

IEFIS G3 Inputs, outputs and Alarms



Document version: 2, May 2016

User manual on the use and configuration of the analog and digital inputs and digital outputs as well as Alarm setup and use.

Related equipment:

iBOX and iEFIS Extender on RS232 bus

iEFIS Extender on CAN bus

General

The G3 infrastructure provides up to 16 general purpose mixed use inputs that can be used either as digital or as analog inputs or both at the same time.

Analog inputs provide the ability to measure a voltage in the range of 0 to 16V DC. When used as digital inputs, a voltage level below 1.6V will be taken as “off” state and any voltage above 1.6V as “on” state.

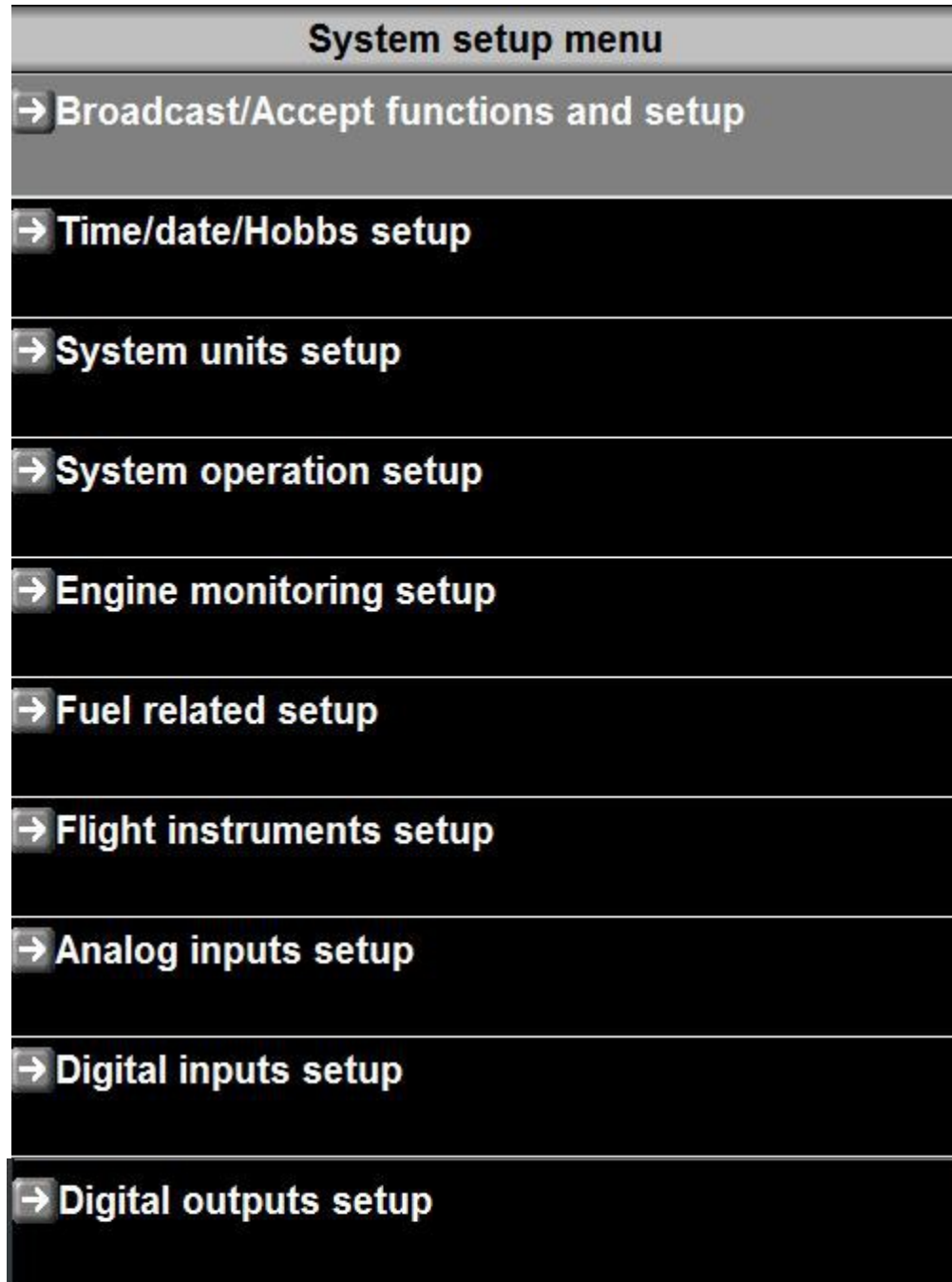
Up to 8 digital outputs can be used. A digital output is an “open collector” transistor to ground. Effectively this acts like a switch where one side is connected to ground and the other side is “open” for use. Note that a maximum DC current limit exists – exceeding this may damage the transistor.

