Data Sheet

XCITE/IO/..

I/O Expansion Modules

XCITE/IO Expansion Modules

Description

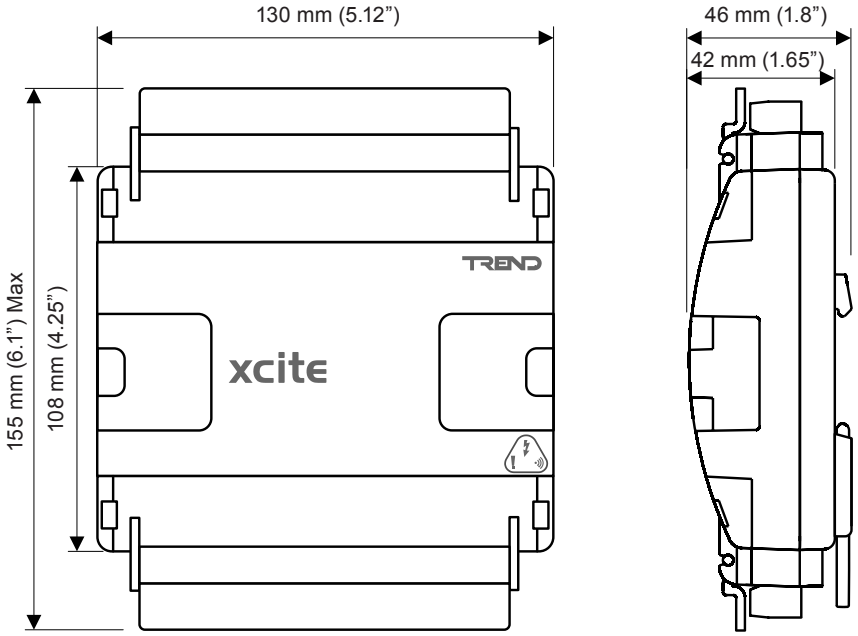
A range of DIN rail mounted I/O expansion modules for use with the IQ®3XCITE/96 and /128 controllers, offering additional input and output channel connection points. Also compatible with the IQ4E, IQ4NC/XNC controllers and 4E/IO module range (firmware v3.30 onwards).

XCITE/IO modules provide a comprehensive choice of universal, thermistor and digital inputs, plus analogue and relay outputs.

Features

- Up to 15 I/O modules per controller
- Versatile I/O bus allows convenient placement of modules
- Up to 30 metres (32 yards) I/O bus length
- Powered from controller I/O bus or external PSU
- Two part I/O connectors for easy installation/commissioning
- Standard TS35 DIN rail mounting

Physical

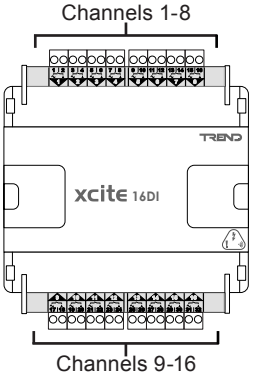


FUNCTIONALITY

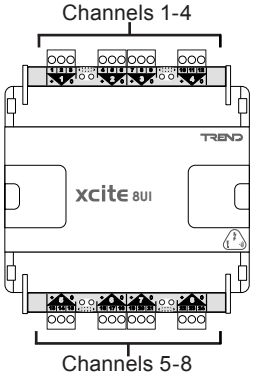
HARDWARE

The range of XCITE/IO Expansion Modules comprises the following variants:

