IQeco31, 35, 38 BACnet Controllers

Description

The IQeco31, 35 and 38 are terminal unit controllers for use with BACnet over MS/TP. They can communicate with other IQecos over the BACnet MS/TP network, and with Trend networked devices by way of a BINC. They have from 10 to 18 I/O channels, and can be supplied either fully programmable or with a fixed strategy. *230 Vac models available Quarter 1, 2012

Features

▪ Fully compatible with the Trend system.
▪ BACnet over MS/TP (WSP certified)
▪ Non-volatile memory, no battery required.
▪ *230 Vac or 24 Vac input power versions
▪ Inputs configurable by software (no links)
▪ Energy efficient strategies available (EUBAC approved)

Physical

IQeco31/24VAC

- 185 mm (7.28”)
- 170 mm (6.69”)
- 152 mm (5.98”)
- 150 mm (5.91”)
- 10 mm (0.39”)
- 98 mm (3.86”)
- 45 mm (1.77”)
- 78 mm (3.07”)
- 89 mm (3.5”)
**Physical (continued)**

**IQeco31/230 (available Q1 2012)**

- 230 Vac
  - AC power input
  - high current relay output

**IQeco35**
(dimensions the same as IQeco31/230)

- 240 Vac
  - AC power input
  - 230 Vac
  - relay outputs

**Graphical Diagrams**

- Upper label
- Lower label
- Dimensions:
  - 205 mm (8.07")
  - 189 mm (7.44")
  - 114 mm (4.49")
  - 63 mm (2.48")

- Outputs:
  - digital outputs
  - analogue output
  - universal input
  - thermistor input
  - universal inputs
  - 24 V auxiliary power output
  - MS/TP OK LED
  - service button

- Engineering port (USB)
- Wallbus (WMB Display)
- BACnet MS/TP network

**Dimensions**

- 230 Vac
  - 205 mm (8.07")
  - 189 mm (7.44")
  - 114 mm (4.49")
  - 63 mm (2.48")
Physical (continued)

IQeco38
(dimensions the same as IQeco31/230)

I/Qeco/IQL Secondary Terminal Cover
This accessory can be used with IQeco31/230, IQeco35, IQeco38 to enable the unit to comply with EN61010-1 without installation in a panel.
FUNCTIONALITY

The IQeco can be purchased either as a fully programmable unit, or with a fixed strategy. The strategy defines its HVAC equipment interaction. Fixed strategy units can be reconfigured with a different strategy from a defined class of strategies within the strategy library.

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 a IQ3/BINC (BACnet Internetwork Node Controller) which acts as a router between Ethernet and the MS/TP trunk. There can only be 1 BINC on the trunk.

The system can be extended to a Trend Current loop Lan, and the MS/TP trunk extends from a IQ3/BINC (BACnet Internetwork Node Controller) which acts as a router between Ethernet and the MS/TP trunk. There can only be 1 BINC on the trunk.

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.

The above configuration enables the following Trend system communications:

- Supervisors/tools can communicate with all IQecos.
- IQecos can initiate and respond to IC Comms from other IQ controllers (IQ1, IQ2, IQ3, IQL) (see below).
- Tools can download firmware upgrades and strategy files to IQecos.
- IQecos can send alarm to supervisors/tools.

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.

IQeco will support the following BACnet communications:
- BACnet devices (workstations, controllers) can communicate with the IQecos using BACnet protocol.

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.

IQeco Addresses

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

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

The IQeco Trend device address (Local Node, outstation e.g. O11) will be 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 IQTool (running on a PC connected either by Ethernet, or by the RS232 local supervisor port to the IQeco’s BINC, or by an IQeco’s USB local engineering port).
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 a barcode with the unique Serial Number; this can be read by a barcode reader from a distance (e.g. scanning a unit mounted in the ceiling from the floor).