On a regular iEFIS (with iBOX), inputs 1 to 8 are located on the iBOX. On any “Lite” version of the iEFIS inputs 1 to 8 are located on the iEFIS Extender connected to RS232 port 2.

Outputs 1 to 4 are located either on the iBOX or iEFIS extender.

On either type of iEFIS, an iEFIS extender connected to the CAN bus provides inputs 9 to 16 and outputs 4 to 8.

The input/output configuration in the setup menu



Analog inputs setup

Each of the 16 inputs is equivalent in functionality.

Analog input setup	
→	Analog Input 1, FLAP POS - No Alarms
→	Analog Input 2, PITCH TRIM - No Alarms
→	Analog Input 3, BANK TRIM - No Alarms
→	Analog Input 4, OIL LEVEL - Alarm set
→	Analog Input 5, No Name - No Alarms
→	Analog Input 6, No Name - No Alarms
→	Analog Input 7, No Name - No Alarms
→	Analog Input 8, No Name - No Alarms

Select one of the 16 analog inputs to view or edit its settings.
Here you will find the following entries to edit:

Analog input 4 setup	
→ Function: Standard analog channel	
→ Name for this input: OIL LEVEL	
→ Highest value for display: 10	
→ Alarm value: 9	<input type="checkbox"/>
→ Caution value: 8	<input type="checkbox"/>
→ Caution low value: 5	<input type="checkbox"/>
→ Alarm low value: 4	<input type="checkbox"/>
→ Lowest value for display: 0	
→ Current raw value from iBOX: 0	
→ Multiply with 1	
→ Then divide by 1	
→ Then add 0	
→ Use 0 decimals in final value	
→ Current scaled value: 0	
→ High Alarm disabled	<input type="checkbox"/>
→ Low Alarm disabled	<input type="checkbox"/>

Function

Analog inputs may be used for special purposes. Normally select “Standard analog channel”. Special purposes are described at the end of this section.

Name for this input

Enter a descriptive name for this input. This is used for example if there is an alarm. You can use up to 11 characters.

Highest value for display

Should you be using any analog display such as a bargraph in your screen design this value sets the upper limit for the display. It should be the highest value you want to display.

Alarm value

If you want the top section of the displayed analog indicator to show a different color (normally red) select the value from which the display will be that color.

This value is smaller or the same as the highest value for display.

Also indicate to the system if you want to use this value by checking the box to the right. You must also check this box if you want to use this limit as alarm even if you are not using any indication on the screen.

Caution value

You can enable a caution region below the above. This value must be less or equal to the value above. Enable the box to the right if you want the system to use this value.

Caution low value

You can enable a low caution region above the value below. This value must be more or equal to the value below. Enable the box to the right if you want the system to use this value.

Alarm low value

If you want the bottom section of the displayed analog indicator to show a different color (normally red) select the value from which the display will be that color.

This value is less or the same as the low caution value for display.

Also indicate to the system if you want to use this value by checking the box to the right. You must also check this box if you want to use this limit as alarm even if you are not using any indication on the screen.

Lowest value for display

Should you be using any analog display such as a bargraph in your screen design this value sets the lower limit for the display. It should be the lowest value you want to display.

Current raw value from iBOX

This shows the current raw measurement value from the source (either iBOX or iEFIS extender). This value is in the region of 0 to 4095 (12 bit analog to digital conversion where 0 = 0V and 4095 = 16V).

Multiply with

You can multiply the RAW value above with an integer factor.

Then divide

After the above multiplication you can apply an integer division.

Then add

After the multiplication and division you can add an offset. Note that you can enter a negative number so you can also subtract.

Use n decimals in final value

After the above scaling you can add a decimal point. This will then be used in any numeric display of the value should you add such a display to your screen design.

Current scaled value

This serves as a check to allow you to verify your scaling.

