EXDA-01 Digital + Analog Expansion

A Much Better Idea : Logical : Unique

AmbiLogique

Electronic Controllers

Features:-

20 inputs and outputs:-

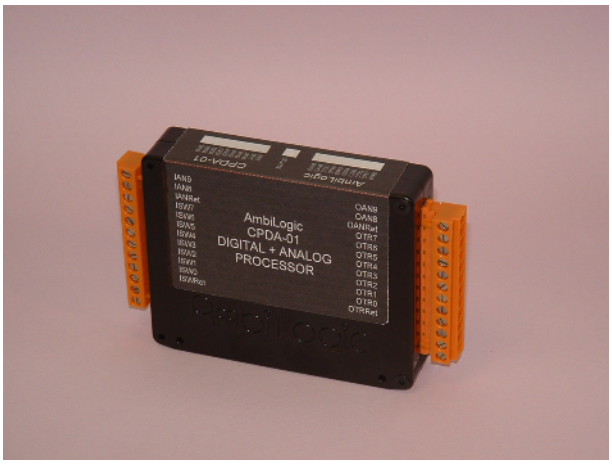
- 8: digital inputs
- 2: 0-1V analogue inputs
- 8: NPN transistor outputs
- 2: 0-10V analogue outputs.

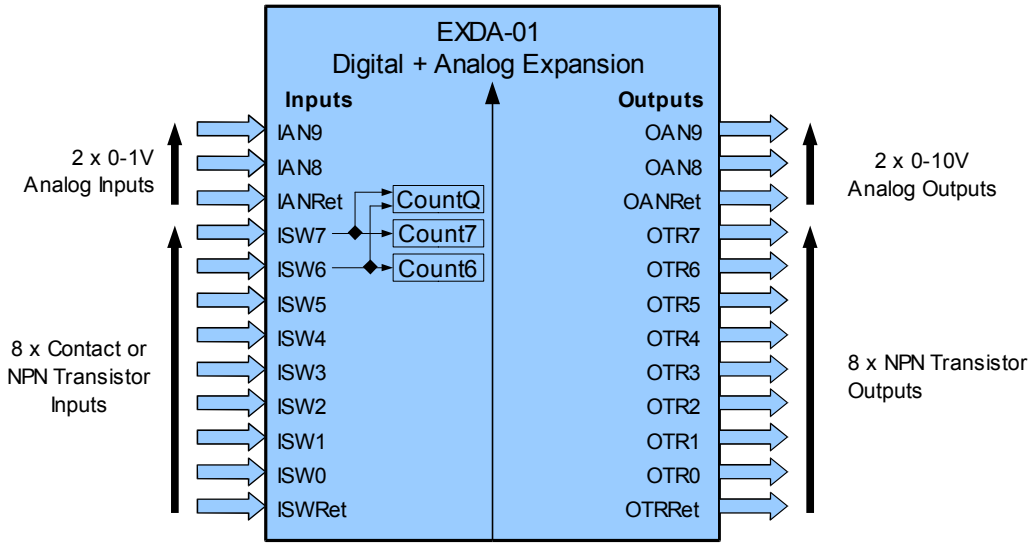
3 Medium-Speed (1kHz) counters

- 2 up-count
- 1 quadrature up/down-count

Low 2W power consumption.

Connections via detachable screw terminals.





Count6, Count7 = up counters; CountQ = quadrature up/down counter.

Connection Diagram

The EXDA-01 is a programmable digital + analogue expansion module which plugs into an AmbiLogique backplane. This module offers a similar set of inputs and outputs to the CPDA-01 Processor Module.

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EXDA-01 Digital + Analog Expansion

The EXDA-01 has the following selection of inputs and outputs built in:-

- 8 switch or NPN non-isolated transistor digital inputs
- 2 0 to 1V non-isolated analogue inputs
- 8 NPN transistor non-isolated digital outputs (these can drive relays)
- 2 0 to 10 V non-isolated analogue outputs.