A PC running SET is able to use an IQeco’s local engineering port (USB) to communicate with the entire Trend system to which the IQeco is connected. If the supervisor port address in the IQeco is set to 0 (default), a supervisory CNC (sCNC) at address 125 is dynamically created for the period of the SET session. When the PC is removed the sCNC times out and no longer exists on the network. If the sCNC address is configured to be non-zero, the sCNC remains on the network map when the SET PC is removed.

There can be the IQ3/BINC 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 BINC 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 BINC (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 x1000+Device Address), but may be changed in the IQeco’s BACnet Application network module.

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

Note that 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 IQ3/BINC.

The adjacent diagram shows an example logical network with the INCs in the BINC and 3xtend/EINC forming an internetwork. The IQecos on the MS/TP trunk form a single Lan. The PC is connected by way of the vCNC in the BINC.

IQTool

IQTool runs within SET. It will run on a PC on which SET v6.6 or greater has been installed, and can communicate with the IQecos by way of the BINC (over Ethernet using the BINC’s vCNC or over RS232 using the BINC’s sCNC) or by way of an IQeco over USB using the IQeco’s sCNC.

IQTool allows communication with the entire BACnet trunk.

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

The IQTool Monitor Task 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 a custom (user-created) strategies.

The IQTool Upgrader Task will upgrade the firmware in one or many IQecos. It may be necessary to upgrade the strategy in which case it strategy should be uploaded first and upgraded by SET, and downloaded back to the IQeco after the firmware upgrade.
**IQTool** (continued)

The IQTool Licence Requester is used to request a licence to change from fixed function to programmable controller. This enables a licence request to be created that can be emailed to Trend; upgrades must be purchased.

The IQTool Licence Committer enables the licence received back from Trend to be sent to the IQeco to enable the change from fixed to programmable controller.

**HARDWARE**

**Unit**

The IQeco is a small terminal unit controller designed for surface or DIN rail mounting. A surface mounted IQeco31/24VAC will comply with EN61010-1. A DIN rail mounted IQeco31/24VAC or IQeco/230, IQeco35, IQeco38 must be mounted inside an enclosure conforming to EN61010-1 (to eliminate the need to install in a panel the IQeco/IQL Secondary Terminal Cover can be installed over these units).

The IQeco/230, IQeco35, IQeco38 have 4 point surface mounting and the IQeco31/24VAC version has two removable surface mount brackets. All units have a plastic housing with a hinged clear polycarbonate terminal cover.

The units are the same size and have the same mounting points as the equivalent IQL controller, but please note that the cabling requirements of MS/TP are different to LonWorks.

**Power Input**

The IQeco has both 230 Vac (available Q1 2012) and 24 Vac input power options.

/230: This option requires 230 Vac ±15%, 50/60 Hz at up to 22 VA, which consists of up to 3.6 VA internal power, plus the power required by the solid state digital (valve or damper) outputs and the combined supply (auxiliary outputs, wall bus, and analogue outputs). The IQeco input power earth (ground) terminal is isolated from the input power neutral, and must be separately earthed (grounded) locally; this ground terminal is internally connected to the IQeco electronics earth (ground).

/24VAC: This option requires 24 Vac ±15%, 50/60 Hz, at up to 22 VA, which consists of up to 3.6 VA internal power, plus the power required by the solid state digital (valve or damper) outputs and the combined supply (auxiliary outputs, wall bus, and analogue outputs). The 24 Vac uses an half wave rectifier internal power supply unit. Multiple controllers with half wave power supplies may be powered from a single grounded transformer but the supply polarity must be maintained across all units supplied from the same transformer. The 24 Vac input power neutral must be earthed (grounded) at the transformer secondary. The ac input power neutral is internally connected to the IQeco electronics earth (ground). The ac input power ground terminal must be earthed (grounded) at the controller.

![IQeco ac power input terminals](image)

Note that the IQeco must be earthed (grounded), using its earth (ground) terminal.
Combined Supply.

IQecos produce a 24 Vdc combined supply which is shared between the wallbus, auxiliary output supply, and analogue outputs.

