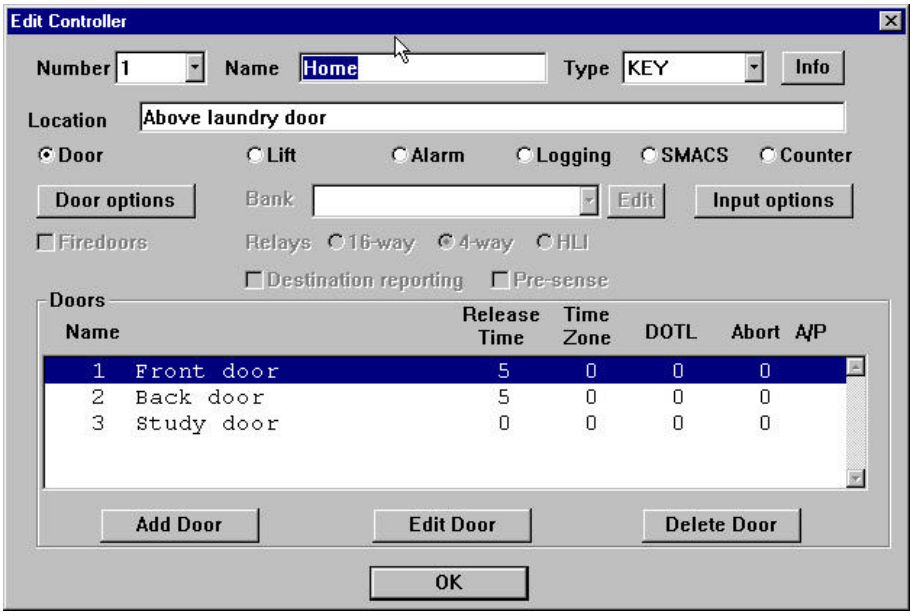
The controller itself draws about 300mA when all four relays are active. The current draw of all of the peripheral equipment is listed in the sections above. When driving multiple relays at 5V the current supply capacity of the controller will very quickly be used up; this is why pig-relays normally are fitted with 12VDC coils so that the relays can be powered by a 12VDC power supply. Note that when powering pigs, pigpens or relays from extra power supplies that the 0V connections between the controller and the extra power supplies must be commoned.

# Software description

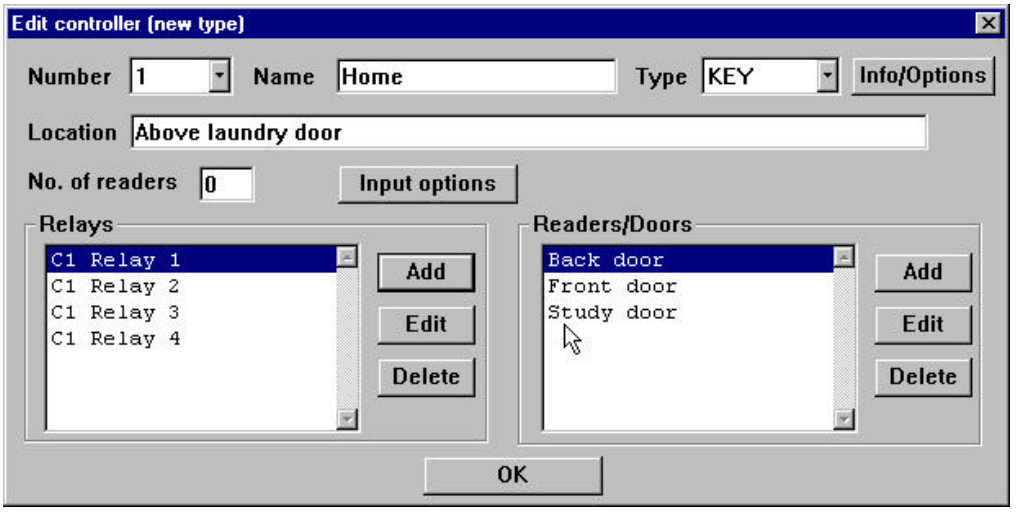
With the use of PIG-relays the structure of the firmware has changed significantly; accordingly so has the structure of the PC3 software. Several screens have changed, and the way the system operates has been modified; however the software should be fully backward compatible.