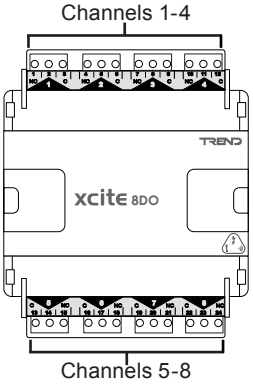
../16DI
16 Digital Inputs



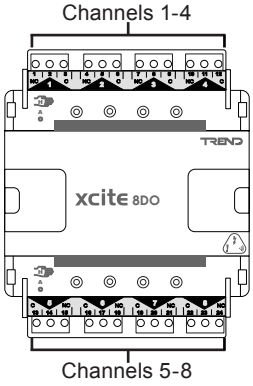
../8UI
8 Universal Inputs



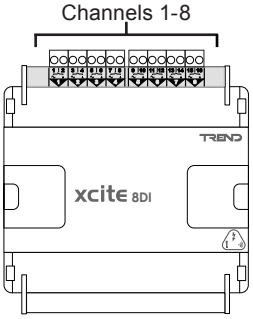
../8DO
8 Relay Outputs



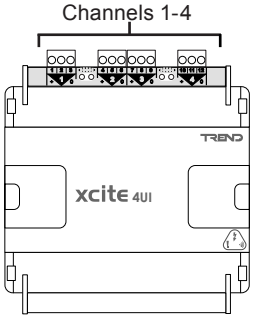
../8DO/HOA
8 Relay Outputs + Override



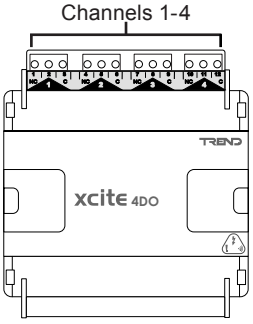
../8DI
8 Digital Inputs



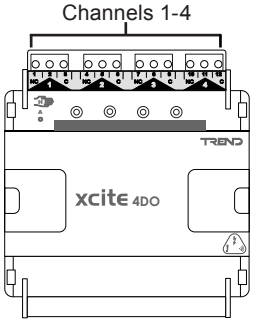
../4UI
4 Universal Inputs



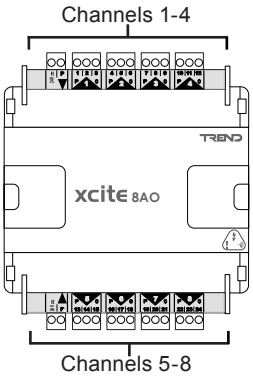
../4DO
4 Relay Outputs



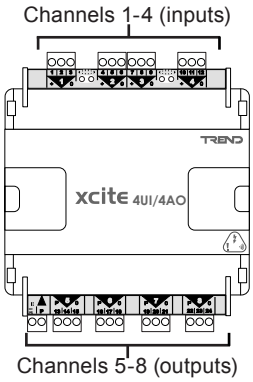
../4DO/HOA
4 Relay Outputs + Override



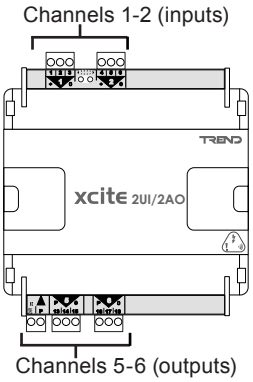
../8AO
8 Analogue Outputs



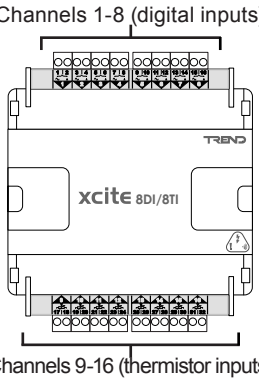
../4UI/4AO
4 Universal Inputs
+ 4 Analogue Outputs



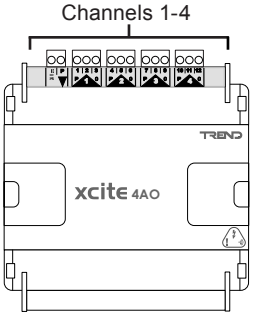
../2UI/2AO
2 Universal Inputs
+ 2 Analogue Outputs



../8DI/8TI
8 Digital Inputs
+ 8 Thermistor Inputs



../4AO
4 Analogue Outputs



Enclosure

Each XCITE/IO module is housed in a polycarbonate enclosure with a complimentary styling to the IQ3XCITE controllers. Integral spring clips on the back of the module enable the unit to be clipped on to (and quickly released from) a standard TS35 DIN rail. Digital/Relay output (DO) modules also have hinged clear polycarbonate covering the output channel connectors.

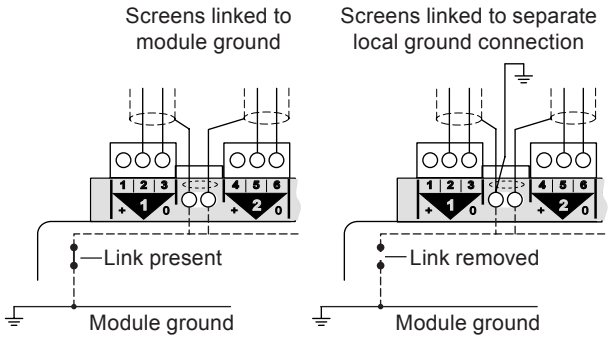
XCITE/IO modules must be installed in a secondary enclosure with a minimum protective rating of IP20 (or equivalent) or mounted outside normal reach (e.g. in a plenum).

Input/Output Channels

Across the range of XCITE/IO modules the following types of input and output channel are supported:

- Universal Input (UI)
- Digital Inputs (DI)
- Thermistor Inputs (TI)
- Digital/Relay Output (DO)
- Analogue Outputs (AO)

Cable Screening
The use of screened cable is recommended for voltage and thermistor inputs. Additional screen terminals are provided on all UI and TI type modules which are internally connected to the module's I/O bus ground line. This internal connection can be broken by the removal of a wire link, e.g. in order to provide a separate local ground connection.



For other types of input or output connections cable screening is optional but not generally required unless the cable passes through electrically noisy environments.

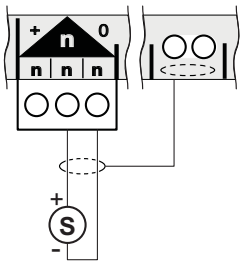
Where screened cable is used the screen must either be connected to the module's screen terminals (where provided) or to the local panel/enclosure ground and left unterminated at the far end.

Universal Input (UI)
These channels will function as one of the following according to the setting of onboard links:

- voltage input,
- thermistor input,
- digital input, or
- current input.

