Data Sheet

IQecoVAV/.., IQeco39

BACnet MS/TP Terminal Unit Controller

IQecoVAV/.., IQeco39 BACnet Controller

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Description

The IQ®eco is a terminal unit controller for use with BACnet over MS/TP. It can communicate with other IQecos over the BACnet MS/TP network, and with Trend networked devices via an IQ4NC. It has an optional actuator and pressure sensor which facilitates its use as a VAV controller.

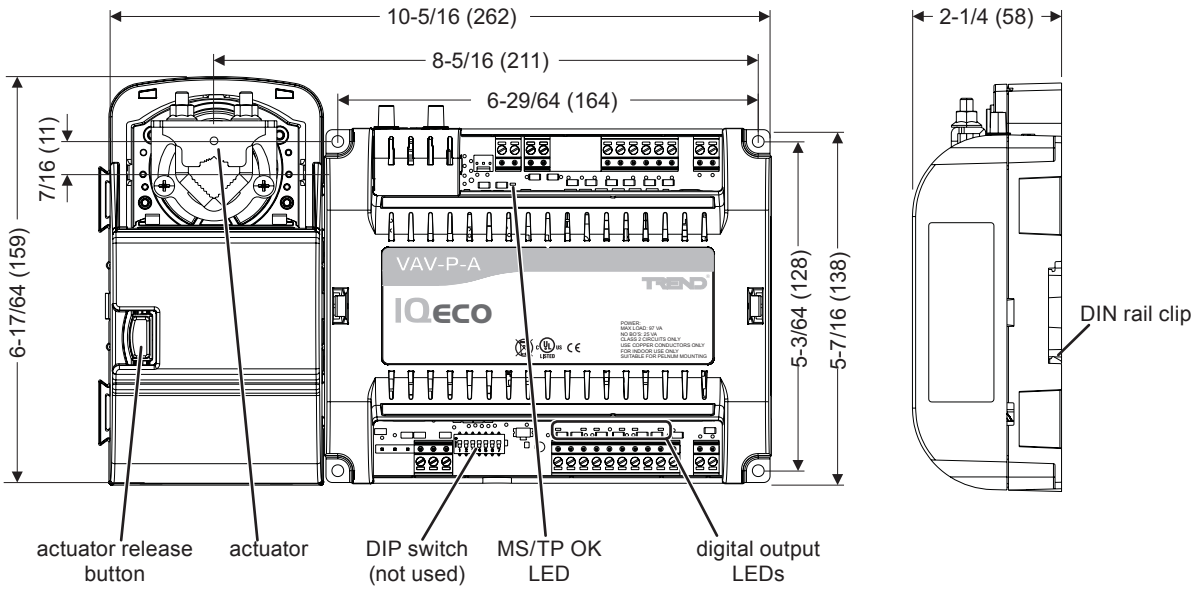
It has a maximum of 17 I/O points.

Features

- Fully compatible with the IQ system.
- BACnet over MS/TP (WSP certified)
- Non-volatile memory, no battery required.
- 24 Vac input power
- I/O configurable by software only (no links)

Physical

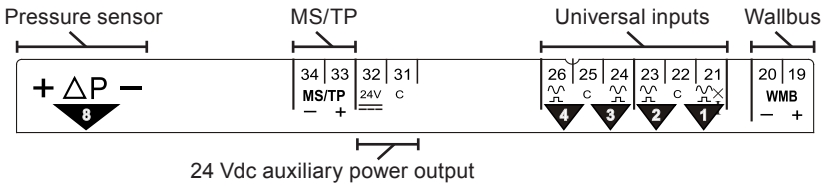
IQecoVAV/../PA/ Dimensions



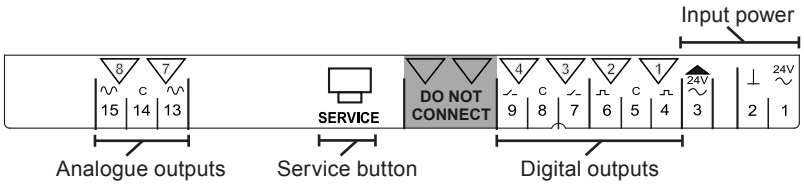
Physical (continued)

IQecoVAV/../PA/ Terminal Labels

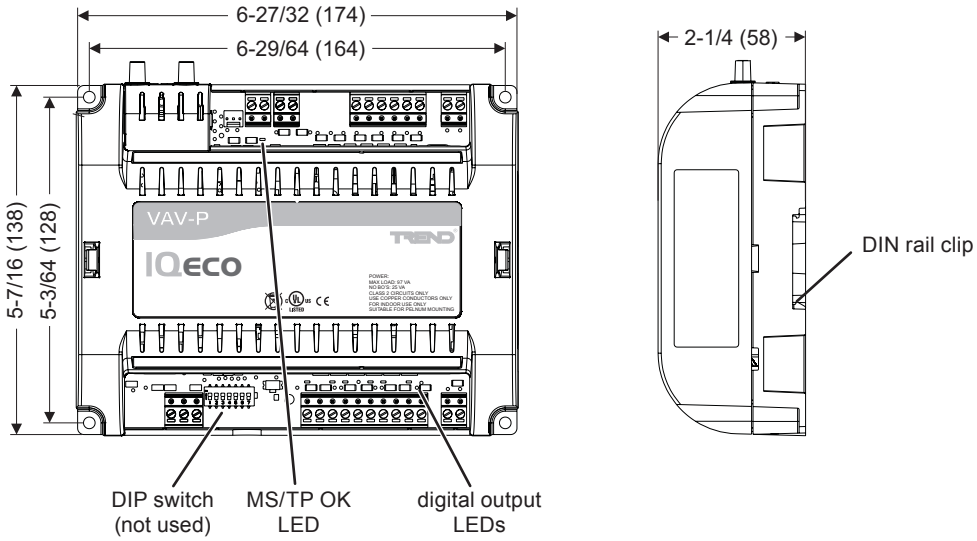
Upper Label



Lower Label

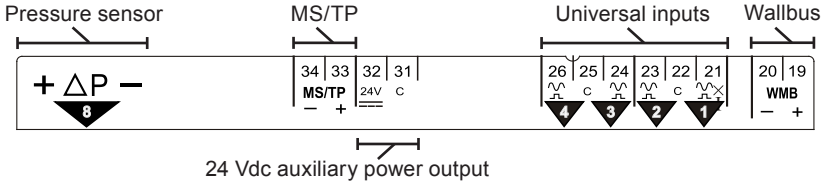


IQecoVAV/../P/ Dimensions



IQecoVAV/../P/ Terminal Labels

Upper Label



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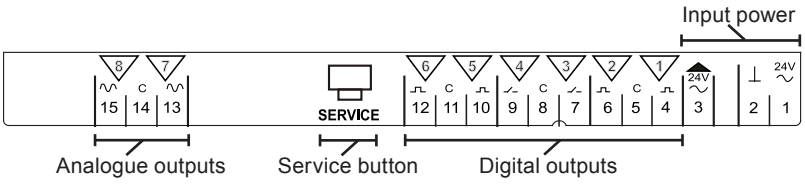
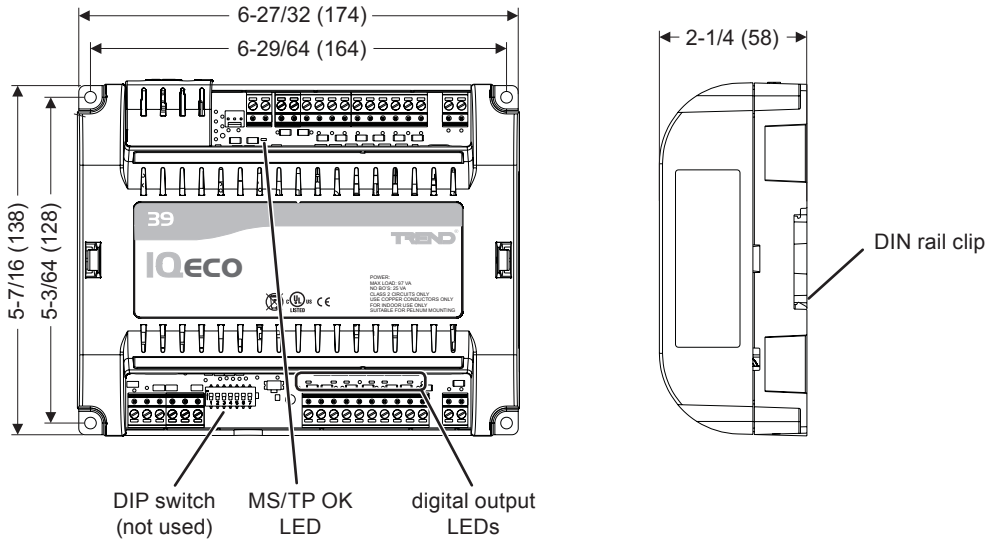


