AXIS TEN PRODUCTS

Fully Tested

Date: 28 AUG 07
Serial No: 0708V
Test:

Tested & Certified by:

www.axisten.co.uk

Industrial Building Block

RoHS - Yes

Voltage Level Detector, Version: ATP4/2

Features

- **Easy to use**
- **Trigger Point: ¼V to 32V (& higher)**
- **Hysteresis is % of Trigger Point**
- **No spurious oscillations**
- **One Open Collector NPN output**
- **One Open Collector PNP output**
- **Selectable Input/Output logic**
- **Two Status LED's; Power & Signal**
- **DC Powered: 9V to 24V**

User Options

- **Extendable Input Range**
- **Hysteresis**
- **SIL Relay or Optoisolator output**

General Description

This product is a simple but versatile Voltage Level Detector. It is made up of four functional sections:

1. Input signal conditioning
2. Signal comparison
3. Output State control
4. Output Drivers.

The input signal conditioning enables users to set the Input Voltage Trigger point. The precise trigger point is easily set using a twenty-four turn potentiometer; extended trigger points above 32V may be set with the addition of one external resistor.

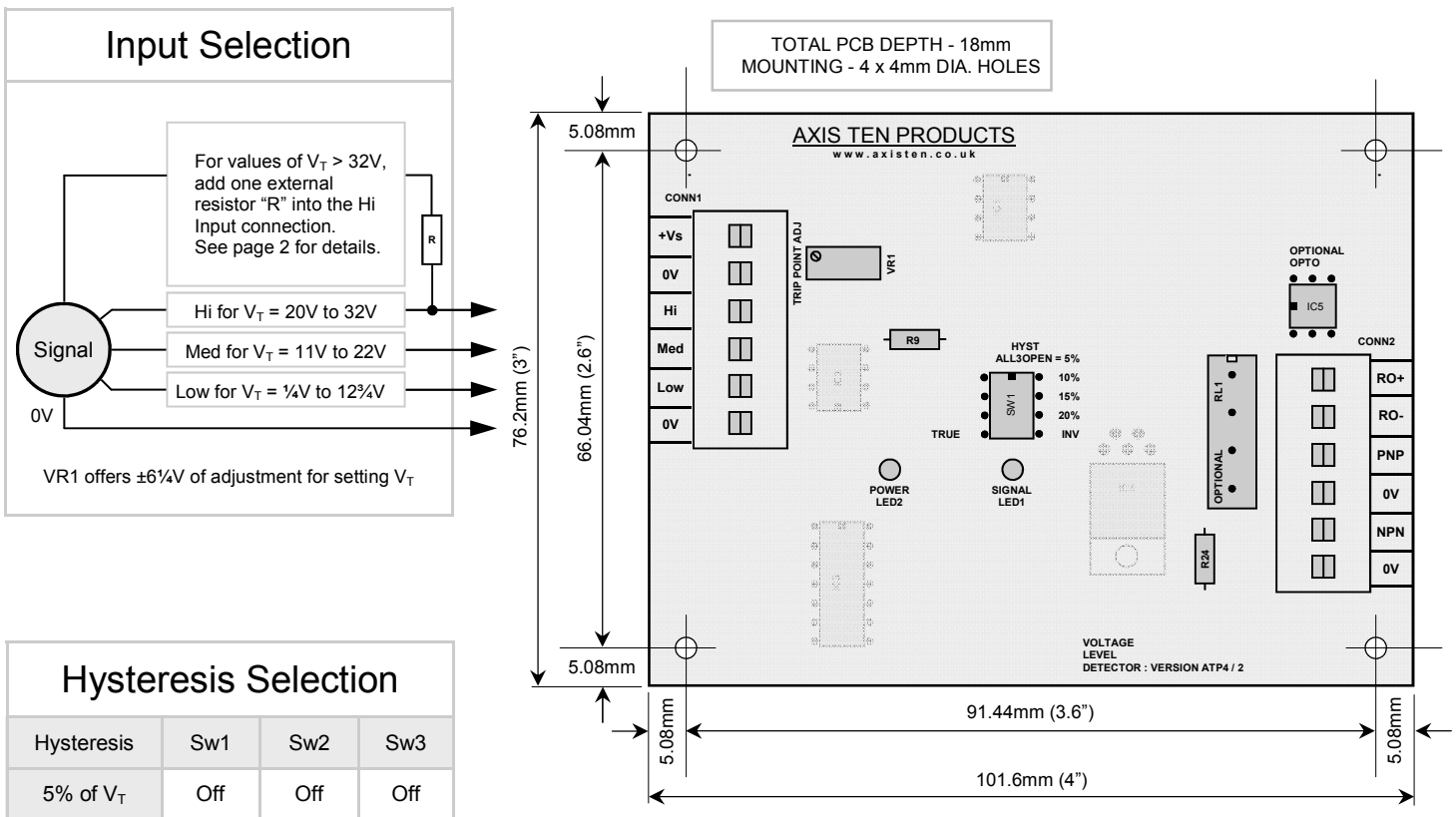
Hysteresis is selected via a DIL switch, and in this case, it is selected as a percentage of the trigger voltage; hysteresis values other than the presets may be set with the addition of one resistor.