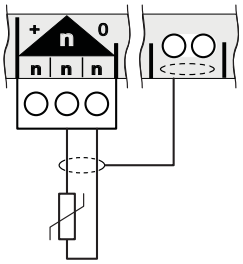
Voltage input: Used with a 0 to 10 Vdc source.

Example wiring



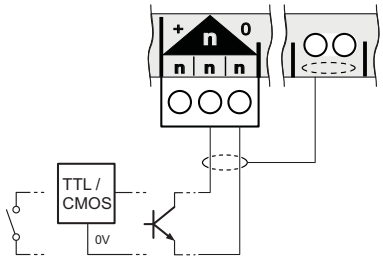
Thermistor input: Used for a thermistor (NTC 10 kΩ @ 25°C, -40 to +110°C), potentiometer or fan speed control. The thermistor bridge resistor is 10 kΩ with a bridge supply of 5 V.

Example wiring



Digital input: Used for a volt free contact, logic circuit (e.g. TTL, CMOS), open collector (transistor) or open drain (FET).

Example wiring



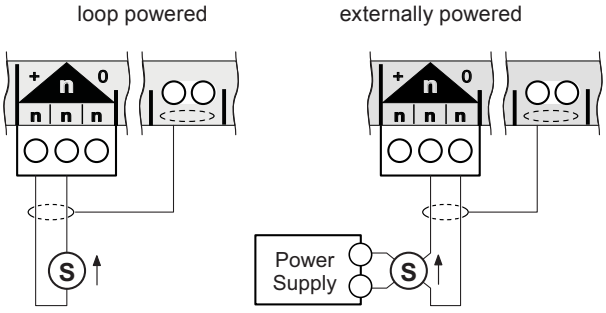
The volt free contact has a nominal wetting current of 3 mA. The input is ON when the contact is closed.

An open collector or open drain must be able to sink 3 mA. The input is ON when the transistor or FET conducts. Polarity must be observed.

A logic circuit must be able to sink 3mA. The input will be ON when the voltage present on the input terminal is less than 2 Vdc (minimum 0 V). A voltage greater than 3.5 Vdc (maximum 50 Vdc) or open circuit will turn the input OFF. Voltage levels between 2 and 3.5 Vdc may cause indeterminate operation.

Current input: Used for 0 to 20 mA sources. May be either loop powered or externally powered according to which terminals are connected.

Example wiring



In the loop powered mode the **+** terminal can source 20 Vdc ±5% (depending on I/O bus supply) at a maximum of 20 mA.

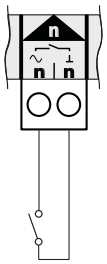
Digital Input (DI)
These channels are compatible with the following input devices:

- volt free contact (e.g. switch or relay),
- logic circuit (e.g. TTL, CMOS),
- open collector (transistor) or open drain (FET),or
- 24 Vac circuit.

The various digital input connections are as follows:

Volt free contact input:

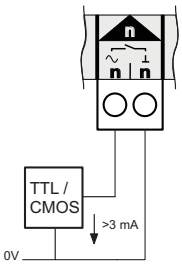
Example wiring



The volt free contact has a nominal wetting current of 3 mA. The input is ON when the contact is closed.

Logic input:

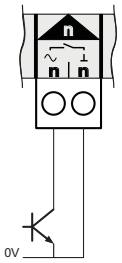
Example wiring



A logic circuit must be able to sink 3 mA. The input will be ON when the voltage present on the input terminal is less than 2 Vdc (minimum 0 V). A voltage greater than 3.5 Vdc (maximum 50 Vdc) or open circuit will turn the input OFF. Voltage levels between 2 and 3.5 Vdc may cause indeterminate operation.

Open collector (or open drain) input:

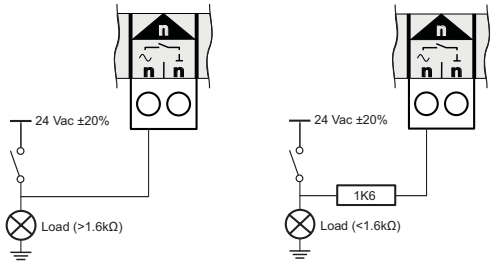
Example wiring



An open collector or open drain must be able to sink 3 mA. The input is ON when the transistor or FET conducts. Polarity must be observed.

24 Vac circuit: Used to monitor the state of a 24Vac circuit.

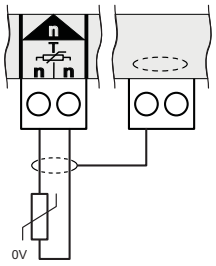
Example wiring



In the above example the input will be ON when the load is powered. If the load impedance is less than 1.6 kΩ (e.g. filament lamp or relay coil) then a 1.6 kΩ resistor must be fitted in series with the input.

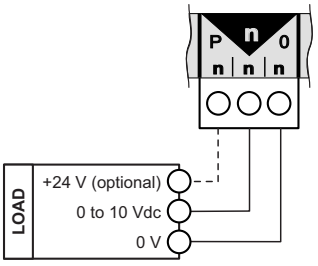
Thermistor Inputs (TI)
Used for a thermistor (NTC 10 kΩ @ 25°C,-40 to +110°C), potentiometer or fan speed control. The thermistor bridge resistor is 10 kΩ with a bridge supply 5 V.