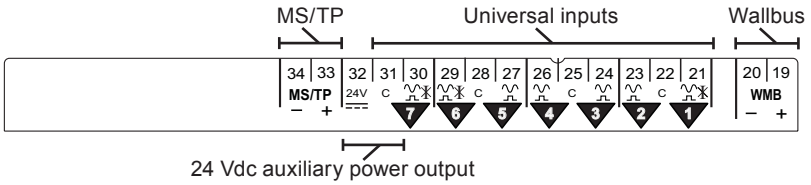
Physical (continued)

IQeco39 Dimensions



IQeco39 Terminal Labels

Upper Label



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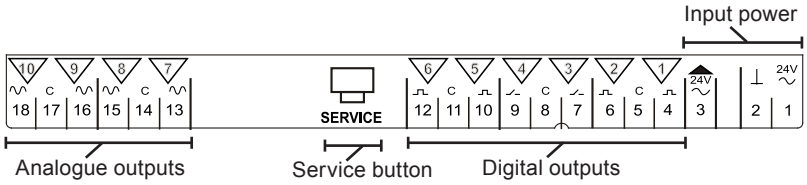


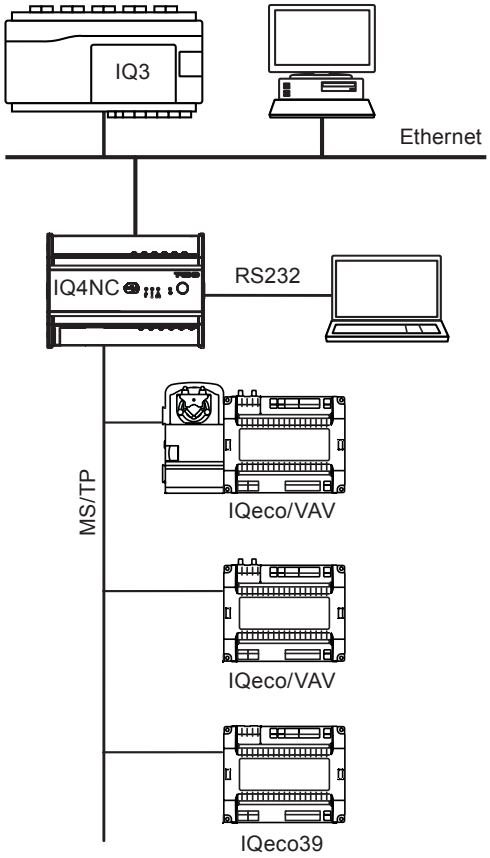
FUNCTIONALITY

The IQeco consists of a generic IQeco series shell (core hardware and firmware) with specific additional hardware (actuator and pressure sensor). The strategy defines its HVAC equipment interaction and is fully configurable but some versions of IQeco are supplied pre-programmed with a default strategy.

The IQeco functionality can be divided into four sections: system, hardware, firmware, and strategy.

SYSTEM

Trend System



The IQecos will connect together using an MS/TP trunk. The MS/TP trunk extends from an IQ4NC which acts as a router between Ethernet and the MS/TP trunk. The IQ4NC allows IQecos to communicate with other Trend devices on the Trend network that are operating on other network media. There can only be 1 IQ4NC on the trunk.

The IQ4NC may be configured to obtain values from the IQecos and display them on web pages.

BACnet Communications
The IQeco controller is certified as a BACnet Application Specific Controller (B-ASC) by WSP Cert. It uses the BACnet trunk as its communications network. It will support the following BACnet communications:

- BACnet devices (workstations, controllers) can communicate with the IQecos using BACnet protocol.
- The BACnet IC Comms Data From module can receive unconfirmed COV messages from another BACnet device.

However, IQeco cannot provide BACnet alarm and event notification (BACnet alarms), nor can it provide BACnet trending (plots).

A full specification of the objects, properties, and BIBBS (BACnet Interoperability Building Blocks) supported by the IQeco are given in the IQeco PICS document, Product Implementation Conformance Statement, (TP201091).

Out of the Box Operation

A pre-configured IQeco will commence to run its control strategy once it is installed and powered up. It will control the HVAC equipment according to its current parameter settings. So an IQecoVAV out of the box will run the default VAV strategy.

Note that the IQecoVAV is supplied with a default control strategy whereas the IQeco39 is supplied with an empty strategy. See 'Library/Programmable Strategies', page 15.

IQeco will try and form a network with any other Trend device on the MS/TP trunk. If other IQecos are present they will try to form a network together. As a result, attribute type IC comms set up for communication between the controllers will operate successfully.

BACnet communications will work with default settings, but it may be necessary to use the IQ4NC and SET (System Engineering Tool) to set up addresses (e.g. avoid duplicate addresses, set specific device instances etc.) and other parameters. After this set up, SET and the IQ4NC can be removed, although thereafter there will be no Trend Communications with the IQeco. Note that when using IQ4NC to commission a network, ensure any other router is disconnected.

If IQecos and an IQ4NC are connected as a system 'out of the box' they will form a network, the IQ4NC will give the IQecos its default Lan address (9), and the controllers will all be accessible to a supervisor or tool by way of the IQ4NC's Ethernet or serial port connections (although there is a remote chance of an address clash as described in the IQeco Configuration Manual TE201089).

IQeco Addresses

The IQeco controllers will build a Trend Lan with the IQ4NC as its INC (Internetwork Node Controller). There can only be one Lan on the BACnet trunk and the Lan number is configured in the IQ4NC. The Lan number will be read-only in the IQeco and will be set up when it is installed by its IQ4NC.

There can be only one IQ4NC on the BACnet trunk, and the IQ4NC cannot be on the same Lan as an IQ3 on the Ethernet internetwork.

The IQeco's Trend device address is set up in the factory on a rolling basis in the range 11 to 119. So in a batch of IQecos, each will have a different device address (printed on the unit's label along with its unique Serial Number).

An IQeco may be re-addressed by the Addressing Applet in SET (running on a PC connected to the Trend network.)

New addresses should be written on the unit's label which has a tear-off adhesive label strip with serial number (both as text and as a small barcode), and address information which can be used for a paper record e.g. a log book. A second large adhesive label is supplied to be mounted outside the metal work containing the IQeco with similar information. This will also have the serial number as text and as a barcode; this can be read by a barcode reader.

There can be the IQ4NC with up to 64 IQeco controllers or other BACnet devices on the BACnet trunk. The IQecos should use Trend device addresses in the range of 11 to 119. (The IQ4NC defaults to Lan 9, device address 9 with its vCNCs at addresses 1 and 4).

The IQeco's BACnet MAC address will be the same as its Trend device address. *Note that the IQ4NC (with Trend device address 126) will have a default BACnet MAC address of zero (it can be changed, but is recommended to be left at zero).*

Other non-Trend MS/TP master and slave devices can be added to the trunk, but their presence may compromise the physical network loading and bandwidth. Care must be taken to avoid a BACnet MAC address clash. Master devices are required to use BACnet MAC addresses in the range 0 to 127, and slave devices are required to use BACnet MAC addresses 128 to 254.

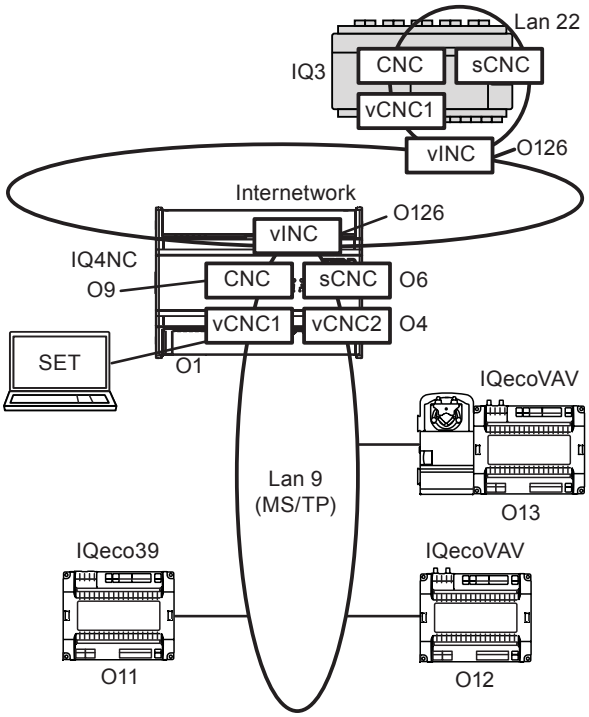
Using BACnet comms the IQeco is either addressed by its BACnet Device Instance, or by its BACnet Network Number and BACnet MAC address.