This makes a total of 20 inputs and outputs.

Connections are made via detachable screw terminals.

The EXDA-01 controller plugs into any numbered slot in any of the AmbiLogique backplanes, and takes its power from the backplane. Its Slot address is picked up automatically from the backplane, and its facilities then become available to diagrams running in the Processor module on the backplane.

Please Note: Some AmbiLogique products or components may carry the “AmbiLogic” trade mark from our former Australian company.

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Connections:

Note: The Subslot, Register and Mask values are needed to map the physical inputs and outputs into the Control Diagram.

Terminal	Signal	Description	Subslot	Register	Mask
A12	IAN9+	Analogue Input	0	3	0
A11	IAN8+	Analogue Input	0	2	0
A10	IANRet	Return for Analogue Inputs			
A09	ISW7+	Switch / Contact / NPN Input	0	1	128
A08	ISW6+	Switch / Contact / NPN Input	0	1	64
A07	ISW5+	Switch / Contact / NPN Input	0	1	32
A06	ISW4+	Switch / Contact / NPN Input	0	1	16
A05	ISW3+	Switch / Contact / NPN Input	0	1	8
A04	ISW2+	Switch / Contact / NPN Input	0	1	4
A03	ISW1+	Switch / Contact / NPN Input	0	1	2
A02	ISW0+	Switch / Contact / NPN Input	0	1	1
A01	ISWRet	Return for ISW Inputs			
C01	OAN9+	0-10 V Analogue Output	0	6	0
C02	OAN8+	0-10 V Analogue Output	0	5	0
C03	OANRet	Return for Analogue Outputs			
C04	OTR7+	Transistor Output	0	4	128
C05	OTR6+	Transistor Output	0	4	64
C06	OTR5+	Transistor Output	0	4	32
C07	OTR4+	Transistor Output	0	4	16
C08	OTR3+	Transistor Output	0	4	8
C09	OTR2+	Transistor Output	0	4	4
C10	OTR1+	Transistor Output	0	4	2
C11	OTR0+	Transistor Output	0	4	1
C12	OTRRet	Return for Transistor Outputs			

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Interface to Diagram:

The Slot address for all facilities is taken from the slot into which the EXDA-01 is plugged. In practice this will be 1 upwards, because Slot 0 is always occupied by the Processor Module.

Subslot 0: Input/Output

Register 0: Device Identifier: returns hex A502 (42242) for EXDA-01.
Register 1: Contact/NPN Inputs: bit mapped: use mask to select required input.
Register 2: Analogue Input 8: returns 0 to 1.00 (input voltage).
Register 3: Analogue Input 9: returns 0 to 1.00 (input voltage).
Note that writing (outputting) to the above registers has no effect.
Register 4: Transistor Outputs: bit mapped: use mask to select required output.
Register 5: Analog Output 8: 0 to 10.00 corresponds to output voltage.
Register 6: Analog Output 9: 0 to 10.00 corresponds to output voltage.
Register 7: Count6: medium-speed up counter attached to ISW6.
Register 8: Count7: medium-speed up counter attached to ISW7.
Register 9: CountQ: medium-speed up/down quadrature counter attached to ISW6 and ISW7.
Register 10: CountCtrl: Provides reset and hold facilities for the medium-speed counters.

- Mask 1: C6 Reset: Forces Count6 to zero. Once the reset has occurred, the bit itself is reset.
- Mask 2: C6 Hold: Stops Count6 and holds its value. Set and reset via TERMOUT.
- Mask 4: C7 Reset: Forces Count7 to zero. Once the reset has occurred, the bit itself is reset.
- Mask 8: C7 Hold: Stops Count7 and holds its value. Set and reset via TERMOUT.
- Mask 16: CQ Reset: Forces CountQ to zero. Once the reset has occurred, the bit itself is reset.
- Mask 32: CQ Conditional Reset: Forces CountQ to zero when ISW6 and ISW7 are both FALSE (high). Once the reset has occurred, the bit itself is reset. This function is useful where the index signal on a quadrature encoder spans more than one step of the encoder.