Example wiring

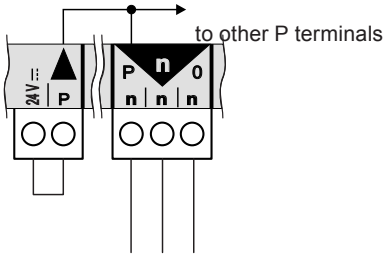


Analogue Output (AO)
Provides a variable voltage between 0 to 10 Vdc. The output can source up to 20 mA. The P terminals for each channel can provide an optional supply to the load.

Example wiring

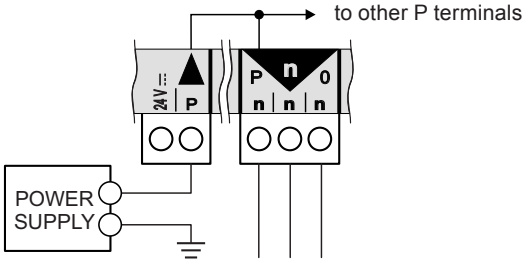


The P terminals for each channel are internally linked to the main P input terminal. This can be fed either from the module's own 24 Vdc output terminal or an external 24 Vac/dc supply.



The module's 24 Vdc output is derived from the I/O bus supply and is internally limited to 100 mA per 24 V terminal. However, the maximum available current will also be dependant on the I/O bus supply (see "Module Power Supply" on page 6).

Where an external power supply is used it can be either 24 Vac or 24 Vdc according to the requirements of the connected loads.

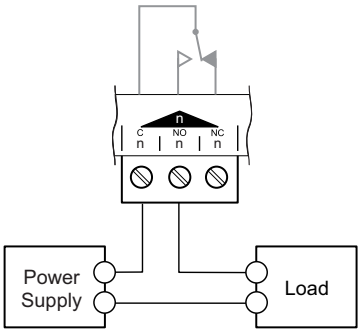


Note: An external PSU must have an isolated output, comply with the relevant EMC and safety standards and be dedicated to I/O channel use. The module is protected against the wrong connection of a non-isolated PSU by a non-replaceable fuse.

The maximum total current that can be drawn from all P terminals is internally limited to 1.6 A irrespective of the supply method used.

Digital/Relay Output (DO)
Digital output channels provide a single pole dry contact changeover relay.

Example wiring



The relay contacts close (i.e. NO makes with C) when the output channel is ON.

Note: To meet safety requirements each bank of four relay outputs must all be switching either low voltage or mains voltage but never both. If switching mains voltage they must be the same phase and polarity.

Digital/Relay Output with Override Switch (DO/HOA)
DO/HOA variant modules provide the same output switching arrangement as standard DO modules, but with the addition of a 'Hand/Off/Auto' override switch for each output channel. The switch has three positions:

- **H**and: Manual override ON (relay closed)
- **O**ff: Manual override OFF (relay open)
- **A**uto: Normal operation (relay follows channel output)

A red indicator illuminates in either of the override conditions (i.e. Hand or Off) and the output indicator will show the on/off state of the channel.

Note: The state of the HOA switch is fed back to the controller strategy driver module from where it can be viewed using web pages, supervisors or IQ®SET (System Engineering Tool).

I/O Bus

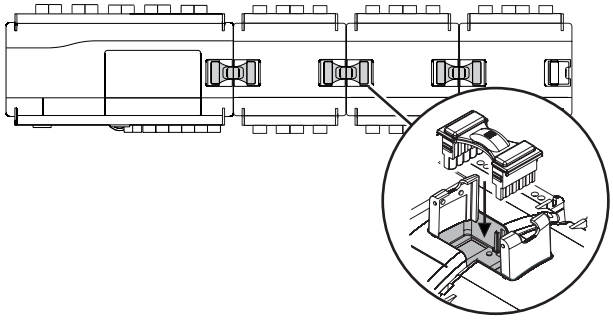
XCITE/IO modules interconnect with each other and the controller via the I/O bus, which comprises the following power and signal connections:

- +24 Vdc
- Data Hi
- Ground
- Data Lo
- 0 V

Access to the I/O bus on the IQ3XCITE controller is via a connecting point located on the right-hand side of the unit.

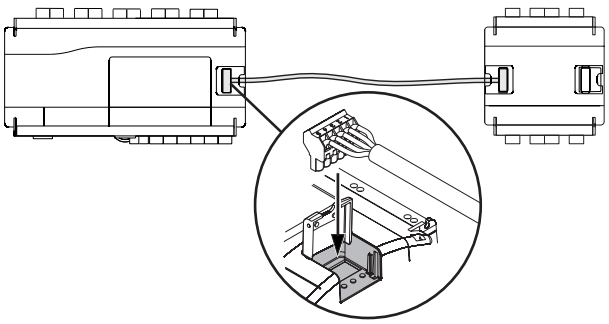
Each XCITE/IO module has a similar connecting point on both the left and right-hand side, enabling the bus to be daisy-chained between modules.

A short rigid interconnector (XCITE/IC) is available to allow easy connection between adjacent modules. One interconnector is supplied with each I/O module; spare interconnectors are also available (see "Accessories" on page 10).