24 Vdc Combined Supply

'A' mA maximum

auxiliary output supply (AUX, + terminals)

wallbus

analogue outputs

Each of these loads has a maximum consumption as shown in the table below. The combined supply isn’t sufficient for all loads to run at maximum consumption, so there has to be a trade-off between the loads.

<table>
<thead>
<tr>
<th>IQeco 31/24VAC</th>
<th>IQeco 31/230</th>
<th>IQeco 35</th>
<th>IQeco 38</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Vdc supply</td>
<td>Wallbus</td>
<td>Analogue output</td>
<td>Auxiliary supply maximum</td>
</tr>
<tr>
<td>'A' mA max.</td>
<td>mA max.</td>
<td>mA max.</td>
<td>mA max.</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
<td>20</td>
<td>20 mA from + terminal (No. 24)</td>
</tr>
<tr>
<td>120</td>
<td>50</td>
<td>20</td>
<td>100 mA from + and AUX terminals</td>
</tr>
<tr>
<td>120</td>
<td>50</td>
<td>20</td>
<td>100 mA from + and AUX terminals</td>
</tr>
<tr>
<td>175</td>
<td>50</td>
<td>80</td>
<td>100 mA from + and AUX terminals</td>
</tr>
</tbody>
</table>

Wallbus (WMB): The consumption depends on the display being used; e.g. the RD-WMB consumes 10 mA.

Analogue outputs: These consume up to 20 mA per channel. The IQ31 and IQ35 have only one channel to be used, whereas the IQ38 has 4 channels which can be used.

Auxiliary supply: This is available from the + and AUX terminals to supply peripheral devices (e.g. sensors).

Example 1: An IQeco35 has an RD-WMB, its analogue output has a 10 mA max. load, and it is supplying 1 current loop sensor (20 mA).

RD-WMB 10 mA
An. out 10 mA
Sensor 20 mA
Total 50 mA

The maximum available is 120 mA so there is 70 mA available from the AUX terminals if required. Note that the maximum auxiliary current will be (20 + 70) i.e. 90 mA which is below the limit of 100 mA.

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 BINC, and the IQeco automatically sets itself to the same baud rate. All devices on the trunk must use the same baud rate.

Note that the MS/TP network has different requirements to the IQL LonWorks® network.

All MS/TP devices (BINC, 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). 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 mm²) 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 maximum distances. Details of cables are given in the Trend TP Cable Data Sheet, TA200541.
Switch off Water Balancing for Lan
Switch off Water Balancing for Unit

The IQ3/BINC provides network biasing (470 ohms); a maximum of two devices on the network can provide network biasing.
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.

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

There may be the IQ3/BINC 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 IQ3../BINC/... 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.

MS/TP OK Indicator

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 as described below (see Service Button).

Service Button

Pressing the IQeco 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 to IQTool is to use a barcode scanner (see below).

Holding down the button as the unit is powered up will cause a strategy cleardown. 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 installation instructions.

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.

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>✗ ✗ ✗ ✗ ✗ ✗ ✗ ✗</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✗ ✗ ✗ ✗ ✗ ✗ ✗ ✗</td>
<td></td>
<td></td>
</tr>
<tr>
<td>✗ ✗ ✗ ✗ ✗ ✗ ✗ ✗</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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 on service button mode is determined by the strategy, all the IQeco standard strategy solutions make consistent use of the service button as follows:

<table>
<thead>
<tr>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN101</td>
</tr>
<tr>
<td>IN102</td>
</tr>
<tr>
<td>IN103</td>
</tr>
<tr>
<td>IN104</td>
</tr>
<tr>
<td>IN105</td>
</tr>
<tr>
<td>IN106</td>
</tr>
<tr>
<td>IN107</td>
</tr>
<tr>
<td>IN108</td>
</tr>
</tbody>
</table>

The strategy will record the ‘on’ input to set the function 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 midnight, after an archive instruction, on data entry by RD-WMB (wallbus), or on service button operation. The tools (e.g. SET Live Adjustment, IQTool) 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 supplied 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:

It needs to be a laser scanner.
It has to be able to read “code 128 auto”
It must be able to work close up and from about 3.5 m (12 ft) away
The distance it can read depends on the user requirements (e.g. scanning a unit mounted in the ceiling from the floor).
Inputs and Outputs

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

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relay</td>
</tr>
<tr>
<td></td>
<td>HC</td>
</tr>
<tr>
<td>IQeco31/24VAC</td>
<td>0</td>
</tr>
<tr>
<td>IQeco31/230</td>
<td>1</td>
</tr>
<tr>
<td>IQeco35/24VAC</td>
<td>1</td>
</tr>
<tr>
<td>IQeco35/230</td>
<td>1</td>
</tr>
<tr>
<td>IQeco38/24VAC</td>
<td>1</td>
</tr>
<tr>
<td>IQeco38/230</td>
<td>1</td>
</tr>
</tbody>
</table>

Although a programmable IQeco is completely flexible, the table below shows typical applications for the available channels.

<table>
<thead>
<tr>
<th>Options</th>
<th>IQeco31</th>
<th>IQeco35</th>
<th>IQeco38</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan Control</td>
<td>On/Off</td>
<td>on/off (1RO)</td>
<td>on/off (1RO)</td>
</tr>
<tr>
<td>Variable Speed</td>
<td>AO</td>
<td>AO</td>
<td>AO</td>
</tr>
<tr>
<td>Valve Control</td>
<td>Raise/lower or Thermic</td>
<td>2 (4DO or 2DO)</td>
<td>2 (4DO or 2DO)</td>
</tr>
<tr>
<td>Electric Heater</td>
<td>-</td>
<td>RO</td>
<td>-</td>
</tr>
<tr>
<td>Room Controls</td>
<td>-</td>
<td>-</td>
<td>3 AO</td>
</tr>
<tr>
<td>Discharge Air Temp.</td>
<td>UI</td>
<td>UI</td>
<td>UI</td>
</tr>
<tr>
<td>Space Temp.</td>
<td>TI</td>
<td>TI</td>
<td>TI</td>
</tr>
<tr>
<td>Setpoint</td>
<td>TI</td>
<td>TI</td>
<td>TI</td>
</tr>
<tr>
<td>Window contact</td>
<td>DI</td>
<td>DI</td>
<td>DI</td>
</tr>
<tr>
<td>Fan speed selection</td>
<td>-</td>
<td>UI</td>
<td></td>
</tr>
<tr>
<td>PB/PIR</td>
<td>-</td>
<td>DI</td>
<td></td>
</tr>
<tr>
<td>Other remote sensors</td>
<td>UI</td>
<td>3UI</td>
<td></td>
</tr>
<tr>
<td>Motor feedback</td>
<td></td>
<td></td>
<td>DI</td>
</tr>
</tbody>
</table>

KEY: RO = Relay Output, AO = Analogue Output, DO = Digital Output, TI = Thermistor Input, DI = Digital Input, UI = Universal Input

The fixed function standard strategy solutions map the standard inputs as follows:
- Discharge temp. IN1 (UI)
- Space Temp. IN2 (TI)
- Setpoint IN3 (TI)
- Window Contact IN4 (DI)
- PB/PIR IN5 (DI)
- Fan Speed Selection IN7 (UI)
- Flow/safety IN8 (UI)

IQeco standard solutions provide a consistent user interface in that the presentation modules used (sensors, knobs, digital inputs, switches, and drivers) will be the same across all the solutions where appropriate. Similarly the input and output channels are consistent. This enables a user to become familiar with which adjustment modules to use and what I/O should be connected as he moves from strategy to strategy. Each strategy is described by its strategy data sheet; these are listed in the Order section below.

e.g. W1 "Unit Bypass Request 1=Active" is used across the solutions
W2 "Electric Heat 1=Enabled" will only be used with solutions with an electric heat output

Relay Outputs (OUT1, to OUT4)
IQeco31, IQeco38: OUT 1 only
*IQeco35: OUT 1, OUT2, OUT3, OUT4
All relays are changeover except IQ31/24VAC which is make only (using terminals 4, 5).
IQeco31 OUT1 is 5 A; IQeco31/230, 35, 38 OUT1 is 8 A
OUT2, 3, 4 are 5 A. All rated 250 Vac.