High alarm

Here you can enable the high value alarm. You have three options:

Alarm disabled, Alarm enabled and Alarm enabled+iBOX alarm out.

Please also check the “high alarm” box and select the correct limit if you want to use the high alarm.

Low alarm

Here you can enable the low value alarm. You have three options:

Alarm disabled, Alarm enabled and Alarm enabled+iBOX alarm out.

Please also check the “low alarm” box and select the correct limit if you want to use the low alarm.

Notes on alarm values

Alarm limits entered here are always the scaled values. Raw values can only be used if the multiplication and division is “1” and “add” is “0”. The decimal point has no effect and will automatically be taken into account.

Example scaling

We have a DC current sensor that outputs 2.5V when there is no current flowing. In positive direction the voltage increases by 0.1V for every ampere and in the negative direction the voltage decreases by 0.1 for every ampere.

The sensor has a range up to 20A so that means the output voltage will go from 0.5 to 4.5V.

We would like a display based on an analog arc with the needle centered and pointing up when current is zero and the needle should move to the right for positive current flow and to the left for negative current flow.

At 2.5V the raw reading will be $4096 \cdot 2.5 / 16 = 640$.

At 0.5V the raw reading will be $4096 \cdot 0.5 / 16 = 128$.

So the raw reading will be centered around 640 with a range of $(640 - 128 = 512)$ either side.

At the maximum reading of 512 we would like the current to show 20.0. This means we need to divide by 25.6. We cannot do that directly as we can only work in whole numbers. So in this case we can simply multiply by 100 and then divide by 256. In this case we will get 200 $(512 \cdot 100 / 256 = 200)$.

OK, so now we know we need to multiply by 100 and then divide by 256.

But this still leaves us with a small problem – we want 2.5V to read “0.0”. Now at 2.5V we would get $640 \cdot 100 / 256 = 250$. So we now simply “add” -250 to get zero.

Now we will get our desired numeric range of -200 to +200. Now all that is left to do is to insert a decimal point. In this case we “Use 1 decimal point in final value”.

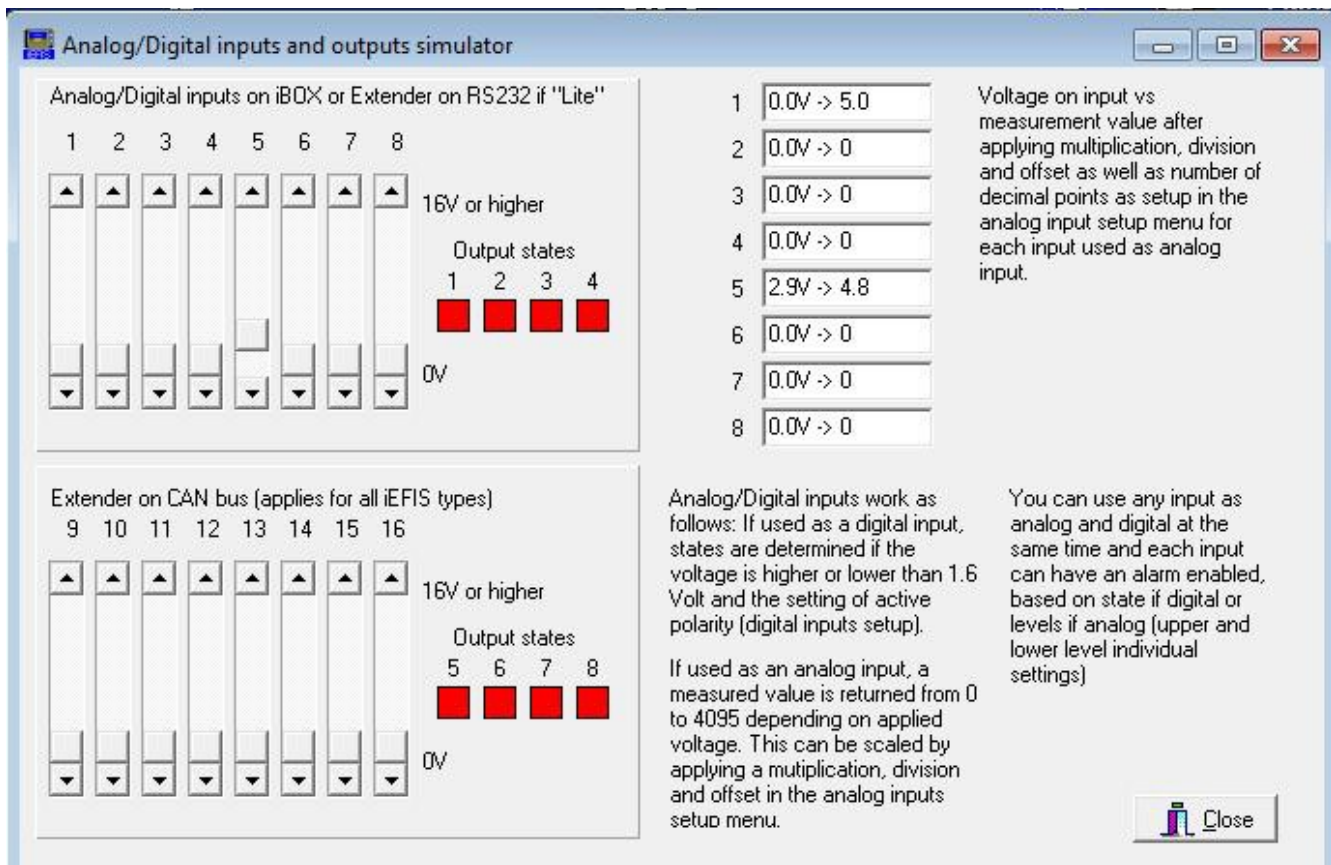
After we have done this we can enter suitable values for the display color areas and if we like we can enable alarms (only “high” alarms as in this case the lower value is also a “high” alarm – just with the current flowing the other direction).