The IQeco's BACnet Device Instance will default to a function of the IQeco's Trend Lan Number and Device Address (Lan number x 1000 + Device Address), but may be changed in the IQeco's BACnet Application network module.

The BACnet Network Number is held in the IQ4NC, and is normally equal to the IQ4NC's Trend Lan number, but may be changed in the IQ4NC's BACnet MSTP network module.

Note: If communicating with an IQeco through a BACnet router, communication with the IQeco is only possible using BACnet protocol. Trend communications will not work unless the router is an IQ4NC.

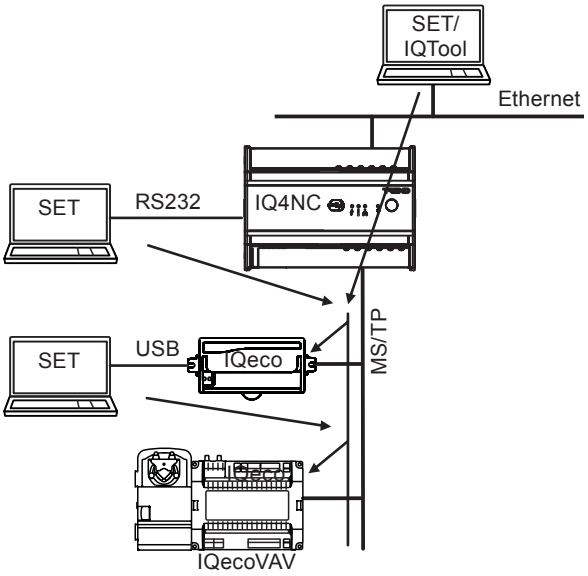
The diagram below shows an example logical network with the INCs in the IQ4NC and IQ3 forming an internetwork. The IQecos on the MS/TP trunk form a single Lan. A PC (running SET) is connected by way of the vCNC in the IQ4NC.



System Engineering Tool (SET)

SET is installed and run on a PC/laptop and can communicate with the IQecos over the Trend network by way of the IQ4NC or over RS232 using the IQ4NC's supervisor port..

Note that SET can also connect to an IQeco VAV, 39 via the USB port on an IQeco 31, 35 or 38.



The Addresser Applet facilitates the addressing of a Lan of IQecos on an MS/TP trunk. It enables the discovery of the IQecos, either manually (by pressing their Service buttons or scanning the barcode label) or automatically. It will also facilitate resolving duplicate addresses.

The Monitor Applet can be used to monitor or change strategy parameters. Templates have been provided for the standard strategies (solutions) which show the key parameters relevant to the strategy in various views. The user should create templates for custom (user-created) strategies.

The Firmware Upgrade Applet will upgrade the firmware in one or many IQecos. It may be necessary to upgrade the strategy in which case its strategy should be uploaded first and upgraded by SET, and downloaded back to the IQeco after the firmware upgrade.

HARDWARE

Box

The IQeco is a small terminal controller designed for surface or DIN rail mounting inside terminal units. It has a Noryl HS2000X GY2D015 (material) plastic housing.

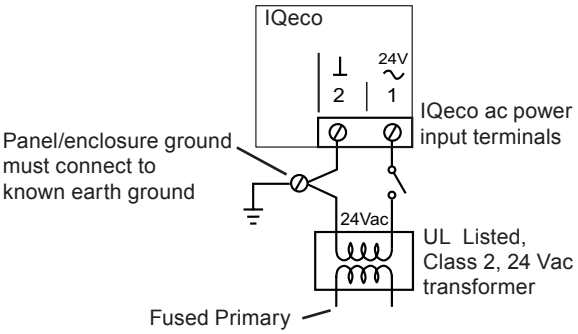
The integral actuator unit (supplied with IQecoVAV/../PA/) is in a separate unit which is clipped to the side of the main controller unit. It is normally supplied mounted on the left of the controller, but it may be removed and clipped to the other side. In addition its direction of rotation can be changed.

Power Supply

The IQeco requires 24 Vac ±15%, 50/60 Hz, at up to 97 VA, which consists of 48 VA maximum load on terminal 1 (including full power to outputs 5 and 6) and 49 VA maximum load on terminal 3.

Minimum power (with terminal 3 disconnected) is 25 VA which includes power to the actuator.

The 24 Vac uses an half wave rectifier internal power supply unit. This enables multiple controllers with half wave power supplies to be powered from a single grounded transformer but the supply polarity must be maintained across all units supplied from the same transformer.



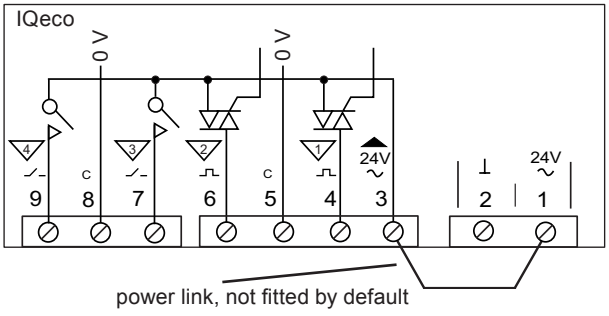
The input power neutral must be earthed (grounded) to the panel/enclosure ground at the transformer secondary. The ac power input neutral is internally connected to the IQeco electronics earth (ground).

The 24V supply must include a suitably rated switch in close proximity and be clearly marked as the disconnecting device for the unit. Do not position the equipment so that the disconnecting device is difficult to operate.

> ⚠ *Note that the IQeco must be earthed (grounded), using its power supply neutral or common terminal.*

The power to the two triac outputs OUT1, OUT2, and two relay outputs, OUT3, OUT4 is supplied from the external terminal 3 (24 Vac). This can be linked to the power input terminal 1 (24 Vac), or it can be connected to an external 24 Vac supply.

The link between terminals 1 and 3 is not fitted by default.



BACnet MS/TP

The IQeco behaves as a master on the MS/TP trunk. MS/TP (master-slave token passing) is based on the two wire RS485 network. It can operate at speeds from 9k6 baud to 76k8 baud; 76k8 baud is recommended for best performance. The baud rate is set in the IQ4NC, and the IQeco automatically sets itself to the same baud rate. All devices on the trunk must use the same baud rate.

Note: The MS/TP network has different requirements to the IQL LONWORKS® network.

All MS/TP devices (IQecos, or third party devices) must have their power supply neutral or ground terminal connected to earth, in conjunction with normal safety practices.

The MS/TP trunk should be wired as a straight bus (not loop or star). It should use tinned copper, screened, twisted-pair cable with characteristic impedance between 100 and 130 ohms. Distributed capacitance between conductors shall be less than 100 pF per meter (30 pF per foot).

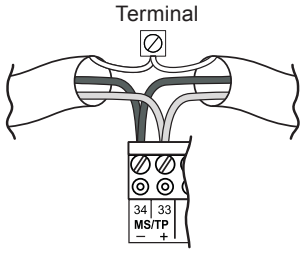
Distributed capacitance between conductors and screen shall be less that 200 pF per meter (60 pF per foot). Foil or braided screens are acceptable.

The maximum recommended length of an MS/TP segment is 1200 meters (4000 feet) with AWG 18 (0.82 mm^2) cross section area cable. The use of greater distances and/or different wire gauges shall comply with the electrical specifications of EIA-485. Cables of a smaller gauge will result in shorter maxiumum distances. Details of cables are given in the TP/... Twisted Pair Cable Data Sheet (TA200541).

Matched terminating resistors (±1%, ¼ Watt, range 100 to 130 ohms) are required.

The IQ4NC provides network biassing (470 ohms); a maximum of two devices on the network can provide network biassing.

Up to 3 repeaters may be used. Each MS/TP segment must have a single point screen ground. Do not ground the MS/TP screen using a controller terminal. Do not ground both ends of the screen. At connecting points, tie the screen through a terminal, for example:



Failure to comply with these practices will result in significant impairment of the communication performance.

For detailed information about wiring the MS/TP trunk see the IQecoVAV.., IQeco39 Installation Instructions - Mounting (TG201088).

There may be the IQ4NC and up to 64 IQecos or other manufacturer's devices on the trunk.

A separate limitation is that the IQeco presents a ¼ BACnet 'unit' load (ref. EIA-485), as does the IQ4NC. Other manufacturer's devices should be considered as an entire 'unit' load unless otherwise specified. The MS/TP segment supports up to 32 'unit' loads.