## Controller options

When adding a controller now there are two different possible screens which will display – the existing old style one pictured here:

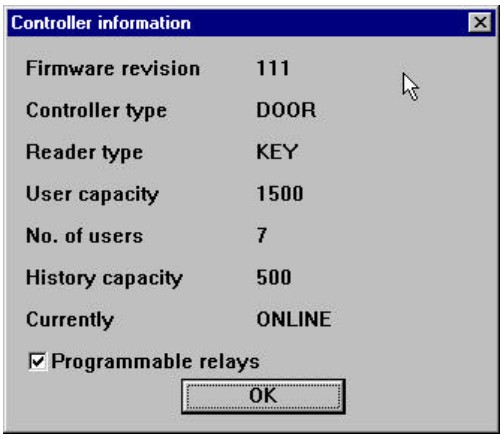



Or the new style one pictured here:

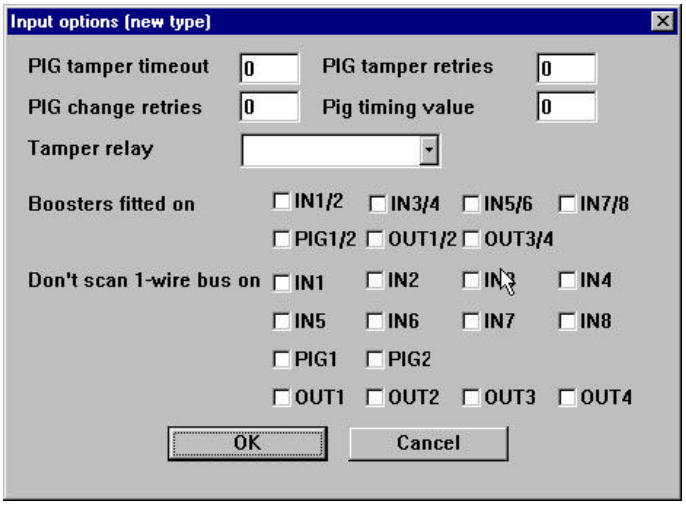



The new style controller window is only valid with this new firmware. In theory the controller window type will automatically be set when the software communicates with the controller – it sends a command to the controller to ask whether it has these new options and if applicable the controller tells the software to set the option appropriately. However if you need to set this manually (when programming controllers offline) you click on the Info/Options button in either the new or old controller window. The controller information window will display as pictured overleaf.

This information window now has a check box called 'Programmable relays' – if this is checked then the new-style controller window will display; if it is not checked then the old-style controller window will display. Note that the controller window won't change immediately the check-box is selected – you have to close the controller window and then re-open it in the new style.




On the new style controller window is a button for input options. Clicking this displays the screen below.