Note: Rigid interconnectors cannot be used between XCITE/IO modules and 4E/IO modules or IQ4E, IQ4NC/XNC controllers. In such cases a cabled interconnection must be used (see below).

Where modules are mounted separately from the controller or neighbouring modules the interconnection may be made using an XCITE/CC cable connector (see "Accessories" on page 10) and suitable screened cabling (Belden 3084A is recommended).



Cabled interconnections can also be used to link XCITE/IO modules with 4E/IO modules or an IQ4E controller.

Note: The 4E/IO and IQ4E require a different cable connector (see "Accessories" on page 10).

Between modules the I/O bus may be wired from right to left side (as shown above), right to right or left to left, as long as correct bus polarity is maintained. Spurs are not permitted.

Where cabled interconnections are used the maximum overall I/O bus length is determined by the construction and earthing (grounding) arrangements of secondary enclosures:

Configuration	Max Overall Cable Length
Single enclosure: screened and bonded contiguous metal enclosure with single earth (ground) point.	30 m (32 yards)
Multi-section enclosure (e.g. Form 4): screened and bonded contiguous metal enclosure with single earth (ground) point. .	30 m (32 yards)
Multiple enclosures: separate screened metal enclosures earthed (grounded) to a common earth (ground) point.	10 m (11 yards)

For further details refer to the XCITE/IO Installation Instructions - Mounting (TG200627).

Bus Termination
The I/O bus must be terminated at the farthest end from the controller. A suitable plug-in terminator (XCITE/TERM) is supplied with the IQ3XCITE controller; spare terminators are also available (see “Accessories” on page 10).

Earthing/Grounding Arrangements
It is important that correct earthing/grounding is provided for the controller and modules on the I/O bus.

The I/O bus ground is connected to earth/ground via the controller. Modules located within the same secondary enclosure are earthed/grounded via the I/O bus.

Where modules are located in different secondary enclosures or where I/O bus cables exceed 1 m (39”) a local earth/ground connection must be provided. For further details refer to the XCITE/IO Expansion Modules Installation Instructions - Mounting (TG200627).

All DIN rails must be earthed/grounded.

Module Power Supply
I/O modules are typically powered from the controller via the I/O bus. The bus supply is derived from the controller’s combined 24 Vdc supply and, therefore, the maximum current available to the I/O bus depends upon other current demands placed on the controller. For further details on calculating current availability from the controller’s combined supply refer to the IQ3 Configuration Manual (TE200768) or IQ4 Configuration Manual (TE201263).

The maximum current required by each type of XCITE/IO module is listed in the table below – these can be used to estimate the total current required.

Module Type	Maximum Current Consumption
XCITE/IO/**16DI**	36 mA
XCITE/IO/**8DI**	28 mA
XCITE/IO/**8DI/8TI**	30 mA
XCITE/IO/**8UI**	180 mA
XCITE/IO/**4UI**	100 mA
XCITE/IO/**8DO**, XCITE/IO/**8DO/HOA**	100 mA
XCITE/IO/**4DO**, XCITE/IO/**4DO/HOA**	60 mA
XCITE/IO/**8AO**	180 mA + aux supply (max 200 mA)*
XCITE/IO/**4AO**	100 mA + aux supply (max 100 mA)*
XCITE/IO/**4UI/4AO**	180 mA + aux supply (max 100 mA)*
XCITE/IO/**2UI/2AO**	100 mA + aux supply (max 100 mA)*

** If using module’s 24 V supply to provide power to some or all P terminals (see “Analogue Output (AO)” on page 4).*

In practice a module may require less current than the stated maximum. To obtain a more accurate value for current consumption it is necessary to consider:

- the current consumed by the module’s core electronics;
- how many inputs/outputs are being used; and
- the state of the output channels at any one time, i.e. outputs that are ON or at maximum level will consume more current.

For further guidance on calculating XCITE/IO module current consumption more accurately refer to the IQ3 Configuration Manual (TE200768).

Where the total current requirement of the I/O bus exceeds the maximum available from the controller, one or more additional 24 Vdc power supplies may be installed.

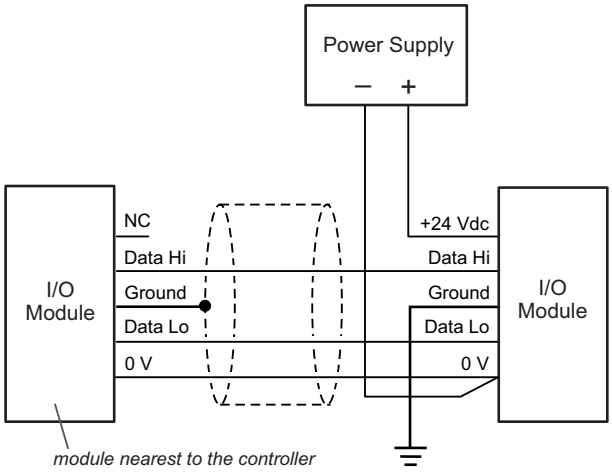
Additional supplies may also be required where the current flow through the power line of a module would exceed the maximum of 1.6 A, thus requiring the I/O bus power line to be split or segmented.