The Input Signal is compared to a precise and stable reference voltage, with the resulting state output displayed to an observer via an LED indicator.

The Output State control circuit simply enables the Input-to-Output logic to be either: TRUE (when the Input Voltage exceeds the Trigger Point, both Outputs are HIGH) or INVERT (when the Input Voltage exceeds the Trigger Point, both Outputs are LOW).

The Output Drivers consist of one completely open collector NPN transistor, and one open collector (150k to 0V) PNP transistor. If the user chooses to install either a SIL Relay or an Optoisolator for output purposes, then the PNP output driver becomes the driver for these additional components; however, the NPN output may still be used for any other purpose.

BOARD LAYOUT & DIMENSIONS



ABSOLUTE MAXIMUM RATINGS

Power Supply	+26V
Signal Input Voltage	±100V.

NOMINAL RATINGS

Power Supply onto +Vs & 0V	+9V to +24V
Signal Input Voltage	+100V
Input Impedance	20k (min)
PNP Output Source Current	+20mA
NPN Output Sink Current	-20mA
NPN Output Collector Voltage	+35V

ORDERING

Part no: ATP4/2
External DC Powered only.

Hysteresis Selection

Hysteresis	Sw1	Sw2	Sw3
5% of V_T	Off	Off	Off
10% of V_T	On	Off	Off
15% of V_T	Off	On	Off
20% of V_T	Off	Off	On
35% of V_T	On	On	On

For other values of Hysteresis, it is necessary to add R9 to the circuit. To determine the appropriate value for R9, see page 2 for details.

Connector Blocks

Both connector blocks are screwless. To connect wires up to 1mm^2, strip the insulation back by ~7mm, depress the appropriate orange plunger and gently insert the bare conductor until the conductor contacts the back of the connector. Release the plunger and a reliable connection is made.

This product can be made to special order with screw connector blocks if preferred. However, a minimum order quantity of 25 units will apply.

Input/Output Truth Table

Input Voltage V_{in}	State LED	State Switch Sw4	NPN Output	PNP Output
$V_{in} < V_T$	OFF	TRUE	0 (ON)	0 (OFF)
$V_{in} > V_T$	ON	TRUE	1 (OFF)	1 (ON)
$V_{in} < V_T$	OFF	INV	1 (OFF)	1 (ON)
$V_{in} > V_T$	ON	INV	0 (ON)	0 (OFF)

Note: NPN Output is totally Open Collector
PNP Output is pulled to 0V with a 150k resistor

IMPORTANT

Making it work

Details & Options Guide

1. Very Important Note

Never adjust VR2 or VR3. These two potentiometers are factory set and calibration will be lost if adjusted.

2. Power Supply Voltage, V_s.

This can be any value between 9V and 24V.

3. Output signal(s).

This can be NPN, PNP, or both simultaneously.
The NPN output is totally uncommitted and can sink 20mA.
The PNP output is loosely pulled down to ground with a 150k resistor and can source 20mA.
Note: an unused output can be safely left unconnected.

4. Output options

If a SIL relay with volt-free contacts OR an Optoisolator is required, then the PNP output driver becomes dedicated to this purpose, and the PNP output must be left unconnected.

If a SIL relay is required, the coil operating voltage must be selected to match the chosen Power Supply Voltage, V_s, and the coil load current must not exceed 20mA. The suitable SIL relay should be soldered onto the circuit, where the volt-free contacts appear across two conn2 terminals marked RO+ and RO-.