*Note that to meet safety requirements, for the 4 relays (OUT1 to OUT4) on IQeco35, those being used must all be switching either low voltage or mains and not a mixture of low voltage and mains. If switching mains, they must all switch the same phase and polarity.

Arc suppression is recommended, (see Relay Output Arc Suppression Installation Instructions TG200208).
Universal Inputs (IN1, IN7 to IN9)
The universal inputs group has channels as follows:
IQeco31: IN1
IQeco35: IN1, IN7, IN8
IQeco38: IN1, IN7, IN8, IN9

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 IN1 in the diagram above.

The universal input channels can either be voltage input (0 to 10 V), thermistor input (0 to 200 kohm), digital input (volt free contact/open collector), or a 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 (the sensor type defines the switch settings).

Analog Output Supply (AUX)

IQeco31/24VAC: 24 Vdc ±15% at 20 mA maximum, available from the ‘+’ terminal. Uses part of combined supply shared between auxiliary output supply (+, AUX terminals), wallbus, and analogue outputs as described above.

IQeco31/230, 35, 38: 24 Vdc ±15% (for IQeco31/230, IQeco35 at 120 mA max. nominal, for IQeco38 at 175 mA maximum) available from all ‘+’ terminals on the analogue inputs, and the ‘AUX’ terminal. Uses part of combined supply shared between auxiliary output supply (+, AUX terminals), wallbus, and analogue outputs as described above.

Solid State Digital Outputs (OUT5 to OUT8)
All four outputs available on all units.
These outputs are suitable for use with 24 Vac thermal type actuators, 24 Vac synchronous motors, and 24 Vac relays.

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 C terminal (e.g. 22 C) not to an input common. The above diagram shows wiring for OUT9.

The switches are automatically selected as shown in the table below:

<table>
<thead>
<tr>
<th>Input type</th>
<th>Switch A</th>
<th>Switch B</th>
<th>Switch C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>ON</td>
<td>ON</td>
<td>off</td>
</tr>
<tr>
<td>Voltage</td>
<td>off</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Thermistor</td>
<td>off</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>Digital</td>
<td>off</td>
<td>off</td>
<td>off</td>
</tr>
</tbody>
</table>

Analogue Outputs (OUT9 to OUT12)

IQeco31, IQeco35: OUT 9 only
IQeco38: OUT 9, OUT10, OUT11, OUT12

0 to 10 Vdc at up to 20 mA (over temperature range -40 °C to +40 °C, -40 °F to 104 °F), and up to 10 mA (from +40 °C to +60 °C, 104 °F to 140 °F).

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 C terminal (e.g. 22 C) not to an input common. The above diagram shows wiring for OUT9.

24 Vdc Auxiliary Output Supply (AUX)

IQeco31/24VAC: 24 Vdc ±15% at 20 mA maximum, available from the ‘+’ terminal. Uses part of combined supply shared between auxiliary output supply (+ terminal), wallbus, and analogue output as described above.
The thermistor input (0 to 200 kohm) can be used for a thermistor or a potentiometer. The thermistor bridge resistor is 12 kohm with a bridge supply 3.3 V.

The voltage input is for 0 to 10 Vdc input. Note that the input resistance of the IQeco analogue voltage input configuration is 10 kohm as opposed to 208 kohm in the equivalent IQ3 input so that the scaling for a potential divider input will be different (e.g. TB/TS/KOSF, /KOF as shown below, sensor type 111 has the correct scaling).

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

The volt free contact has a nominal wetting current of 300 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. The current input may be either loop powered or externally powered; the type is selected by connecting the sensor to different terminals as shown in the diagrams below.

A loop powered sensor current supply (+) uses part of the combined supply shared between auxiliary output supply (+, AUX terminals), wallbus, and analogue outputs as described above.