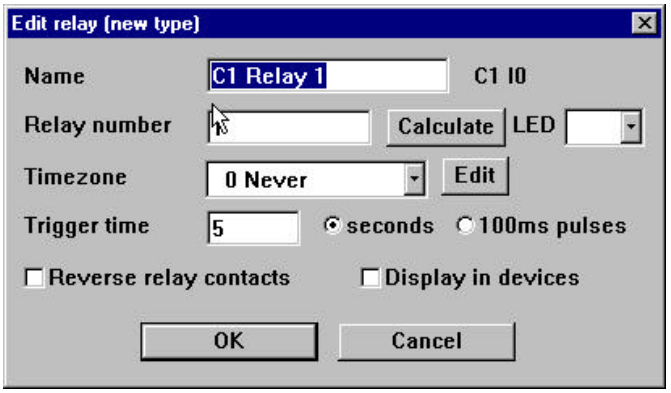

This is where the controller-wide parameters related to the pig bus and other settings are made.
**Pig tamper timeout** – this sets the amount of time that a PIG can be in tamper (offline) before reporting to the screen and/or the tamper relay. Unless tamper alarms are a nuisance this can be set to 0.
**Pig tamper retries –** this sets how many consecutive times the system tries to read a pig before reporting it as being in tamper. Unless tamper alarms are a nuisance this can be set to 3.
**Pig change retries –** this sets how many times an input is scanned when it changes state to verify that the change of state actually happened. This provides a 'debounce' for inputs stopping them from causing false alarms. It could be set to 2 say unless there is a lot of noise.
**Pig timing value –** this sets an internal parameter related to the communications with pig devices. Normally it should be set to 1.
**Tamper relay –** when a pig goes into tamper this relay will be operated until the pig returns from tamper. Currently only pigs used as alarm inputs and door status inputs will cause the tamper relay to operate.
**Boosters fitted –** this is where you tell the system which pig buses have boosters attached.
**Don't scan 1-wire bus on** – this is where you tell it which pig buses to scan or not. Note that silicon keys are also read on the 1-wire bus; accordingly with a silicon key controller you have to tell it to scan on IN1, 3, 5, 7 etc if you want readers 1, 2, 3 or 4 to operate. Whereas with a wiegand controller you would tell it not to scan on inputs where you have wiegand readers fitted.

The new style controller window also has a field for entering the number of readers which are scanned by the controller.
Thus using this together with the input options it is possible to configure a system from being no readers, alarm inputs only right through to 4 readers and a pig bus or any combination in between.
Whichever buses are selected for operation, the software automatically searches all of them for any pig thus it is not necessary to tell the system where a particular pig is located – if it can find it on any of the active buses then it will. Similarly if a pig is moved from one bus to another the system will find it in its new location if at all possible.

## Relays

With the new firmware the concept of 'door' has been separated from the concept of a 'relay'. Because there can now be many relays, some of which can have PIG ID's as their relay number, relays must be programmed into the controller before they can be used for other functions. For example, in the past door 1 automatically triggered relay 1 – this is no longer necessarily the case with the new firmware. Instead, the first step when setting up a system is to define the relays which can be used on it – for door relays, alarm output relays etc. Once they are defined then when setting up a door or an alarm area selection can be made from the relays which have already been programmed into the system.

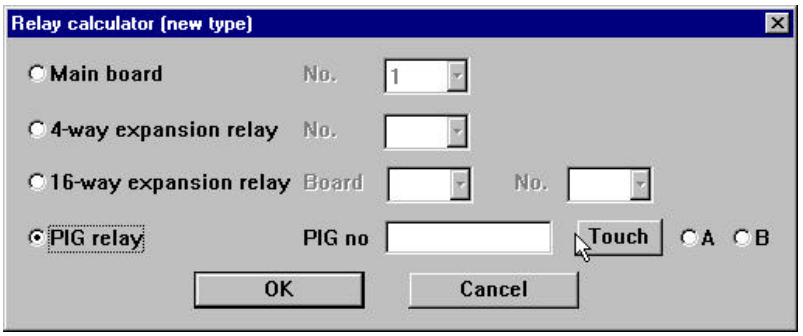
A relay has a name (which must be unique in the system), a relay number (which can be an on-board, expansion or PIG number), a trigger time and a timezone. Relays are programmed from the new controller setup screen shown on the previous page. When a controller is first created four relays are automatically added – these correspond to the four on-board relays. Additional relays can be added and relays can be edited or deleted from the buttons on the new controller screen.
When editing a relay the setup screen is pictured below.




**Name:** this must be a unique name. The system will not allow you to enter a name which is the same as another relay in the system – even on another controller. This is to save ambiguity when dealing with relays in drop-down menus in other parts of the program.
**Relay number:** Enter the relay number which will be associated with this relay. Relays are numbered as follows:

- on-board relays are numbered 1-4
- 4-way expansion relays are numbered 5-16
- 16-way expansion relays are numbered 33-296 (i.e. expansion board 0 relay 1 is numbered 33)
- pig relays are numbered according to their pig number

A 'relay calculator' is used to make this easier. By clicking on the 'calculate' button you are presented with the following screen:




Use the relay calculator to define the relay number for this relay.
Where a PIG relay is to be used, its number can be entered (as well as the appropriate port A or B for a PIG-2 or PIG-3 device). If the number is not known it can be registered by clicking on the 'Touch' button.
When registering via this button there are some rules to follow:

a) The 'touch' button sends a message to a controller to tell it to scan for a PIG on any of its available inputs. The controller selected for this message is the 'registration controller' which is set up in Technician/Site.
b) When scanning for a device the controller looks for any available pig bus with a single device attached to it, and returns the number of that device. This means that you will need to disconnect any buses with a single device on them from that controller when registering.

c) The registration routines act just like the pig buses in normal operation i.e. pigs will be scanned via boosters if the appropriate options are set in the controller/input options screen. And only buses which are enabled for pig (1-wire bus) scanning will be scanned.