Now we can have a look at our screen design, select an analog arc, place it where needed and configure size and position – also assign it to the analog input we have chosen.

Display of the analog arc using our example above. We also added a text readout (special text item).



Using the simulator's I/O simulator



The iEFIS screen designer and simulator contains a useful tool that allows you to simulate the analog inputs as well as the outputs.

You will find this tool under the "Sensor simulation" menu in the designer.

Here it is used to simulate input number 5 which we used in the previous "current" example.

We have emulated a voltage of 2.9V which results in a value of 4.8A after applying our multiplication, division and "add" as well as the decimal point.

You can also simulate alarm conditions and ensure that the EFIS reports these as intended.

Analog inputs – other uses

Several other EFIS functions can be used with the analog inputs. In particular these:

Flap position indicator

Pitch trim position indicator

Roll (bank) trim position indicator

These functions are selected in the relevant setups for flaps and trim.

Note that these selections can only be used with the first 8 inputs.

Special purpose function analog inputs

You can select a “special purpose” to an analog input. If you do this the original function is still fully available so you can continue to use it in parallel to the special function.

Alternate AOA system

You can apply a DC voltage as source for the AOA functionality in the system. Note that you must also select “AOA on analog input” in the Instruments setup menu should you want to use this function.

This can be used to replace the built in functionality based on the systems pressure sensors with an external system provided it can produce a variable voltage that lies within the input voltage range of the iBOX. This can also be used to temporarily construct a test system for the user programmable AOA tone generator. Simply use a variable resistor (potentiometer) to create a variable voltage. Note that AOA sounds will only be produced is a flight is active and there may be minimum and maximum airspeeds applicable. There is also a digital input function that can be used to disable the sound.

Note that all scaling functions provided are still functional and must be used.

Your task is to set scaling values so the system will derive AOA in steps of 0.1 degrees for a range from 0 to 18 degrees. So your scaling must produce a number from 0 to 180.

Example: Assume your alternate AOA sensor gives you a voltage from 3V to 8V to cover the range from 0 to 18 degrees.

We arrive at the values: Multiply with 100, divide by 711 and then add -108. This then can be tested in the I/O simulator.

At 3V the raw reading will be $4096 * 3 / 16 = 768$

At 8V the raw reading will be $4096 * 8 / 16 = 2048$

The range is $2048 - 768 = 1280$. So to get 180 we do $1280 / 7.111111 = 180$.

So to scale this we multiply first with 100 and then divide by 711 (which is the same as divide by 7.11 which is close enough for our purpose). Then we need to get rid of the 3V offset so we subtract $768 / 7.1111 = 108$.