Indicators

MS/TP OK: On power up the green LED flashes for 100 ms each time a message is transmitted by the IQeco, after which it stays on indicating that the IQeco has successfully communicated with at least one other Trend device on the MS/TP network. If the IQeco does not receive any messages (i.e. a deaf IQeco), it will flash every 800 ms for 700 ms. This indicator is also used in service button mode - see 'Service Button Mode' below.

Digital Output State: Each digital output has a greed LED adjacent to the terminals which will illuminate when the output is energised and can be used for commissioning and fault finding.

Service Button

The service button is used to identify the IQeco to the Addresser Applet (in SET), to reset the IQeco, and to enter service button mode.

Identify the IQeco to the Addresser Applet: Pressing the IQeco's service button generates a message which identifies the IQeco by means of its unique serial number; this can be interpreted by system tools and can be used to find the IQeco's device address and Lan number. An alternative method of identifying the IQeco is to use a barcode scanner.

Reset the IQeco: Holding down the button as the unit is powered up will cause a strategy clear down. If the button is held down between 5 s and 15 s the IQeco is returned to factory defaults (RTFD) and after the reset it will start running its 'out of the factory' strategy. If the button is held down between 15 s and 30 s then there will be no running strategy (although a subsequent RTFD would restore the 'out of the factory' strategy). The IQeco should be then be reconfigured from scratch.

Either reset will set Address module parameters as follows: Local Address to 119; Identifier, Attributes (E, F) and the Supervisor Port Address cleared. For details of these procedures see the IQeco Configuration Manual (TE201089).

Service Button Mode: Holding down the service button for 2 to 5 s when the unit is already powered up will cause the IQeco to enter service button mode.

This mode makes use of virtual input channels (IN101 to IN108). The real input channels, (IN1 to IN9) described below, have external connections, whereas the virtual input channels have no external connections but can be set to a digital state as a result of the service button presses. The virtual input channels can be connected to external type digital input modules in the same way as for the real input channels and then the module outputs may be used in the strategy.

The virtual input channels will normally be off, but by pressing the button in a defined sequence, one of the channels may be set on for one pass of the sequence table.

On entry into service button mode the 'MS/TP OK' LED will flash rapidly for 1 s; when the flashing stops this indicates the start of selection phase 1.

There are 3 selection phases in succession; in each phase the button may be pressed or not pressed. At the end of each phase the LED will flash once to confirm no press, and twice to confirm a press. The virtual input channel is selected as shown in the table below where a tick refers to a button press and a cross means no press.

	101	102	103	104	105	106	107	108
Phase 1	×	✓	×	✓	×	✓	×	✓
Phase 2	×	×	✓	✓	×	×	✓	✓
Phase 3	×	×	×	×	✓	✓	✓	✓

For example, to select channel 106, the button must be pressed during phases 1 and 3.

Service Button (continued)

After selection phase 3 the LED will flash rapidly and the button must be pressed to confirm the selection made during phases 1 to 3; if the button is not pressed no action will occur. If the button is pressed, the selected virtual input channel will switch on for one pass of the sequence table.

Although the use of the service button in service button mode is determined by the strategy, all the IQecoVAV/.., 39 standard strategy solutions make use of the service button mode as follows:

	Function
IN105	Switch on Occupation for Lan
IN106	Switch off Occupation for Lan
IN107	Switch on Occupation for Unit
IN108	Switch off Occupation for Unit

The strategy will record the 'on' input and clear it when the appropriate 'off' input is selected.

Backup

The data (shell firmware, strategy, parameters) is stored in flash memory which is non-volatile in the case of power failure. Changes to the address module are stored immediately but for other parameter changes, in order to prolong the life of the flash memory, they are written to flash: every 2 hours starting at at midnight, after an archive instruction, on data entry by RD-WMB (wallbus), or on service button operation.

The tools (e.g. SET) will send the archive instruction after the parameter changes. Changes from IC Comms will get stored as described above.

Barcode Scanner

A large barcode label is suppled with the unit. This is intended to be mounted on the outside of the metal work containing the IQeco; this will enable the label to be scanned at a distance by a barcode scanner. *Note that the small barcode labels can be collected together and scanned in when required.*

The scanner should conform to the following requirements:

- Laser scanner able to read 'code 128 auto'.
- It must be able to work close up and from about 3.5 m (12') away. The distance it can read depends on the user requirements.

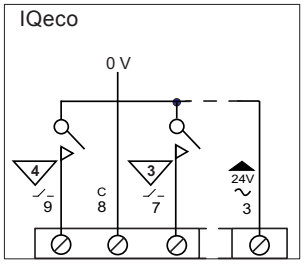
Inputs and Outputs

The I/O channels available vary with the IQeco type as shown in the table below:

		IQecoVAV/.../PA	IQecoVAV/../P	IQeco39
Outputs	Relay (supplied from terminal 3)	2	2	2
	Digital (supplied from terminal 3)	2	2	2
	Digital (supplied from internal 24V supply)	0	2	2
	Analogue	2	2	4
Inputs	Universal (voltage, thermistor or digital)	1	1	3
	Universal (voltage, thermistor, digital or current)	3	3	4
	Pressure Sensor	1	1	0
Actuator		1	0	0

Relay Outputs
2 channels (OUT3, OUT4)

NO relay, switching 24 Vac, 0.5 A maximum.



The 24 Vac supply (terminal 3, 24 Vac) to the relays (OUT3, OUT4) and triacs (OUT1, OUT2) can be looped back from the 24 Vac input power supply or can be connected to an additional power supply.

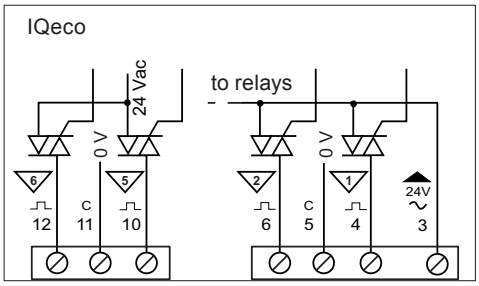
Each output has an LED (green) adjacent to the terminals which will illuminate when the output is energised and can be used for commissioning and fault finding.

Arc suppression is recommended, (see Relay Output Arc Suppression Installation Instructions (TG200208)).

Digital Outputs
IQeco39, IQecoVAV/../P/: 4 channels (OUT1, OUT2, OUT5, OUT6)
IQecoVAV/../PA/: 2 channels (OUT1, OUT2)

Note: OUT5 and OUT6 are used for actuator supply on IQecoVAV/PA/ and must not be used for any other purpose.

Switching 24 Vac, 0.5 A maximum



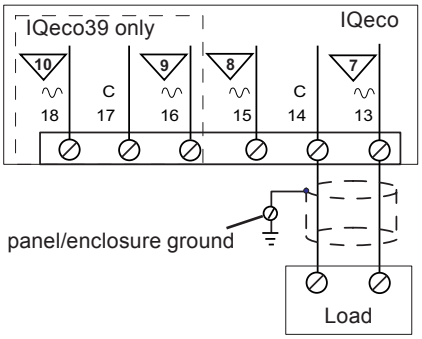
The 24 Vac supply (terminal 3, 24 Vac) to the relays (OUT3, OUT4) and triacs (OUT1, OUT2) can be looped back from the 24 Vac input power supply or can be connected to an additional power supply.

Outputs OUT5 and OUT6 are supplied from an internal 24 Vac supply, not from terminal 3.

Each output has an LED (green) adjacent to the terminals which will illuminate when the output is energised and can be used for commissioning and fault finding.

Analogue Outputs (OUT7 to OUT10)
IQeco39: 4 channels (OUT7, OUT8, OUT9, OUT10)
IQecoVAV: 2 channels (OUT7, OUT8)

0 to 10 V at 10mA maximum (load >1 kohm)

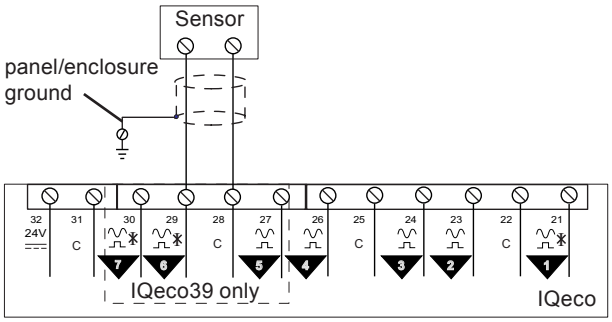


18 AWG 2 wire twisted screened cable should be used with the screen connected to the panel/enclosure ground and unterminated at far end. Connect the return to the central C terminal (e.g. 14 C) not to an input common. The above diagram shows wiring for OUT7.