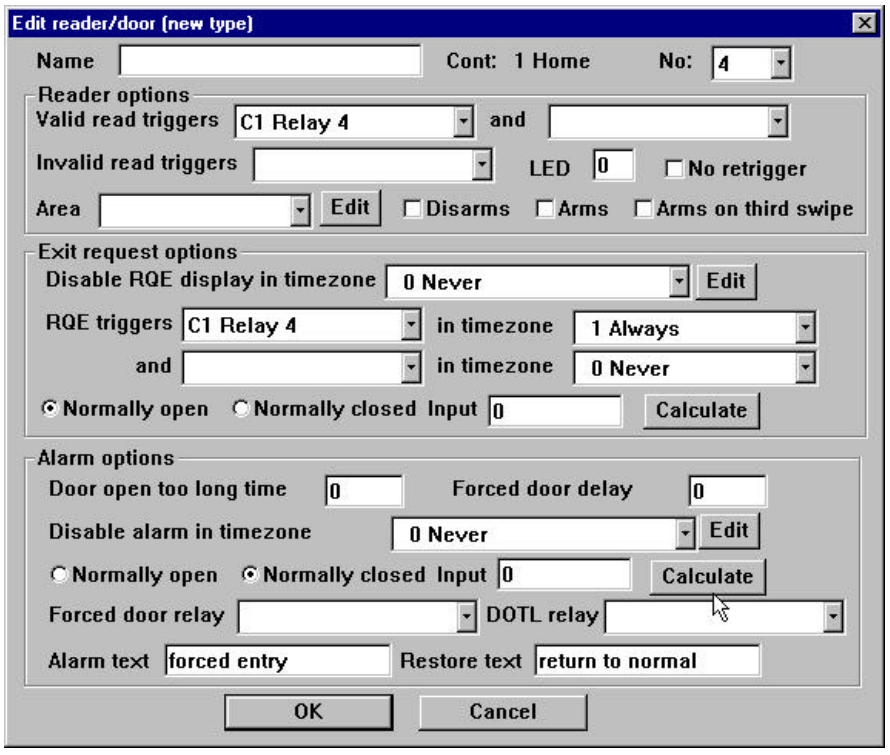
**Led:** use this to set whether a LED will be operated by this relay i.e. when this relay is on do you want the LED to indicate it.
**Timezone:** this selects the timezone for the relay. Note that this is where timezones for doors are set – the timezone for the relay which is associated with that door determines the timezone for the door.
**Trigger time:** this selects the amount of time (in either seconds or 100ms pulses) that the relay operates for when it gets triggered. It can be triggered by a valid read, an invalid read, an exit request or an alarm condition. Whenever the relay is triggered it will be triggered for the time which is set here.

The firmware currently supports up to 36 relays (of any type) on a single controller.

## Doors

With the new firmware a door is no longer associated directly with a relay. Once the relays are defined you are able to define up to four 'doors' for the system. Each door can trigger multiple relays, and also has a definable exit request input and door status input.

Adding a door on the new controller screen displays the form below:




There are many options here which make setting up a door extremely flexible and powerful.

**Name –** Enter the name of the door e.g. Front door
**No –** this will select the door number 1-4. It will automatically give you the next available number.
**Reader options:**

**Valid read triggers relay –** Now it is possible to make a valid read trigger up to two relays. The available relays (as defined in the relay screen) will be in the drop-down menu for selection. When a valid read occurs at this reader the appropriate relays will be triggered for their respective trigger time.
Note that the first relay triggered defines the timezone and other settings for the door; the second relay is like an 'auxiliary relay'.
**Invalid read triggers relay** – now it is possible to trigger a relay on an invalid read. This might be useful to indicate to a guard etc that someone is attempting to gain access when unauthorised.