Specifications

1. Power Input:
   +14V 50 mA, +7V 150 mA
   This is the standard output from the AmbiLogique Power/Comms modules – so you don't have to worry about it.

2. Contact / NPN Transistor Digital Inputs:

Excitation voltage:	6.0 to 9.0 V
Sink current:	3.0 to 5.0 mA
Maximum Input voltage:	-1.0 to +120 V
Protection:	Blocking diode
Internal signal:	open = FALSE; closed = TRUE;
Thresholds:	5.0 V (open); 3.0 V (closed) typical

3. Analogue Inputs:

Resolution:	12 bits: 274 µV per bit
Range:	0 to 1.1 V
Input resistance:	11.1 kΩ
Total errors not exceeding:	4 bits: 1.2 mV: 0.12 % of full range
Internal signal:	0 to 1.10

Specifications (continued)

4. Transistor Digital Outputs:
   Max working voltage: + 33 Vdc
   Max current: 2.0 A individually: total for all outputs not to exceed 8A
   Protection: VDR

5. Analogue Outputs:
   Resolution: 12 bits : 2.4 mV per bit
   Range: 0 to +10 V
   Internal Resistance: 100 ohms ± 1%
   Max Current: 10 mA
   Total errors not exceeding: 4 bits : 10 mV : 0.1 % of full range
   Internal signal: 0.0 to 10.0

6. Dimensions:
   Heights: 83 mm above backplane
   97 mm above mounting base when assembled on to an AmbiLogique backplane on TS35 rail.

   Width: 25.0 mm max

   Depths: 103 mm over body
   125 mm over terminals

7. Ambient temperature: -10 to +60 °C

Indicators

There are 3 groups of indicators on the top panel of the EXDA-01.

Contact / NPN Input Group:
These are labelled "**ISW0**" through "**ISW7**"
The indicators are ON when the input is TRUE, i.e. switched to Return.

Analog Input Group:
These are labelled "**IAN8**" and "**IAN9**"
The indicators glow with an intensity proportional to the input voltage.

Comms:
This indicator flashes each time the module is interrogated or commanded via the backplane bus. The indicator lights when it recognises a packet addressed to its slot, and goes out when the response has been transmitted.
If this indicator is not flashing, the module is not being addressed. This is not necessarily a fault condition if the processor is not reading the module's inputs or adjusting it s outputs. That is to say if the diagram makes no reference to any of the EXDA-01's inputs or outputs, no packets will be sent to the module, and the Status indicator will not flash.
If the outputs alone are referenced, even if the outputs are unchanging, the backplane communications protocol ensures that they are refreshed periodically, so the Status indicator will flash.

Analog Output Group:
These are labelled "**OAN8**" and "**OAN9**"
The indicators glow with an intensity proportional to the output voltage.

Indicators (continued)

Transistor Output Group:
These are labelled "**OTR7**" through "**OTR0**"
These indicators are ON when the corresponding output transistor is ON.

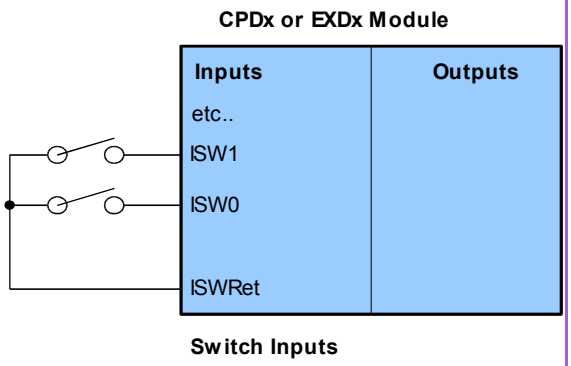
Connecting External Devices

1. **Switch Inputs ISW0..7**

   a) **Contact Input:**

   Wire the contact between ISW.. and ISWRet.