Universal Inputs
IQeco39: 7 channels (IN1, IN2, IN3, IN4, IN5, IN6, IN7)
IQecoVAV: 4 channels (IN1, IN2, IN3, IN4)

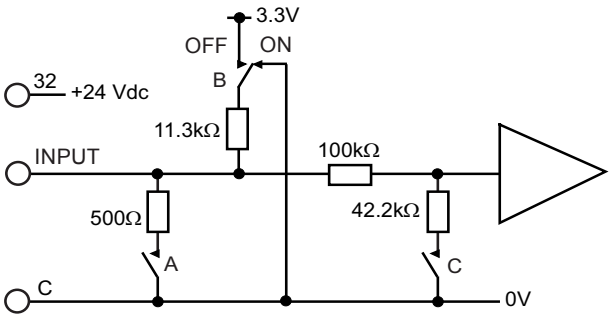
The function of each input can be selected as follows:

IN1, IN6 & IN7: voltage, thermistor or digital
IN2 to IN5: voltage, thermistor, digital or current
IN6, IN7: voltage, thermistor or digital



18 AWG 2-wire twisted screened cable should be used for wiring the inputs, with the screen connected to the panel/enclosure ground and unterminated at far end as shown for IN6 in the diagram above.

The 24 Vdc auxiliary output power (terminal 32, 24V) can be used to power sensors or input devices.



Input type	Switch A	Switch B	Switch C
Current	ON	ON	off
Voltage	off	ON	ON
Thermistor	off	off	off
Digital	off	off	off

The universal input channels can either be voltage input (0 to 10 V), variable resistance input (0 to 29 kohm), or a digital input (volt free contact/open collector). IN2 to IN5 can also be current input (0 to 20 mA). The input type is set automatically by strategy configuration (rather than having to also set hardware links) and this will switch in the required resistors using switches A, B, and C. These switches are set appropriately by connecting the channel in the strategy to a digital input module or a sensor module (sensor type defines switches).

Switch A (Current) is only present in IN2 to IN5. Inputs 1, 5, and 6 have the ✱ icon shown to indicate current input not available.

Universal Inputs (continued)
The **thermistor** input can be used for a thermistor or a potentiometer:

Thermistor inputs are scaled for a standard Trend thermistor (10 kohm at 25 °C, 77 °F). Sensor types are set up for 0 to +40°C (10 kohm thermistor Deg C), +32 to +104°F (10 kohm thermistor degF), -29 to +104°C (10 kohm thermistor degC Outside Air), and -20 to +220°F (10 kohm thermistor degF Outside Air).

A potentiometer input can be used for a standard Trend potentiometer (1 kohm to 11 kohm) or a fan speed switch (i.e. as in TB/TS/KEF). Sensor types are set up for a knob with half degree trim (1 to 11 kohm potentiometer 0.5 deg trim) and a fan speed switch (Fan Speed switch (TBTS/KEF)).

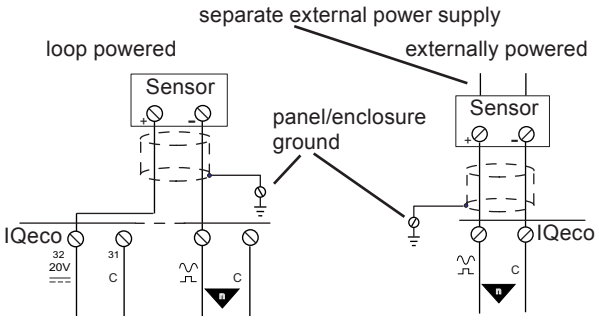
The **voltage input** is for 0 to 10 Vdc input (sensor type - Voltage 0 to 10V).

The **digital input** an be used for a volt free contact, or for an open collector. For digital inputs no sensor type is selected so all thee switches (A, B, C) are de-energised as required for digital input signal conditioning.

The volt free contact has a nominal wetting current of 290 µA. The input is on when the contact is closed. There is no polarity.

The open collector or open drain (FET) must be able to sink 300 µA. When the transistor or FET conducts, the digital input will be on. Polarity must be observed.

The **current input** supports 4 to 20 mA (sensor type - Current 4 to 20 mA). The current input may be either loop powered or external powered; the type is selected by connecting the sensor to different terminals as shown in the diagrams below.

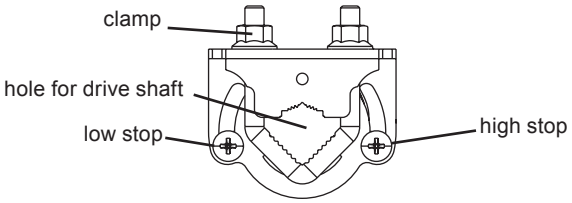


Auxiliary Power Output

24 Vdc is available on terminal 32 to supply loop powered sensors as shown in the diagrams above. It is rated as 24 Vdc ±15%, 100 mA.

Actuator

The integral rotary actuator will clamp to a round or square shaft of 3/8” to 1/2” (10 mm to 13 mm) equivalent diameter. The actuator will rotate over a maximum range of 12° to 95°. The range can be limited by two motor stops (which prevent the actuator overdriving the damper). This is done by rotating the damper to its central position, clamping the drive to the damper, rotating the damper completely closed and setting the low stop, and then rotating the damper completely open and setting the high stop.



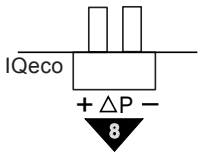
An 8 mm spanner using 8 to 10 Nm torque is required to adjust the clamp.

If the damper stops are changed it may be necessary to change the VAV Damper driver full scale drive time. The time should be measured in seconds from fully closed to fully open and the parameter changed if necessary.

The actuator unit can be mounted either side of the unit; the internal cable connection can be reversed to reverse the actuator action.

Pressure Sensor (IN8)

This is only available on IQecoVAV/PA/, IQeco/VAV/P/.



The differential pressure sensor measures from 0 to 1.5 inches water column (0 to 375 Pa). It has two pressure tubes for connection to the airflow pickups on the duct work or the VAV box by using flexible plastic tubing (3/16" ID tubing). These tubes are polarised (+, -) and their polarity must be observed.

The zero offset is required to be locally calibrated during installation. The default VAV strategy supplied with IQecoVAV facilitates this; a switch (W14) can be set in all the IQecos on the MS/TP trunk when there is zero pressure in the ducts to setup their zero offsets. The SET/IQTool monitor task template provided with the default strategy solution can be used to apply the switch. It may also be used on selected IQecos if required.

If not usng the default VAV strategy, the DP Offset Adjustment applet (supplied with SET) should be used. The applet calculates the DP offset (when there is zero pressure in the duct) by working backwards from the air flow measurement through K factor compensation. The applet will normally require configuring by setting up the item references to DP Sensor (S?), Air Flow Sensor (S?), and K Factor Knob (K?).

Sensor types are set up for 0 to 1.5 inches water column (Onboard DP 1.5 inwc) and 0 to 375 Pa (Onboard DP 375 Pa).

The sensor measurement accuracy after local zero offset calibration is given in the specification section (at the rear of this document).

Note that the pressure measurement is for use within closed loop VAV control operation. The error figures are provided to allow absolute pressure (or corresponding flow rate) accuracy to be determined where an identifier of such is required.

The total error can be calculated from the quoted accuracies as follows:

$$\text{total error (Pa)} = \text{differential pressure} \times \frac{\text{accuracy}}{100} + \text{zero offset} + \text{non-linearity}$$

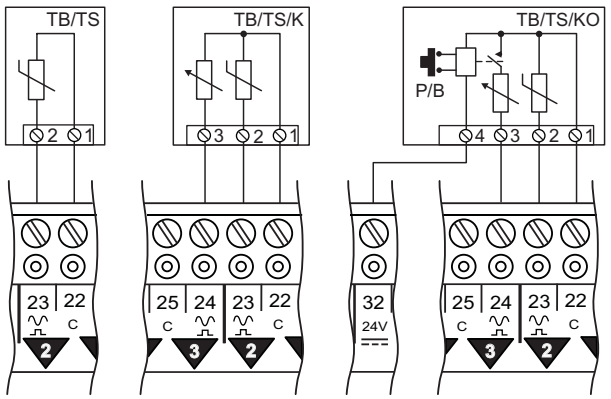
Please note that large cycles of temperature and/or pressure will introduce further zero offset errors which will require a further local calibration (as described above) to reduce errors to the values specified.