Thermistor Inputs (IN1, IN2, IN6)
The thermistor inputs group has channels as follows:
IQeco31: IN2, IN3
IQeco35, IQeco 38: IN2, IN3, IN6

Digital Inputs IN4, IN5
The digital inputs group has channels as follows:
IQeco31: IN4
IQeco35, IQeco 38: IN4, IN5

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/KOSF has the TB/TS/K features plus an occupation override push button. The TB/TS/KOF is similar to the TB/TS/KO but also has fan speed control. The TB/TS/KOSF is similar to the TB/TS/KOF 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 standard strategy mapping connects the TB/TS/KOF fan speed switch to IN7 which is only present on IQ35, IQ38.
The wallbus facilitates the connection of display units. It is polarity independent; it should be wired with twisted pair cable, and will operate up to 60 m (200 ft).

### Wallbus

The wallbus facilitates the connection of display units. It is polarity independent; it should be wired with twisted pair cable, and will operate up to 60 m (200 ft).

An RD-WMB series room display may be connected to the IQeco’s wallbus. The following units are available:

- **RD-WMB/K**: Room display with thermistor space sensor and setpoint adjust.
- **RD-WMB/KOS**: As RD-IQeco/K plus occupation override pushbutton and occupation status LEDs.
- **RD-WMB/KOSF**: As RD-IQeco/KOS plus fan speed control.

The RD is installed into the IQeco strategy using SET by selecting I/O Setup and adding I/O module 2. The I/O module type will be set to ‘WMB Display’. The RD’s local sensor will appear on I/O module 2’s input channel 1. This can be connected to an external sensor module, whose sensor type should be set to ‘WMB prescaled’ (sensor type module 112). The RD sends its value (plus an internal configurable offset) to the sensor module; the output of this sensor module is displayed on the RD, and the displayed units are those of the sensor (°C or °F).

The other RD values are automatically mapped as follows:

- **Setpoint**: K44 - input to/output from RD. The button increment is set to 0.1, 1.0, or 10 whichever is closest to the difference between K44’s Top and Bottom of range parameters.
- **Occupation State**: S10 - input to RD. RD will indicate the occupation state (occupied or unoccupied) according to the enumerated output of S10 (0=occupied, 1=unoccupied, 2=bypass, 3= standby). The RD will indicate occupied for states 0, 2 and unoccupied for states 1, 3. If the value of S10 is set to 255 neither icon is displayed.
- **Occupation Override**: W1 - input to/output from RD. RD occupation override button will toggle the occupation state.
- **Fan Speed**: K45 - input to/output from RD. Button 3 steps through the fan speeds available according to I/O module 2 fan configuration parameter. This has 7 modes:
  - Mode 0: No fan icon shown, Mode 1: 2 position fan (Off/On), Mode 2: 3 position fan (Off, On, Auto), Mode 3: 4 position fan (Off, 1, 2, 3), Mode 4: 5 position fan (Off, 1, 2, 3, Auto), Mode 5: 4 position blind, Mode 6: 5 position blind.
  - Value of K45 set as follows: 0=off, 1=speed 1, 2=speed 2, 3=speed 3, 4=Auto, 255=On. So for 2 position fan values set to 0 or 255, for 3 position set to 0, 255, 4.

### Engineering Port (USB)

The IQeco’s USB port uses a Micro B USB connector (USB 2.0 full speed). This port is the IQeco’s local engineering connection. By using this port, SET and its software tools including strategy download are able to access the complete Trend network.

As explained above, with the default supervisor port address (0), a supervisory CNC (sCNC) at address 125 is dynamically created for the period of the SET session. When the PC is removed the sCNC times out and no longer exists on the network.

The engineering port (sCNC) address should be set non-zero if it is likely that software tools could be connected to more than one IQeco simultaneously on the same MS/TP trunk. (This will prevent an address clash at address 125). It can be changed using the IQTool monitor task IQecoDiagnostics_Strategy template or by SET Device View.