Additional Power Supplies
Important: *Not permitted for UL compliant installations.*

Where it is necessary to install an additional power supply along the I/O bus, the supply output must be isolated from earth (ground). The supply unit must also comply with the relevant EMC and safety standards.

Note: Trend offer a range of DIN rail mounted auxiliary power supplies that are suitable for this purpose.

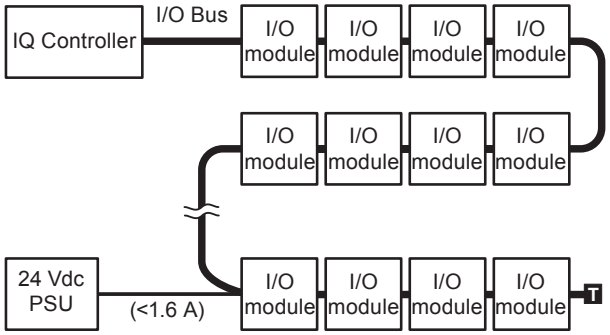
Where the supply is required the normal 24 Vdc I/O bus connection between modules is not made. Instead the supply unit is wired between the 24 Vdc and 0 V terminals as shown below:



Important*: The 0 V connection must be made when an external supply is used and the 0 V line must be continuous for the entire length of the I/O bus.*

Pre-wired cables are available to link modules and provide flying leads to a PSU (see “Accessories” on page 10). Alternatively, the standard cable connector (XCITE/CC) may be used to make the connection of external power supply units to the I/O bus.

The following example shows a number of I/O modules split in to two groups, the first eight powered from the controller and the remaining four powered from an external power source:



I/O Module Addressing

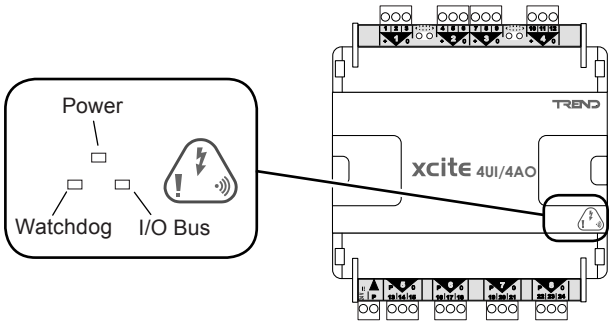
Each module on the I/O bus must be assigned a unique address. XCITE/IO modules can be set between address 1 and 15 by means of a rotary selector switch. Address 0 can also be set which disables the module.

The I/O bus indicator will flash on any modules that are set to the same address.

Indicators

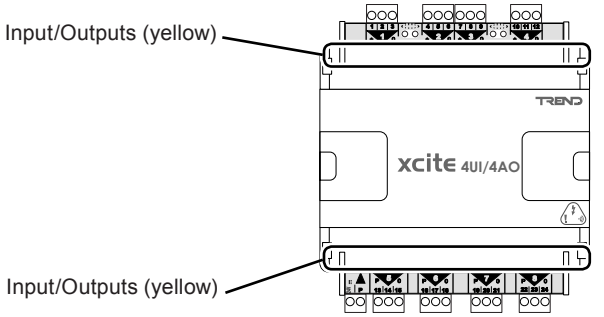
Various LED indicators are provided giving feedback on the operational status of the module and its inputs/outputs.

General Indicators (visible through cover):



Indicator	Colour	Function
Power	Green	Condition of input power supply
Watchdog	Red	Presence of a firmware/strategy fault
I/O Bus	Red	Status of I/O bus

Input/Output Indicators (adjacent to the appropriate I/O terminals and label, visible through cover):



Indicator	Colour	Function
Digital Input	Yellow	On/Off state of associated input *(applies to DI channels and UI channels in digital input mode)*
Analogue Output	Yellow	Light intensity varies with output voltage *(applies to AO channels only)*
Digital / Relay Output	Yellow	On/Off state of associated input *(applies to DO channels only)*

Warning Indicators (visible through cover):

Indicator	Colour	Function
Polarity Error	Red	Indicates that a 24 Vac type input has the supply grounded on the wrong side relative to the module ground *(applies to DI channels only)*
Aux Current Overload	Red	*Indicates that excess current is being drawn from the 24 V terminal(s) (applies to AO variants only)*
Override HOA	Red	Indicates when an output is manually overridden *(applies to HOA variants only)*

FIELD MAINTENANCE

The XCITE/IO Expansion Modules require no routine maintenance.

WARNING: Contains no serviceable parts. Do not attempt to open the unit. Failure to comply may cause damage to the unit.

DISPOSAL

COSHH (Control of Substances Hazardous to Health - UK Government Regulations 2002) ASSESSMENT FOR DISPOSAL OF XCITE/IO Expansion Modules.

RECYCLING ♻.
All plastic and metal parts are recyclable. The printed circuit board may be sent to any PCB recovery contractor to recover some of the components for any metals such as gold and silver.

WEEE Directive:

At the end of their useful life the packaging, and product , and battery (if fitted) should be disposed of by a suitable recycling centre.