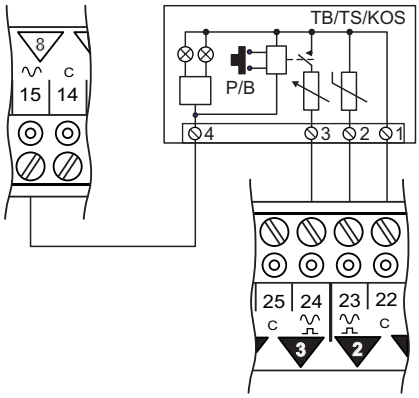
Note that any calibration for the box constant in the standard strategies should be done after local calibration for zero offset.

Sensors

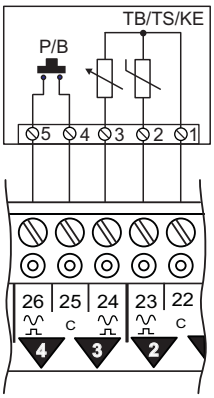
TB/TS Series: The TB/TS provides a wall mounting thermistor space sensor that can be connected to an IQeco input. The TB/TS/K also provides setpoint adjustment as a potentiometer input. The TB/TS/KO has the TB/TS/K features plus an occupation override push button. The TB/TS/KOS is similar to the TB/TO/KO but also has additional occupation status LEDs.

Examples of connecting the TB/TS series using the standard strategy mapping to the inputs are shown in the diagrams below:



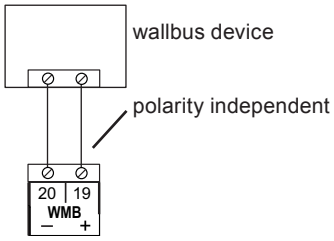


The TB/TS/KE is not used in the standard strategies but could be wired as shown below:



Wallbus

The wallbus facilitates the connection of a walbus device (e.g. room sensor or display). It is polarity independent; it should be wired with twisted pair cable, and will operate up to 60 m (200 ft).



The IQeco can only communicate with one wallbus device. See the device's data sheet for details.

FIRMWARE

The IQeco firmware may be upgraded over the network by way of the IQ4NC using the Firmware Upgrade Applet (in SET).

Strategy Modules

In the IQeco the number of each type of module may be adjusted to match the requirements of the application within the memory capacity of the controller. The IQeco has an absolute limit of 300 modules (excluding alarm log, sequence table and option module) of which 200 maximum can be sequenced. An empty IQeco contains address, time, program, and two network modules which reduce the additional number of modules to 295.

The available memory capacity is measured in ecobrIQs (IQeco ecobrIQs use different amounts of memory to IQ3 brIQs and should not be compared).

In addition the plot memory allows a maximum of 10,000 log points (2,000 records) shared between up to twenty plot modules (synchronised type only).

Although in most cases the number of modules is limited only by the memory capacity some module types have maximum number regardless of memory capacity.

The table below lists the modules available in the IQeco firmware and, where limits apply, the maximum number available.

Flexible indicates the only limit is available ecobrIQ capacity.

Module		Number
Address		1 (fixed)
Digital Input	Internal	Flexible
	External	Flexible
Alarm Destination	Trend Lan	Flexible (max 2)
Alarm Group		Flexible
Alarm Route		Flexible
*Alarm Log		1 (fixed)
Analogue Node		Flexible
Digital Byte		Flexible
Digital Input		Flexible
Directory		Flexible
Display		Flexible
Driver	Digital	Flexible
	Analogue	Flexible
	Time Proportional	Flexible
	Raise/Lower	Flexible
	Multistage	Flexible
Function	Filter	Flexible
	Rescale From	Flexible
	Rescale To	Flexible
	Square root	Flexible
	Adder/Scaler	Flexible
	Multiplier	Flexible
	Analogue Gate	Flexible
	Comparator	Flexible
	Hysteresis	Flexible
	A to D Converter	Flexible
	Divider	Flexible
	Proximity	Flexible
	Heatmeter	Flexible
	Integrator	Flexible
	Minimum	Flexible
	Maximum	Flexible
	Average	Flexible
	Power	Flexible

Module		Number
‡IC Comms	Data To	Flexible (max 30)
	Global To	
	Data From (analogue, bit, or byte)	
†I/O Module		1 (fixed)
Knob		Flexible
Logic	Combination	Flexible
	Timer	Flexible (max 10)
	Hours Run	Flexible
	Counter	Flexible
	D to A	Flexible
Loop		Flexible
Network	MS/TP	1 (fixed)
	BACnet Application	1 (fixed)
NTD		Flexible (max 32)
Option		1 (fixed)
††Plot	Synchronised	Flexible (max 20)
Program		1 (fixed)
Sensor	External	Flexible
	Internal	Flexible
Sensor type	Fixed	12 (fixed)
	Configurable	Flexible (max 100)
‡‡Sequence		1 (fixed)
Switch		Flexible
Time		1 (fixed)
User		1 (fixed)

* Holds up to 10 alarms
‡ Includes BACnet comms and BACnet U-COV support.
† For IQeco/Display
†† The maximum number of records for a plot is 1,000 (5,000 log points), but maximum total records shared between all plot modules is 2,000. The plot modules can record values between -32767 to + 32767.
‡‡ Contains 200 steps

For more details of individual modules see the IQeco Configuration Manual (TE201089).

The 12 fixed sensor types listed below are accessed by setting up the appropriate sensor type module number into the sensor module:

In SET, as the modules are created, a count is maintained of the module count, ecobrIQs, and log points used (1 plot record = 5 log points). An indication is given of the amount remaining. If a limit is exceeded, then SET will prohibit the creation of further modules as appropriate.

It is possible to create modules which are not numerically sequential so module lists can be non-continuous (e.g. L1, L2, L5, L7...).

Sensor Type Module No.	Name	Description
101	10kTherm DegC TBTS	Scales standard Trend thermistor (10kohm at 25°C).for working range 0 to 40 °C
102	Knob TB 0.5deg trim	For standard TB sensor knob (1k to 10kohm, -0.5 to +0.5)
103	Fan TBTS/ KEF	TB/TS/KEF fan speed scaled to enumeration (0, 1, 2, 3, 4 for off, Lo, Med., Hi, Auto respect.)
104	Current 4-20ma	scales 4 to 20 mA to 2 to 10
105	Volts 0-10V	scales 0 to 10 V to 0 to 10
106	Onboard DP 1.5inwc	IQLVAV, 39 differential pressure sensor output scaled to 0 to 1.5 inwc
107	Onboard DP 375Pa	IQLVAV, 39 differential pressure sensor output scaled to 0 to 375 Pa
108	10kTherm DegF TBTS	Scales standard Trend thermistor (10 kohm at 25 °C). for working range 23 to 122 °F
109	10kTherm DegC OAT	Scales standard Trend thermistor (10kohm at 25 °C) for working range -29 to +104 °C
110	10kTherm DegF OAT	Scales standard Trend thermistor (10 kohm at 25°C) for working range -20 to +220 °F
111	Fan TBTS/ KOF	TB/TS/KOF fan speed scaled to enumeration (0, 1, 2, 3, 4 for Off, Lo, Med., Hi, Auto respect.)
112	WMB Prescaled	For RD space sensor passes value into strategy unchanged

Identification

The IQeco will identify itself as an IQeco to w comms. A supervisor should be set up to detect it as an IQeco.

Alarms

The IQeco Configuration Manual (TE201089) fully describes alarms. The following alarms can be generated if the appropriate alarm modules are set up (group, route, destination modules):

Sensor alarms

Alarm	Code
SENSOR FAIL occurred	OUTL
SENSOR FAIL cleared	COUT
INPUT ERROR occurred	READ
INPUT ERROR cleared	O/K
HIGH VALUE occurred	HIGH
HIGH VALUE cleared	CHIH
LOW VALUE occurred	LOW
LOW VALUE cleared	CLOW

Digital Input Alarms

Alarm	Code
DIGIN OFF occurred	DI=0
DIGIN OFF cleared	CDI0
DIGIN ON occurred	DI=1
DIGIN ON cleared	CDI1

Loop

Alarm	Code
Setpoint Deviation	SDEV
Setpoint Clear	CSDV

They are same format as IQ alarms.

Note the MS/TP network alarms are generated by the IQ4NC.

Inter-Controller Communications

The IQecos may communicate with each other and IQ2, IQ3 (and IQL) controllers using Inter Controller Communications (peer to peer communications) using IQ System Lan/node addressing.

The IQeco is capable of initiating Data To, Global To, or Data From IC Comms. It will respond to Data To, Global To, Data From, and Max, Min Sum and Average comms. It cannot send IC Comms using BACnet Protocol.