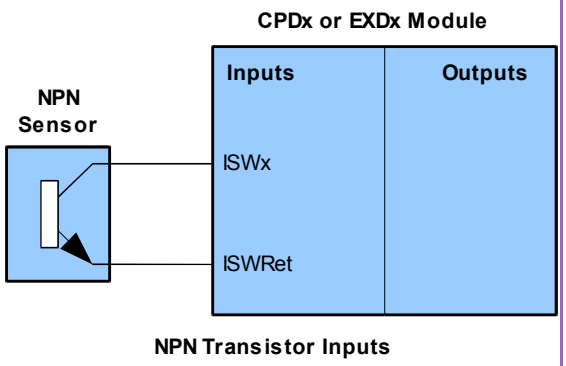
   The input will be TRUE when the contact is closed.



   b) **NPN Transistor Input:**

   Collector to ISW..
   Emitter to ISWRet

   The input will be TRUE when the transistor is ON.



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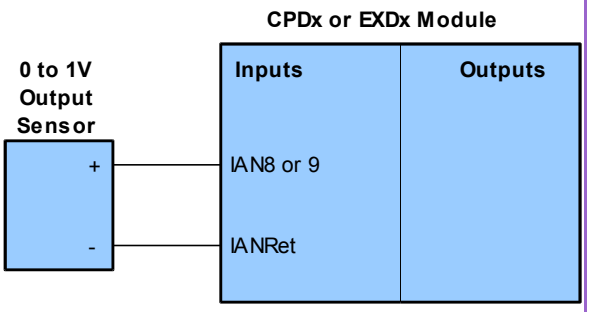
Connecting External Devices (continued)

2. Analog Inputs IAN8, 9:

a) 0 to 1 V input:

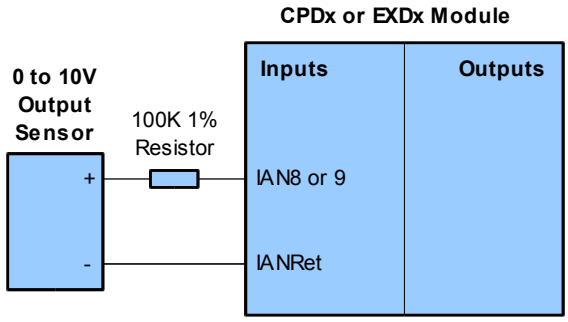
Positive to IAN8 or 9
Negative to IANRet
Remember that IANRet is not isolated from the PLC 0V line.



0-1V Analogue Inputs

b) 0 to 10 V input:

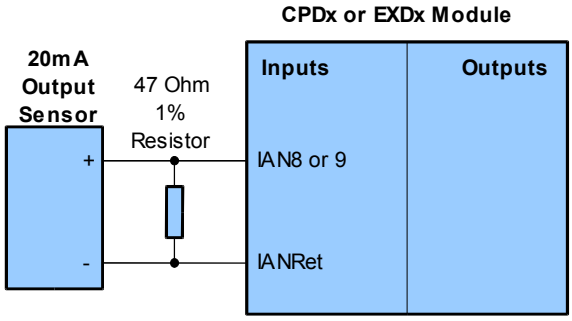
Positive to a 100 Kohm 1% resistor
Other side of the resistor to IAN8 or 9
Input resistance of IAN8 and IAN9 is 11.1 Kohm ± 0.1%.
Negative of the input to IANRet
Remember that IANRet is not isolated from the PLC 0V line.



0-10V Analogue Input

c) 0 to 20 mA or 4 to 20 mA input:

Wire a 47 ohm 1% resistor between IAN8 or 9 and IANRet.
Positive input to IAN8 or 9 (and the resistor).
Negative input to IANRet.
Remember that IANRet is not isolated from the PLC 0V line, so the PLC must be the lowest device in the loop.
In the case of 4-20 mA input, 4 mA will input 0.188 to the diagram, and 20 mA will input 0.940 to the diagram.