Connection to a PC would normally be made by using an adaptor cable with a USB connector appropriate to the PC on one end and a Micro B USB cable on the other (maximum cable length is 5 m).
**FIRMWARE**

**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 with an absolute maximum of 300 modules (excluding alarm log and option module) of which 200 maximum can be sequenced. The empty IQeco contains address, time, program, and two network modules which reduce the additional number of modules to 295.

The available 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).

The table below lists the modules included in the IQeco; most can be configured using SET. They are described in the IQeco Configuration Manual TE201089. The list also includes the maximum number of that type of module that can be created (remaining ecobrIQ capacity allowing).

If a module has ‘F’ (flexible) against it, the only limit is available ecobrIQ capacity.

---

<table>
<thead>
<tr>
<th>Module</th>
<th>Number</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>1 (fixed) ‡</td>
<td>External or Internal</td>
</tr>
<tr>
<td>Digital Input</td>
<td>1 (fixed) ‡</td>
<td>External or Internal</td>
</tr>
<tr>
<td>Alarm Destn</td>
<td>2 (fixed) ‡</td>
<td>Trend Lan type only</td>
</tr>
<tr>
<td>Alarm Group</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Alarm Route</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Alarm Log</td>
<td>1 (fixed) ‡</td>
<td>Up to 10 alarms</td>
</tr>
<tr>
<td>Analog Node</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Digital Byte</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Directory</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Driver</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Function</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>IC Comms</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>I/O Module</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Knob</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Logic</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Loop</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td>2 (fixed) ‡</td>
<td>MS/TP, BACnet Appl.</td>
</tr>
<tr>
<td>NTD</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Option</td>
<td>1</td>
<td>Fixed Function</td>
</tr>
<tr>
<td>Plot</td>
<td>20</td>
<td>2000 records total max.* Synchronised only‡‡</td>
</tr>
<tr>
<td>Program</td>
<td>1 (fixed) ‡</td>
<td></td>
</tr>
<tr>
<td>Sensor</td>
<td>F</td>
<td>External or Internal</td>
</tr>
<tr>
<td>Sensor type</td>
<td>12 (fixed) ‡</td>
<td>12 fixed scalings† plus programmable sensor types (as for IQ3)</td>
</tr>
<tr>
<td>Sequence</td>
<td>1 (fixed) ‡</td>
<td>Contains 200 steps</td>
</tr>
<tr>
<td>Switch</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>1 (fixed) ‡</td>
<td></td>
</tr>
<tr>
<td>User</td>
<td>1 (fixed) ‡</td>
<td></td>
</tr>
</tbody>
</table>

---

**Notes:**

‡ These fixed modules are always in IQeco (not optional)

* 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

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

---

**Sensor Type**

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

---

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...).

**Identification**

The IQeco will identify itself as an IQeco to w comms.

**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):
The IQeco generates the following module alarms.

Sensor alarms:
- 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
- DIGIn OFF occurred (DI=0)
- DIGIn OFF cleared (CDI0)
- DIGIn ON occurred (DI=1)
- DIGIn ON cleared (CDI1)

Loop
- Setpoint Deviation (SDEV)
- Setpoint Clear (CSDV)

They are same format as IQ alarms.

The MS/TP network alarms are generated by the BINC.

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 can also send and respond to IC Comms using BACnet Protocol.

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

<table>
<thead>
<tr>
<th>Direction</th>
<th>Variable</th>
<th>Initiated by IQxx to this IQeco</th>
<th>*Initiated in this IQeco to IQxx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data From</td>
<td>Analogue</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Data From</td>
<td>Digital Byte</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Data From</td>
<td>Digital Bit</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Data To</td>
<td>Analogue</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Data To</td>
<td>Digital Byte</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Data To</td>
<td>Digital Bit</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Global To</td>
<td>Analogue</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Global To</td>
<td>Digital Byte</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Minimum</td>
<td>Analogue</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Maximum</td>
<td>Analogue</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Sum</td>
<td>Analogue</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Average</td>
<td>Analogue</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

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.

**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.

**Plot**

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 by a setting in its INI file

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 wallbus WMB display (RD) into the strategy. The RD-WMB space sensor will appear as channel 1 on I/O module 2.