Digital inputs

Digital input setup	
→	Digital Input 1, AP ENGAGE Alarm disabled
→	Digital Input 2, XPNDR SQUAT Alarm disabled
→	Digital Input 3, STOPWATCH Alarm disabled
→	Digital Input 4, STW ZERO Alarm disabled
→	Digital Input 5, VARIO Alarm disabled
→	Digital Input 6, LATCH Alarm enabled+iBOX alarm out
→	Digital Input 7, GEAR DOWN Alarm disabled
→	Digital Input 8, No Name Alarm disabled
→	Digital Input 9, No Name Alarm disabled

Digital inputs can be used for a variety of functions. You can use them for a number of built in functions but also for monitoring of external contacts with or without alarm functionality.

Digital input 6 setup

→ Name for this input: LATCH

→ Active level is high, Current: Inactive

→ Alarm enabled+iBOX alarm out

→ Function: No function

Name

Give this input a descriptive name. The system uses this to inform you of the alarm source if this input is enabled for alarms.

Active level

Select the active level for this input. If set to high then it is considered active when the voltage at the input is at 1.6V or higher. If set to low then the input is considered active if the voltage is below 1.6V.

Alarm

An alarm is considered active if the input is active and the alarm is enabled. Optionally, you can cause the IBOX alarm output to also be activated.

Function

'AP Active NAV/Level'; Engage autopilot on current altitude, current active NAV solution.

'AP Active NAV/VS!'; Current NAV with vertical speed set by rotary control

'AP Turn 180/Level'; Engage current altitude, turn 180 degrees.

'AP Straight/Level'; Engage the AP on current track and altitude.

'Descent detection'; Disable terrain warning on descent. Enable this in the terrain setup menu.

'Transponder squat switch'; Transponder squat switch for use with mode-s (Select this mode of operation in the transponder setup menu).

'Remote menu activate'; Remote menu controls

'Remote menu select';

'Remote menu Down';

'Remote menu Up';

'Transponder Ident'; Activate the transponder ident

'Stopwatch start/stop'; Start or stop the stop watch

'Stopwatch reset'; Reset the stop watch (set to zero)

'Down count start/stop'; Start or stop the down count timer

'Alarm acknowledge'; Acknowledge active alarms

'Flight active detect'; External flight active detection (if allowed in operations setup)

'Vario tone switch'; Switch vario tone on/off

'AOA tone switch'; Switch the user programmable AOA tone generator on/off

'No function'; - input has no built in function

Notes:

If autopilot engage function, if autopilot is engaged, selecting function will disengage the autopilot.

Digital outputs

Outputs are open collector transistors which provide a current path to ground when “on”. You can view these as a switch. When the switch is “on” and you have (for example) a lamp connected to 12V, the lamp will illuminate.

Digital outputs can be switched from a variety of sources and you can also create touchable fields on the display to switch outputs on, off or toggle the output state.

The choices to switch outputs are:

'Not used' = select this if you want a touch field to switch the output.

'Flight Active'

'Any alarm active'

'Any Engine alarm'

'Any Fuel alarm'

'Any Electrics active'

'Any Flight alarm'

'Any analog input alarm',

'Any digital input alarm'

'Analog input 1 alarm'

'Analog input 2 alarm'

'Analog input 3 alarm'