20mA Analogue Input

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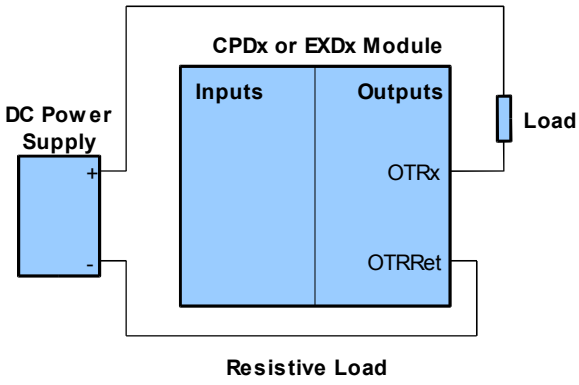
Connecting External Devices (continued)

3. Transistor Outputs OTR0..7:

a) Resistive Loads:

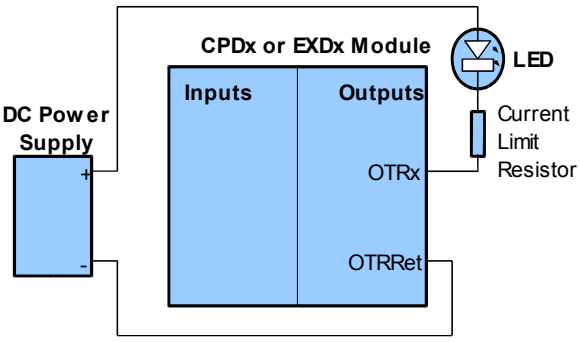
Negative terminal of the power supply feeding the load to OTRRet.
Positive terminal of the load to the positive terminal of the power supply.
Negative terminal of the load to OTR0..7 as required.
Note that OTRRet is connected to the PLC 0V line.



Resistive Load

b) LEDs:

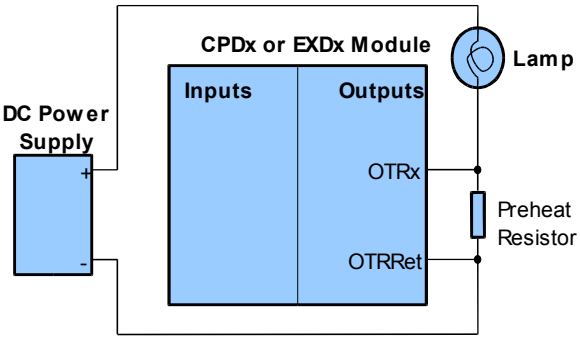
Determine whether the LED is fitted with a current limiting circuit.
Most LEDs are not, and will need a current limiting resistor wired in series with them.



LED Load

c) Filament Lamps:

The problem with filament lamps is the extremely low resistance when cold, giving rise to a huge current surge when switched on. One approach is to put a current limiting resistor in series with the lamp - the power supply voltage then needs to be greater than the lamp voltage.



Filament Lamp Load

An alternative approach is to shunt the switching device with a preheat resistor whose value is such that the filament is just at the glow point when the lamp is switched off.
This approach can greatly increase lamp life where lamps are switched on and off frequently, e.g. where a lamp is flashed as a warning.

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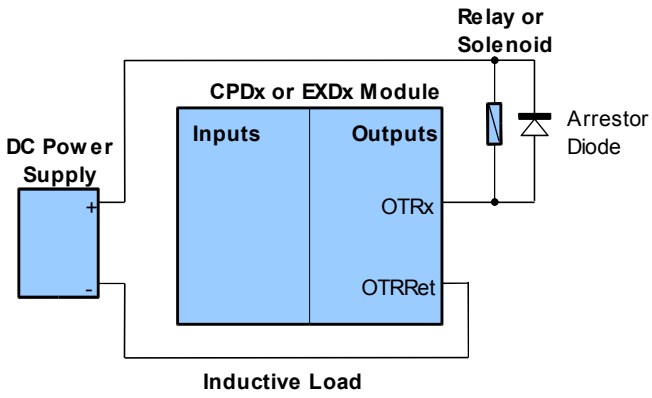
Connecting External Devices (continued)

d) Relays and Solenoids:

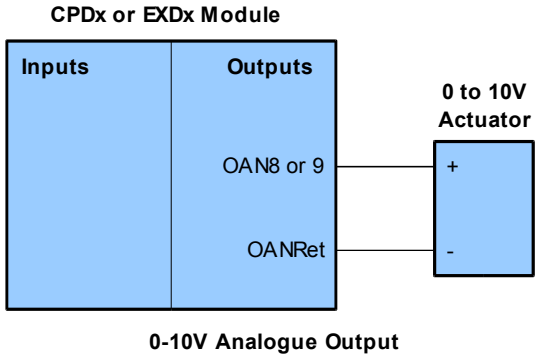
Inductive loads such as relays and solenoids normally need arrestor diodes across them to protect the switching element. AmbiLogique transistor outputs have VDR protection so that the diodes are not strictly necessary, unless the load is being switched frequently. However, fitting the diodes will reduce the voltage spikes associated with switching off inductive loads, and improve EMC performance.



4. Analogue Outputs OAN 8 and 9:

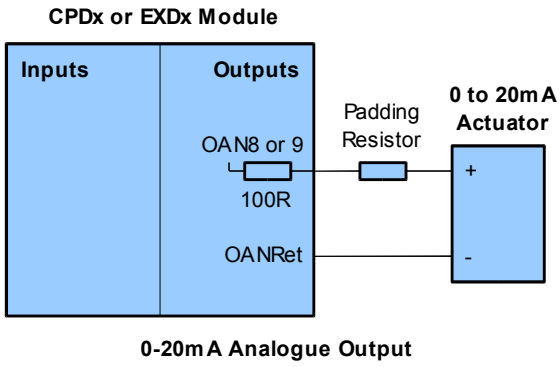
a) Voltage Output (0 to 10 V):

The OAN8 and OAN9 outputs have an internal resistance of 100 ohms. If the load has a significant resistance, the output voltage will be less than expected.
Most 0-to-10 V devices have input resistances greater than 100 Kohms, so the loading error will be less than 0.1% .



b) Current Output (0 to 20 mA):

The total circuit resistance including loads, the internal resistance of 100 ohms, and the padding resistor needs to total 500 ohms.
An output value of 10.0 from the diagram will produce 20 mA.
An output value of 2.0 will produce 4 mA.
For a simpler and better controlled 0-20 or 4-20 mA output scheme, see the data sheet for the EXDA-4201 Expansion Module.



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WARNING
SAFETY-CRITICAL SYSTEMS

A Safety-Critical system is a system whose failure or malfunction could cause death, significant injury or loss of property.

AmbiLogique products incorporate electronic hardware and software, both of which carry a remote but real possibility of failure. AMBILOGIQUE DOES NOT WARRANT, CLAIM OR REPRESENT THAT ITS PRODUCTS ARE INFALLIBLE.

It is therefore THE RESPONSIBILITY OF THE DESIGNER of any safety-critical system which incorporates AmbiLogique products to ensure that:-

1. The system is designed so that any failure of an AmbiLogique component will not cause death, injury or loss of property.
2. The system incorporates independent monitoring means which detect the failure of any of the electronic control elements.
3. The system has alternative and independent means of control which enable it to be controlled and shut down in an orderly manner.
4. Any and all other industry-specific safety requirements are fully implemented.

Revision History:

R 0.0	2005-01-17	Initial issue.
R 0.1	2009-01-05	Safety notice added.
R 1.0	2010-01-31	Editorial
R 2.0	2012-01-25	Open Document format, Name change.