Do not dispose of with normal household waste.
Do not burn.

COMPATIBILITY

Controllers: IQ3XCITE/96, IQ3XCITE/128,
IQ4E/.. (except ../16 variant), IQ4NC/XNC.

I/O Modules: IQ4/IO/.. range

INSTALLATION

The XCITE/IO Expansion Modules are designed to be clipped on to a standard TS35 DIN rail by using the DIN rail clip. They must be installed inside an enclosure rated to at least IP20 (or equivalent) or mounted outside normal reach (e.g. in a plenum). The modules are UL rated as 'UL916 listed open energy management equipment'. The installation procedure involves:

- Mounting the I/O module(s) in position
- Connecting the I/O bus
- Terminating the I/O bus
- Connecting additional PSUs (if required)
- Connecting universal inputs (UI modules only)
- Connecting digital inputs (DI modules only)
- Connecting analogue outputs (AO modules only)
- Connecting relay outputs (DO modules only)
- Selecting channel type for universal inputs (UI modules only)
- Segregating screen connections (UI modules, if required)
- Setting I/O bus address for each module
- Isolating all I/O connections
- Downloading strategy to controller
- Reconnecting all inputs and checking operation
- Reconnecting all outputs and checking operation

A full description of installing these modules is given in the XCITE/IO Installation Instructions - Mounting (TG200627) and XCITE/IO Installation Instructions - Configuring (TG201161).

ORDER CODES

XCITE/IO/8UI	:8 channel universal input I/O module.
XCITE/IO/4UI	:4 channel universal input I/O module.
XCITE/IO/4UI/4AO	:4 channel universal input and 4 channel analogue voltage output I/O module.
XCITE/IO/2UI/2AO	:2 channel universal input and 2 channel analogue voltage output I/O module.
XCITE/IO/8DO	:8 channel relay output I/O module.
XCITE/IO/4DO	:4 channel relay output I/O module.
XCITE/IO/8AO	:8 channel analogue voltage output I/O module.
XCITE/IO/4AO	:4 channel analogue voltage output I/O module.
XCITE/IO/16DI	:16 channel digital input I/O module.
XCITE/IO/8DI	:8 channel digital input output I/O module.
XCITE/IO/8DI/8TI	:8 channel digital input and 8 channel thermistor input I/O module.
XCITE/IO/8DO/HOA	:8 channel relay output with Hand/Off/Auto switch I/O module.
XCITE/IO/4DO/HOA	:4 channel relay output with Hand/Off/Auto switch I/O module.

Note: All modules are supplied with one XCITE/IC rigid interconnector.

USA Versions
Modules for use in the USA are identified by placing /USA/UL before the module type in the order code, e.g.:

XCITE/IO/USA/UL/8UI	:8 channel universal input I/O module. UL rated.

ACCESSORIES

XCITE/IC/5	:Pack of 5 spare rigid I/O bus interconnectors (for XCITE/IO modules and IQ3XCITE controller).
XCITE/CC/10	:Pack of 10 I/O bus cable connectors (for XCITE/IO modules and IQ3XCITE controller).
XCITE/TERM/5	:Pack of 5 spare I/O bus terminators (for XCITE/IO modules and IQ3XCITE controller).
XCITE/PCON/50	:Single pre-wired I/O bus interconnector for adjacent I/O modules (10 mm spacing) with flying leads for the connection of an external bus power supply.
XCITE/PCON/1000	:Single pre-wired I/O bus connecting cable 1 m (39”) long with flying leads for the connection of an external bus power supply
IQ4/IC/ADPT/10	:Pack of 10 I/O bus cable adapters (for XCITE/IO modules, IQ4E controller, and IQ4NC/XNC)

SPECIFICATION

ELECTRICAL

Supply Voltage	:24 Vdc ±15%, derived from I/O bus or optional external isolated output power source.
Supply Current	:dependant on module type and input/output usage (see page 6). Maximum current flow through any module on I/O bus = 1.6 A.
Internal Fusing	:Self-resetting fuse protection for: 24 V aux terminals (100 mA per terminal); P out terminals (1.6 A total all terminals); :Non-replaceable fuse protection for: non-isolated external PSUs
I/O Bus	
Max. length	:30 m (33 yds), depending on system configuration (see page 5).
Max. modules	:15 (subject to max. channel count).
Max. channels	:128 (including controller I/O).

Inputs/Outputs

Universal Inputs (UI)

Function	:Set by onboard link to be voltage input, current input, thermistor input or digital input (volt free contact, open collector/ drain or logic).
Input Noise Rejection	:Minimum 60 dB series mode rejection at input power supply frequency.
Voltage Input	
Input range	:0 to 10 V.
Input resistance	:200 kΩ.
Accuracy	:±0.5% of span (50 mV).
Resolution	:12 bit (4096 steps).
Current Input	
Input range	:0 to 20 mA.
Current source	:I/O bus (loop power) or external PSU.
Input resistance	:240 Ω.
Accuracy	:±0.5% of span (100 µA).
Resolution	:12 bit (4096 steps).
Thermistor Input	
Temperature (NTC 10 kΩ @ 25°C)	
Input range	:-40 to +110°C
Accuracy	:±0.5% of span.
Bridge resistor	:10 kΩ.
Bridge supply	:5 V.
Resolution	:12 bit (4096 steps).
Digital Input	
Input voltage	:0 to 5 Vdc typical (50 Vdc maximum).
ON state	:<2.5 Vdc @ 3 mA (sink).
OFF state	:>3.5 Vdc (or open circuit).
Count rate	:30 Hz max. (pulse width ≥16.6 ms).