If an Optoisolator is required, then one resistor, R24, must be added to the circuit to suit the particular Optoisolator chosen. The value of R24 is determined with the following equation:

$$R24 = \frac{(V_s - 2.3)}{I_{(LED)}}$$

Where: V_s is the power supply in Volts
$I_{(LED)}$ is the Opto LED current in mA
(Note: $I_{(LED)}$ = 20mA max)
R24 is in kΩ

Choose the nearest preferred value for R24 and solder into the circuit board along with the Optoisolator, preferably in a 6pin socket.

The optoisolator collector appears on conn2 terminal RO+, and the optoisolator emitter appears on conn2 RO-.

A list of suitable devices can be found in “Additional Information”.

5. Input-to-output logic

Refer here to the “Input/Output Truth Table” on page 1, and select TRUE or INV (invert) with Sw4.
Note: Sw4 can be safely toggled with the power on.

6. Input trigger voltage, V_T

Refer here to the “Input Selection” section on page 1, and choose an appropriate input from the three available, either Low, Med or Hi.
If V_T exceeds 32Volts, determined the value of the external resistor, R, with the following equation:

$$R = 80V_T - 2090$$

Where: V_T is in Volts
R is in kΩ

Choose the nearest preferred value for R, and connect the Input signal via this resistor to the Hi input on the circuit.

7. Hysteresis

Refer here to the “Hysteresis Selection” section on page 1. Choose the Hysteresis value from 5% (the minimum), 10%, 15%, 20% or 35% of V_T. For other values of Hysteresis, place Sw1, Sw2 & Sw3 into their Off positions, and determine R9 from this equation:

$$R9 = \frac{1400}{(h - 5)}$$

Where: “h” is Hysteresis as a % of V_T
R9 is in kΩ

Choose the nearest preferred value for R9 and solder into the circuit board.
Note: Sw1, 2 & 3 can be safely toggled with the power on.
Hysteresis; what is it? See description in “Additional Information”.

8. Options considered...

…now move onto the “Quick Setup Guide” to finish the job.

Quick Setup Guide

(Using standard Inputs Hysteresis & Outputs, & Nominal Ratings; see p1)

1. Wind VR1 fully clockwise.
   Note, VR1 has 24turns end-to-end.
2. Connect a de-energized Power Supply (24V DC max.)
3. Connect a de-energized stable Signal source to the appropriate Input.
4. Connect NPN and/or PNP outputs to follow-on circuits.
5. Set Hysteresis: 5%, 10%, 15%, 20% or 35%.
6. Set “True” or “Inv” for Input-to-Output logic.
7. Energize Power Supply and Signal source.
8. Set Signal source to the required Trigger Voltage.
9. Slowly wind VR1 anticlockwise until the Signal LED1 turns on.
   Note again, VR1 has 24turns end-to-end.
10. Check for correct operation.
    (Wind the input signal voltage up and down and observe the points at which the Signal LED1 turns on and off.)
11. Setup Complete.

Additional Information

Hysteresis; what is it?

Here is a description by worked example relating directly to this circuit.

Assume:
Required Trigger Point Voltage .. V_T = 10Volts
Required Reset Point Voltage … V_R = 9Volts

Therefore:
Resulting Hysteresis Voltage …. $V_H = (V_T - V_R)$
$V_H = (10 - 9)$ Volts
V_H = 1Volt

...and, % Hysteresis ……. $V_{H\%} = (100 \times V_H/V_T)$
$V_{H\%} = (100 \times 1/10)$ %
$V_{H\%}$ = 10%

Now view the “Hysteresis Selection” table on page 1, and set the three Hysteresis switches as indicated.
For 10% Hysteresis, Sw1 is On, Sw2 is Off & Sw3 is Off.

Suitable Optoisolators & SIL Relays

Darlington Transistors

4N29 FEC: 102-1162
4N30 FEC: 102-1165
4N31 FEC: 102-1166
4N32 FEC: 102-1106 & series
4N33 FEC: 102-1107 & series

Single Transistor

MCT5200 FEC: 102-1116 & series

SIL Relays

FEC: 956-1927
FEC: 956-1935
FEC: 956-1943 & others

Chosen dependant upon V_s

Data Sheet End