**Led** – select a LED which will be operated by this reader. When a valid read occurs at this reader the LED will be activated to indicate this; when an invalid read occurs the LED will flash.
**No retrigger** – this option determines whether a second read will be accepted while the reader is still active from a previous read. An example where this might be useful is in air conditioning control, where it is desired to only have a single record of each activation of the air conditioning which might be triggered for say 2 hours; when this times out then the reader will accept an additonal read, but during the 2 hour period it will not allow retriggering of the output.
**Area –** this option determines whether this reader is associated with an alarm area, and it can be set to arm, disarm or arm on the third swipe optionally.
Note that the arming/disarming functionality works together with the options in the access levels which allow individual users to be granted or denied the ability to arm and disarm at particular readers.

**Exit request options:**

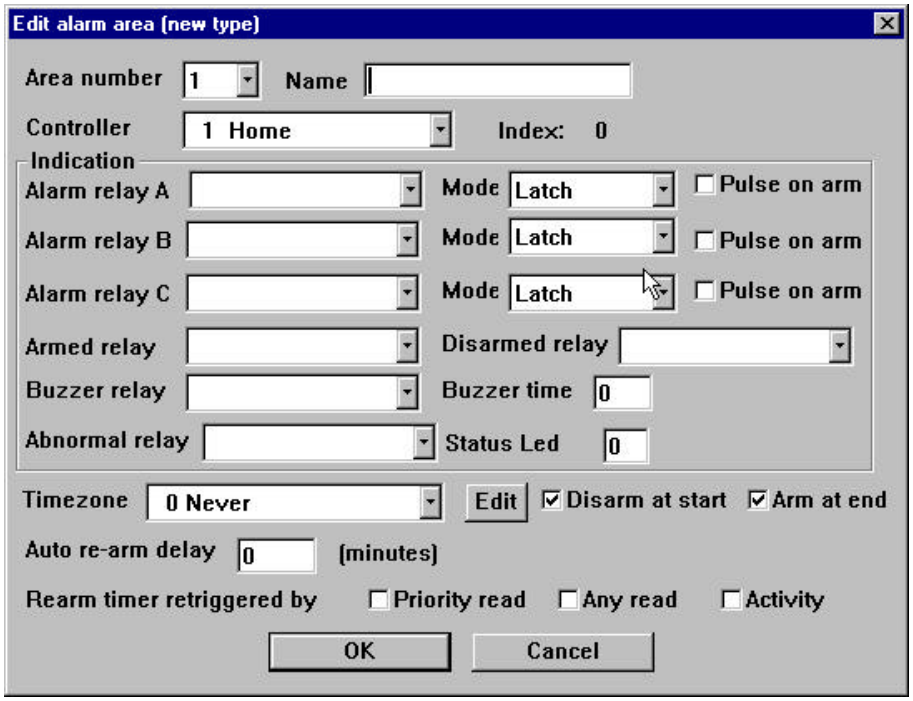
**Disable RQE display in timezone –** sometimes it is a nuisance to display exit requests during the day; this option gives the ability to disable exit requests during a timezone.
**RQE triggers relays –** now two relays can be defined for triggering by exit request buttons, and each can be given a timezone during which the relay gets triggered. An example of where this might be useful would be if the exit request turned on an alarm system after hours; the second relay might trigger the activation of this alarm system.
**Input –** the input which is used for the exit request is programmable as either an on-board, expansion or pig input. The pig input can be registered similar to a relay pig being registered.

**Alarm options:**

**Door open too long time –** sets the time before reporting door open too long. If this is set to 0 then the alarm on the door is disabled.
**Forced door delay –** sets the amount of time before a forced entry is reported. If the door is re-closed during this time period no alarm occurs.
**Input –** the input which is used for the door status is programmable as either an on-board, expansion or pig input. The pig input can be registered similar to a relay pig being registered.
**Forced door relay –** the relay (selected from the available ones programmed on the relay screen) which operates when a forced door alarm is active.
**DOTL relay –** the relay which operates when a door open too long alarm is active.
**Alarm/Restore text –** the text which displays when a forced entry alarm occurs/resets.