Digital Inputs (DI)

Function	:On/off state (or pulse count) to strategy from volt free contact, logic circuit (e.g. TTL, CMOS), open collector (transistor) or open drain (FET), or 24 Vac input.
Input voltage	:0 to 5 Vdc typical (50 Vdc maximum).
ON state	:<2.5 Vdc @ 270 µA (sink).
OFF state	:>3.5 Vdc (or open circuit).
Count rate	:30 Hz max. (pulse width ≥16.6 ms).

Analogue Outputs (AO)

Function	:Variable control from strategy of valve/ damper actuators, voltage to current/ pressure converters, relay modules, lighting dimmers, etc.
Voltage range	:0 to 10 Vdc.
Current	:up to 20 mA (source).
Resolution	:11 bit (2048 steps).
Accuracy	:±0.5% of span.

Thermistor Inputs (TI)

Temperature (NTC 10 kΩ @ 25°C)	
Input range	:-40 to +110°C
Accuracy	:±0.5% of span.
Bridge Resistor	:10 kΩ.
Bridge Supply	:5 V.
Resolution	:12 bit (4096 steps).

Digital/Relay Outputs (DO)

Function	:Single pole changeover control from strategy for general purpose use.
Contact Rating	5 A @ 240 Vac (resistive); 5 A @ 30 Vdc (resistive); 2 A @ 24 Vdc. *Note: To meet safety requirements each bank of four relay outputs must all be switching either low voltage or mains voltage but never both. If switching mains voltage they must be the same phase and polarity. Arc suppression circuit (RC) recommended for inductive loads, see TG200208. UL rating applies up to 240 Vac (120 VA) maximum.*
Override Switch (HOA variants only)	
Hand	:Manual override ON (relay closed)
Off	:Manual override OFF (relay open)
Auto	:Normal operation (relay follows output)

INDICATORS

Power	:Green LED.
Watchdog	:Red LED.
I/O Bus	:Red LED.
Digital Inputs	:Yellow LED *(UI and DO variants only)*.
Analogue Outputs	:Yellow LED *(AO variants only)*.
Relay Outputs	:Yellow LED *(DO variants only)*.
Manual Override	:Red LED *(HOA variants only)*
Input Polarity Error	:Red LED *(DI variants only)*
Aux Current Overload	:Red LED *(AO variants only)*

SPECIFICATION (continued)

MECHANICAL

Dimensions (WxHxD)	:130 mm (5.12”) x 150 mm (5.91”) x 46 mm (1.8”).
Material	:Flame Retardant Polycarbonate.
Weight	:0.322 kg (0.73 lb).
Mounting	:TS35 DIN Rail (EN500022).

Connectors

I/O Bus	:5-way plug-in connector for use with: XCITE/IC rigid interconnector, XCITE/CC breakout connector or XCITE/TERM terminator.
Inputs/Outputs	:2 part connectors (0.2” pitch) with rising cage clamp screw terminals.
Cable Size	:0.14 to 2.5 mm^2 (22 to 12 AWG). *For UL compliance the input power connections must be made using 18 AWG or larger wire rated at least 90°C (194°F).*
Screen Terminals	:rising cage clamp screw terminals
Cable Size	:0.14 to 2.5 mm^2 (22 to 12 AWG). *For UL compliance the input power connections must be made using 18 AWG or larger wire rated at least 90°C (194°F).*
Relay Outputs	:2 part connectors (0.3” pitch) with rising cage clamp screw terminals.
Cable Size	:0.14 to 2.5 mm^2 (22 to 12 AWG). *For UL compliance the input power connections must be made using 18 AWG or larger wire rated at least 90°C (194°F).*

ENVIRONMENTAL

EMC	:EN61326-1:2006.
Immunity	:Table 2 - for equipment intended for use in industrial locations.
Emissions	:Class B.
Safety	
EU	:EN61010-1:2010.
USA/Canada	:UL rated as ‘UL916 listed accessory to open energy management equipment’.
Canada	:CSA22.2 No. 205-M1983 - Signal Equipment.
Ambient Limits	
Storage	:-10°C (+14°F) to 50°C (122°F).
Operating	:0°C (32°F) to 45°C (113°F).
Humidity	:0 to 90% RH non-condensing.
Altitude	:<2000 m (6562’).
Pollution Degree	:2 (Only non-conducting pollution occurs).
Protection	:IP20, NEMA1.

Please send any comments about this or any other Trend technical publication to techpubs@trendcontrols.com

Trend Control Systems Limited

Albery House, Springfield Road, Horsham, West Sussex, RH12 2PQ, UK. Tel:+44 (0)1403 211888 Fax:+44 (0)1403 241608 www.trendcontrols.com