The table below specifies the types of IC Comms with which the IQeco will operate.

Direction	Variable	Initiated by IQxx to this IQeco	Initiated in this IQeco to IQx
Data From	Analogue	Yes	Yes
Data From	Digital Byte	Yes	Yes
Data From	Digital Bit	Yes	Yes
Data To	Analogue	Yes	Yes
DataTo	Digital Byte	Yes	Yes
Data To	Digital Bit	Yes	Yes
Global To	Analogue	Yes	Yes
Global To	Digital Byte	Yes	Yes
Global To	Digital Bit	Yes	Yes
Minimum	Analogue	Yes	No
Maximum	Analogue	Yes	No
Sum	Analogue	Yes	No
Average	Analogue	Yes	No

*IQeco can only send IC Comms to sensors, analogue nodes, knobs, digital inputs digital bits, switches, and digital bytes. It can also send to drivers in other IQs (not to another IQeco) if using label matching item selection.

IQeco will not send alarm status bits with an analogue IC Comms but can process any that it receives.

Security

The IQeco can be protected by setting up a PIN in the user module. If the user forgets his PIN, a 'PIN of the day' may be obtained from Trend Technical Support.

Alternatively, the IQeco can be cleared down using the service button (see 'Reset the IQeco', page 7).

Time

The IQeco time module is supported by a software clock. It will respond to time synchronisation from an IQ3 timemaster (not from IQ2). It will request time synchronisation when it powers up, and the timemaster will synchronise all its time followers (e.g. IQeco) at midnight, when its time is edited, or when it performs a daylight saving time change.

Plots

The IQeco has up to 20 plot modules each of which can be connected to any analogue output.

The total maximum number of records is 2,000 (10,000 log points) which can be shared amongst the plot modules as required. The maximum number of records in one plot module is 1,000 (5,000 log points). The plot module is of synchronised type only.

The plots can be retrieved either as either single (max error 1%) or double (max error 0.01%) precision. The 963 (v3.1 or greater allows the precision to be selected.

The IQeco plots differ from synchronised type plots used in other IQs in that plot records that have been missed (e.g. due to power cycling) are not filled in so that the earlier records are moved forward for the time the power is off.

I/O Module

I/O module 2 is used to install the RD-WMB into the strategy. The RD-WMB sensor will appear as channel 1 on I/O module 2.

Power Management

Power Management is used to minimise the effect of thermic actuator inrush currents on the IQeco's peak current consumption. It is applied to time proportional driver modules and will stagger the turn on times of the pulse modulated waveforms between the drivers so that power will be applied to the outputs in sequence, and not at the same time.

The Address module's 'Power Managed' parameter is used to enable or disable the power management feature.

R/L Sync Mode

Raise lower synchronisation is used to ensure that the actuator without any positional feedback is at a defined position. The raise lower driver will attempt to do this in normal running by driving for the calculated time to reach the appropriate end stop plus full sale drive time when the input is ether zero or 100%.

The address module 'R/L Sync Mode' parameter enables further synchronisation for all raise/lower drivers in the IQeco to occur at midnight, power on, or soft restart by driving the actuator closed for 1.5 times its full scale drive time to ensure it's fully closed. The address module 'R/L Sync Mode' parameter can be set to either Disabled, Automatic, or Automatic Address Staggered.

If Automatic Address Staggered is selected, in order that all VAV units in a system do not operate their valves and dampers simultaneously, the controllers on the Lan will stagger their raise lower driver synchronisation according to their Lan device address. This will delay the synchronisation between 0 s to about 11 min. 26 s according to the address. See the IQeco Configuration Manual (TE201089) for details.

Each raise lower driver module has a 'Position Sync.' parameter. The raising edge of this input will cause that driver to perform synchronisation immediately. This enables the synchronisation to occur under strategy control whenever it is required.

Library/Programmable Strategies

The IQeco39 is supplied without a strategy. The two IQecoVAV models are supplied complete with a default VAV strategy (FCU VAV 2 Stage Electric Heater Strategy). These units each have two different order codes, one for the unit with its strategy in metric units, and one with its strategy in imperial units (see 'Order Codes', page 18).

These three IQeco versions are fully programmable using SET. The default strategy and the other standard strategies are available as strategy solutions to be downloaded by SET. These solutions are available in both imperial and metric versions.

Available strategy solutions:

FCU VAV 2 Stage Electric Heater Strategy (default)
FCU VAV LPHW Analogue Valve Strategy
FCU VAV LPHW Raise/Lower Valve Strategy

Live Adjustments

SET will allow Live Adjustments on an IQeco controller which enables viewing the current module values, and changing knobs and switches. It will also allow changes to parameters but not structural changes to the strategy (creating/deleting modules, changing module types, and changing connections).

Strategy Download/Upload

The strategy file upload or download is performed by SET via the IQ4NC using either the Ethernet port or the RS232 Supervisor port. It can also be done via the USB local engineering port on an IQeco31, 35, or 38; this requires the Trend USB driver to be installed.

FIELD MAINTENANCE

The IQeco Controller requires no routine maintenance.

The unit should cleaned occasionally with a cloth moistened with water in order to avoid buildup of dust or other contaminents. Disconnect power before carrying out any cleaning.

Warning: Contains no serviceable parts. Opening the unit exposes hazardous voltages

DISPOSAL

COSHH (Control of Substances Hazardous to Health - UK Government 2002) ASSESSMENT FOR DISPOSAL OF IQeco CONTROLLER. No parts affected.

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 should be disposed of by a suitable recycling centre.
Do not dispose of with normal household waste.
Do not burn.

COMPATIBILITY

IQeco v1:	An IQecoVAV/.., 39 with v1 firmware cannot be upgraded to v2 firmware.
Supervisor:	916 v1.3, IQView8, IQView v1.4 or greater, 963 v3.4 or greater
Tools:	SET v6.9
Wallbus devices:	RS-WMB, RD-WMB, RV-WMB.
IQ:	IQ4NC gateway. IQ3, IQ4, IQ2, IQL (IC Comms compatible). IQ3 timemaster only.
BACnet:	The IQeco controller is certified as a BACnet Application Specific Controller (B-ASC) by WSP Cert. Compatibility defined in the IQeco Product Implementation Conformance Statement, (TP201091).

INSTALLATION

The IQeco must be mounted either on DIN rail or flat surface using its 4 hole mounting. It should be installed inside an enclosure rated as IP20 (or equivalent) or outside normal reach (e.g. in a plenum).

These IQecos are rated as 'UL916 listed open energy management equipment'. For UL rating all IQeco controllers must be mounted inside an enclosure rated as IP20 (or equivalent).

The IQeco installation involves the following procedure:

Mounting the controller in position
Connecting to the damper shaft (if actuator fitted)
Connecting power input, do not power up
Earthing (grounding) the controller
Connecting MS/TP BACnet network
Terminating the I/O channels, leave unconnected
Powering up
Setting up address using Addresser Applet (in SET)
Checking network
Configuring the strategy using SET (if required) or change to alternative standard strategy solution
Testing strategy by using controller simulation mode in SET
Downloading strategy file using SET
Connecting I/O
Entering VAV box factor (VAV strategy only)
Calibrating pressure sensor zero offset (/PA, /P only)
Setting up actuator drive time (/PA only)
Configuring strategy parameters (if required) using IQTool
Testing the controller
Checking BACnet communications using SET
Configuring rest of system and test system

A full description of installing the unit is given in the IQecoVAV.., IQeco39 Installation Instructions - Mounting (TG201088) and the IQecoVAV..,IQeco39 Installation Instructions - Configuring, (TG201121).

If supplied with a custom strategy, also see appropriate strategy data sheet.

ORDER CODES

IQEVAVP/P/BAC/VAV2E/24VAC	IQecoVAV/P (with integral pressure sensor) + 4DO, 2AO, 4UI. Fully programmable. Supplied complete with FCU VAV 2 Stage Electric Heater Strategy (metric units).
IQecoVAV/VAV/BAC/P/PR/USA/24VAC	IQecoVAV/P (with integral pressure sensor) + 4DO, 2AO, 4UI. Fully programmable. Supplied complete with FCU VAV 2 Stage Electric Heater Strategy (imperial units).
IQEVAVPA/P/BAC/VAV2E/24VAC	IQecoVAV/PA (with integral actuator and pressure sensor) + 6DO, 2AO, 4UI. Fully programmable. Supplied complete with FCU VAV 2 Stage Electric Heater Strategy (metric units).
IQecoVAV/VAV/BAC/PA/PR/USA/24VAC	IQecoVAV/PA (with integral actuator and pressure sensor) + 6DO, 2AO, 4UI. Fully programmable. Supplied complete with FCU VAV 2 Stage Electric Heater Strategy (imperial units).
IQE39/P/BAC//24VAC	IQeco39, 6DO, 4 AO, 7UI. Fully programmable. Supplied with empty strategy.