## Areas

With the areas in the new software all of the previously available relay output options are available – however now that many relays are supported in the firmware they are actually useful. When editing an area the screen below is shown.



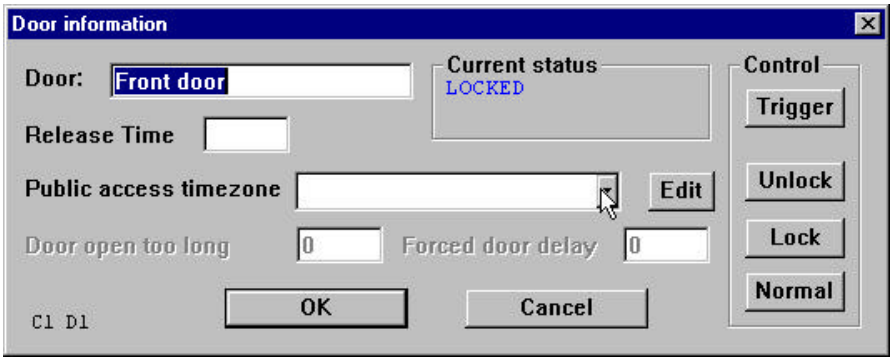

**Area number –** this is a number just used for reference. A new number will automatically be selected for you when you add a new area to the system.
**Area name –** enter a name for the area .
**Controller –** select the controller which will be associated with this area. All inputs in an area must be on the same controller – when an input is allocated to an area it is therefore automatically associated with a particular controller. When a controller is selected all of the drop-down menus for the relays on this screen change to reflect the relays which are available on that controller.
**Alarm relays A, B and C –** up to three alarm relays can be defined for indicating the alarm status of the area. Each relay can be set to

**Latch –** the relay turns on when an alarm on the area occurs, and turns off when the alarm is turned off.
This might be used for driving a strobe light.
**Pulse –** the relay operates for its trigger time (defined in the relay screen)
This might be used for driving a siren or screamer.
**Follow –** the relay turns on when an alarm occurs, and turns off when the offending input returns to normal
This might be used for linking the alarm to a dialler or securitel.
**Pulse on arm-** if this is checked then the relay will pulse (about 300ms) twice when the area arms and once when it disarms. This can provide an audible indication to the operator that they have armed or disarmed the area properly.

**Armed relay** – this relay turns on when the area is armed.
**Disarmed relay** – this relay turns on when the area is not armed.
**Buzzer relay –** when the alarm turns on the buzzer relay operates for the 'buzzer time' – this provides a means of warning people that the alarm is about to turn on.
**Abnormal relay –** if the alarm is not active this relay will follow the state of the inputs.
**Timezone –** this is used to determine the hours of normal operation and after hours operation (in relation to auto-rearming). It also allows the alarm to be selected whether it turns on at the end of the timezone and off at the start of the timezone.
**Auto-rearm delay –** if the alarm timezone is not active, whenever the alarm is off the auto-rearm timer starts. When it expires the alarm will try to arm itself again. The auto-rearm timer can be retriggered by either a read by someone with access to arm/disarm (priority read), by any read, or by activity detected within the alarm area.

### Devices

Under the Devices menu the operator is still able to monitor and control the doors and areas. All of the additional complexity is 'hidden' from the operator. Thus for example the door status screen (Devices/Doors) is shown below:




This screen describes the door from the operator's point of view – they do not need to know the particular relay which is associated with the door, and the timezone etc settings will be automatically reflected in the primary relay for that door. If the door has no door status input defined then the status will only reflect whether the door is locked or unlocked; if the door does have a status input defined then the current status will also be displayed.

Similarly under the area menu the area can be controlled and viewed; the relay operation occurs in the background without any knowledge required by the operator.

## Conclusion

The PIG-relay firmware provides a great deal of flexibility and allows configuration of many extra options. With the ability to add relays singly very cost-effective expansion of the system is possible. Pig-relays allow the full power of the CS Technologies alarm system to be utilized, to make a fool-proof system possible.



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