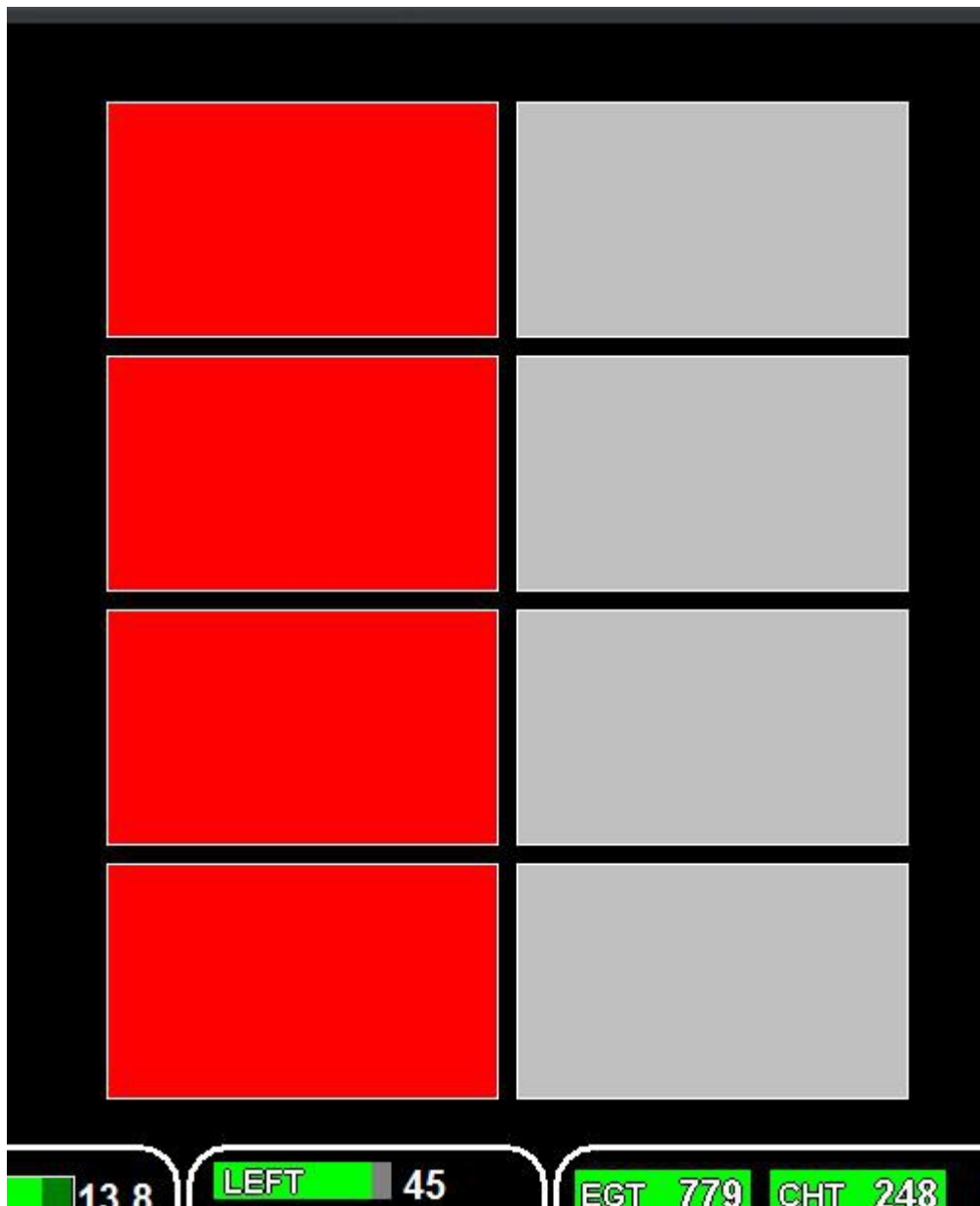
'Analog input 4 alarm',

'Digital input 1 alarm',

'Digital input 2 alarm'

'Digital input 3 alarm'

'Digital input 4 alarm'



Basic example of a screen design including 8 touch fields connected to digital outputs. You use the “touch field” component, set it to an output function (ON, OFF or TOGGLE) and then select “visual” and give it desired colors for the ON and OFF states. You can also just show them as “states” in which case touching them will not change their state.

Gray color means that the assigned output is not available (for example it has been assigned to the CAN based iEFIS extender but this is not connected).

Cautions

Please do not use digital outputs to control safety critical items on the aircraft. These outputs may only be used where failure of such output will not cause degradation of flight safety in any way.

Input circuit

The input appears as a 12.2Kohm resistor to ground. With nothing connected, the input will thus be pulled to ground potential (0V).

This makes it very simple to connect items like switches – simply wire a switch to 12 or 24V volts. Closing the switch then pulls the input high.

Ensure that any devices that produce a voltage to be measured is able to drive a 12.2Kohm load.

Output circuit

The output consists of an open collector darlington transistor to ground.

The transistor is “on” when the output is “on”. The transistor can be used to switch up to 500mA DC. For higher currents, please use a relay.

Note: Darlington transistors will show a residual output voltage of around 0.6V – they cannot switch lower than this. This is not normally an issue but please be aware of this when you measure the output with a volt meter and a load connected.

Note: If a relay or any other inductive load is switched, you MUST fit a reversed biased diode over the coil. A typical choice is the 1N4007.

Failure to do this may lead to destruction of the output transistor due to the back-EMF of the coil as it is switched off.