Note that IQeco39 is not available in Europe, Middle East, and Asia (EMEA).

The IQecoVAV controllers are supplied with the FCU VAV 2 Stage Electric Heater Strategy (see data sheet TA201219 for details); this can be changed to one of the following strategies by downloading the appropriate standard strategy solution from SET:

FCU VAV LPHW Analogue Valve Strategy (strategy data sheet TA201220)
FCU VAV LPHW Raise/Lower Valve Strategy (strategy data sheet TA201221)

These strategies are available with either metric or imperial units. A strategy with metric units may be changed for a strategy with imperial units or vice versa by downloading the appropriate strategy solution using SET; the strategies with imperial units can be installed in SET by selecting a custom installation.

For example, **IQEVAVP/P/BAC/VAV2E/24VAC** has the FCU VAV 2 Stage Electric Heater Strategy (metric units) in the IQeco VAV P - English section. This should be reprogrammed by the standard solution which has the same name (but with a # suffix) from the IQeco VAV P - Imperial section.

SPECIFICATIONS

ELECTRICAL

Power Input Voltage :24 Vac ±15%, 50/60 Hz
Power Input Consumption
- Minimum :25 VA (terminal 3 disconnected) which includes power to the actuator.
- Maximum :97 VA, comprising 48 VA maximum load on terminal 1 (including full power to outputs 5 and 6) and 49 VA maximum load on terminal 3.

Power fail protection :Data stored in flash memory.
Clock accuracy :Software clock (1 minute resolution)

BACnet MS/TP
- Distance :Dependent on cable type and wire gauge as specifeid in EIA-485.
- Load 1/4 BACnet 'unit' load.
- Signalling :RS-485 signalling transceiver standard.
- Baud rate :9k6 to 76k8 baud.
- Termination :100 to 130 ohms matched each end.
- Addresses :recommended address range 11 to 74.

Auxiliary power output :24 Vdc ±15%, 100 mA maximum

Note: The MS/TP network has different requirements to the IQL LonWorks network

Wallbus Two wire bus for connection of a wallbus device (e.g. room sensor or display). Polarity independent. Use twisted pair cable up to 60 m (200 ft).

Inputs

IN1, IN6, IN7 :Universal inputs: (IN6 and IN7 only available on IQeco39). Can be set by software to voltage input (0 to 10 V), variable resistance input (0 to 20 kohms), or digital input (volt free contact/open collector)

IN2 to IN5 :Universal inputs: (IN5 only available on IQeco39) Can be voltage, resistance or digital input as above, plus current input (4 to 20 mA, from loop powered or external powered sensor).
- Voltage input :12 bit resolution. Minimum 60 dB series mode rejection at input power supply frequency. 0 to 10 V, input resistance 10 kohms, accuracy 50 mV equivalent to ±0.5% of span.
- Current input :12 bit resolution (4096 steps - effective). Minimum 60 dB series mode rejection at input power supply frequency. 4 to 20 mA, input resistance 500 ohms, accuracy 0.5% of span (i.e. 100 µA).
- Thermistor input :(potentiometer, thermistor, fan speed control). 0 to 200 kohms 12 bit resolution. Minimum 60 dB series mode rejection at input power supply frequency. Thermistor bridge resistor 11 kohms, accuracy 0.5% (200 ohms to 200 kohms).Bridge supply 3.3 V.
- Digital input :(volt free contact, open collector (or drain)). Count rate 30 Hz (minimum pulse width of 16.6 ms). 3.3 V supply through 11 kohms.
  - Volt free contact input :Wetting current = 300 µA nominal. (ON = closed contact.)
  - Open collector (or drain) input :Must be able to sink 300 µA . Must be earthed (grounded) to same earth (ground) as IQeco. Polarity dependent. (ON = transistor/FET conducts.)

Pressure Sensor :(IN8) Differential pressure sensor input. Calibrated to give 0 to 1.5 inwc (0 to 375 Pa).

The following sources of error apply over the range 18 to 22 °C (64 to 72 °F), after local zero offset calibration adjustment (see pressure sensor section, page 8). Note that the sources of error may vary within these limits over time and changes in temperature.

- zero offset error :±0.5 Pa, 0.002 inwc (typical)
  ±4.0 Pa, 0.016 inwc (maximum)
- span accuracy
  - 0 to 250 Pa :3 % (typical), 6 % (maximum)
  - 250 to 375 Pa :8 % (maximum)
- non-linearity :2% (maximum)

Outside 18 to 22 °C (64 to 72°F) the following additional factors apply:

- zero offset error :±0.05 Pa/°C, 0.00011 inwc/°F (typical)
  ±0.25 Pa/°C, 0.00056 inwc/°F (maximum)
- span accuracy :±0.75 %/°C, %/°F

Note: We would recommend that, before selecting this product for low volume air applications, the particular application's requirements are checked by the HVAC design engineer against this product's specification.

Outputs

OUT1, OUT2 :Digital outputs: Triac outputs equivalent to 24 Vac solid state relays. 24 Vac at 0.5 A maximum. Supplied from terminal 3.

OUT3, OUT4 :Digital outputs: Normally open, make only, single pole relay contacts. 24 Vac at 0.5 A maximum. Supplied from terminal 3. Arc suppression circuit (RC) should be fitted for inductive loads, see TG200208.

OUT5, OUT6 :Digital outputs: (Not available on IQecoVAV/../PA as used for actuator). Triac outputs equivalent to 24 Vac solid state relays. 24 Vac at 0.5 A maximum. Supplied from internal 24 Vac.

OUT7, OUT8, OUT9, OUT10 :Analogue outputs: (OUT9, OUT10 only available on IQeco39). 0 to 10 V at 10mA maximum (load >1 kohm). 11 bit resolution. 0 to 10 V with 10 mA current limit. Accuracy ±5% of span

Actuator
- Rated torque :44 lb-in (5 Nm)
- Range of travel :12° to 95 ° with adjustable mechanical stops
- Rotation speed :1.0 °/s nominal at 60 Hz supply
- Shaft :Accepts round or square shafts with equivalent diameter 3/8" to 1/2" (10 mm to 13 mm). Minimum shaft length 1-9/16" (40 mm)
- Manual override :pushbutton clutch

SPECIFICATIONS (continued)

INDICATORS

MS/TP OK	:(green) On power up flashes for 100 ms each message sent by IQeco. ON indicates successful communication with another Trend MS/TP device. Flashing on 700 mS every 800 ms indicates communications failure on the MS/TP network.
DO1 to DO6	:(green) LED per channel. LED is illuminated when channel is on.

MECHANICAL

Dimensions

IQecoVAV/../PA/	:10 5/16" (262 mm) x 6 17/64" (159 mm) x 2 1/4" (58 mm)
IQecoVAV/../P/	:6 27/32" (174 mm) x 6 17/64" (159 mm) x 2 1/4" (58 mm)
IQeco39	:6 27/32” (174 mm) x 6 17/64” (159 mm) x 2 1/4” (58 mm)
Material	:Noryl HS2000X GY2D015 (17% filled PPE/PS)

Weight

IQecoVAV/../PA/	:857 g (30 oz)
IQecoVAV/../P/	:362 g (12.8 oz)
IQeco39	:362 g (12.8 oz)

Connections

Electrical	:5.0 mm (0.197”) two part connectors for 0.5 to 3 mm^2 (24 to 12 AWG) cable (18 AWG, 0.8 mm^2 typical)
Air pressure	:Push on tubes for 3/16” (4.75 mm) ID tubing
Actuator	:U clamp for 3/8” to 1/2” (10 mm to 13 mm) equivalent diameter shaft

ENVIRONMENTAL

EMC

Immunity	:EN 61000-6-2: 2005 :EN 61000-6-3: 2007 Class B
Emissions	:EN55011 :FCC 15.107 Class B Conducted Emissions. :FCC 15.109 Class B Radiated Emissions.

Safety

US	:UL916 3rd Edition, Listed - Open Energy Management Equipment (PAZX). Listing includes U.S. and Canadian certification

Ambient limits

Operating	
IQecoVAV/..	:32 °F (0 °C) to 122 °F (+50 °C)
IQeco39	:-40 °F (-40 °C) to 140 °F (+60 °C)
Humidity	:5 to 95 %RH non-condensing

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

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