**Power Management**

The power management feature enabled by the Power Managed parameter in the address module is not implemented at this time.

**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 either 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 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.

**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).
Water Balancing

This feature is used on water side systems for balancing and flushing; it shouldn’t be used on airside systems. The raise/lower (floating point) and time proportional outputs are set to 100% until the water balancing is complete. In IQeco this feature has to be engineered in the strategy.

The standard strategies include this feature. They make use use service button mode (see above) with a virtual input channel to switch water balancing on and another virtual input channel to switch water balancing off.

Library/Programmable Strategies

The strategy defines the IQeco's HVAC equipment interaction. The IQeco can be purchased either as a fully programmable unit, or with a fixed strategy. A fixed strategy controller may be upgraded to a programmable controller using the IQTool Licence Requester and Licence Committer tasks (there will be a charge for this). A programmable controller can be purchased with a strategy installed.

Fixed Strategy

The fixed strategy IQeco has the fixed strategy option installed (the fixed function option module will be present). Fixed strategy units can be re-configured with a different strategy from a defined library of strategies within the SET standard strategy solutions. Each standard strategy will have both imperial and metric versions. There are three libraries of strategy: Entry, Basic, and Plus and the fixed strategy controller is tagged with the library it is allowed to run.

The library a particular controller is able to use can be found in the Library Name column (Entry, Basic, or Plus) of IQTool Monitor task, IQecoDiagnosticsController template or in SET Device View.

In SET the strategies that can be downloaded to a particular controller are found by selecting Device/Device Details/Select Solution; the various solutions and their data sheets and compatibilities are listed in the Order Code section of this data sheet.

When a strategy is downloaded to a controller with this option, the old strategy is stopped while the new strategy is validated. If the strategy validation fails, the old strategy is restarted; if the new strategy is validated, then it is loaded as the new running strategy. The validation checks that the strategy is from the correct library and that it has not been structurally modified.

The strategy has a ‘fingerprint’ which defines its designated modules and the connections between modules. Upon validation if this fingerprint has changed the strategy will be rejected.

To maintain the same fingerprint, module types cannot change. Some modules are excluded from the fingerprint: Address, Alarm log, IO module, Networks, Non-Trend Device (NTD), Options, Program, Sequence Table, Time, Users. Connections to alarm groups, routes, and destinations can be changed.

Programmable

This IQeco version is fully programmable using SET. A programmable controller may be supplied with a standard strategy, or with no strategy. The standard strategies are available as solutions and can be downloaded directly or modified as required in the normal way.

Custom

The IQeco can be supplied with a strategy written by the customer. Trend will supply the strategy already downloaded into a programmable IQeco controller saving time on site. For this option the customer strategy must be supplied with the order; Trend will not test the strategy it will only ensure that the strategy supplied with the order can be successfully loaded into the controller.

Strategy Download/Upload

The strategy file upload or download is performed by SET either by way of the BINC (using either the Ethernet port or the RS232 Supervisor port) or by way of the IQeco's Engineering port (USB); this requires the Trend USB driver to be installed (see Compatibility section below).

Firmware Upgrade

The IQeco firmware may be upgraded over the network by way of the BINC using the IQTool Upgrader task; contact technical support if required.

COMPATIBILITY

Supervisor: 916 v1.3, IQView v1.4, 963 v3.4
Tools: SET v6.6 (IQTool); if using the USB engineering port for the first time, install the Trend USB driver which will have been installed on the PC as part of the SET installation (See SET manual, TE 200147).
IQ: IQ3xact/MSTP/BINC gateway, IQ3, IQ2, IQL (IC Comms compatible), IQ3 time master only.
BACnet: The IQeco controller is certified as a BACnet Application Specific Controller (B-ASC) by WSP Cert.

INSTALLATION

The IQeco can be mounted either on DIN rail or flat surface (IQeco31/24 has 2 hole mounting, IQeco31/230, IQeco35, IQeco38 have 4 hole mounting.) A surface mounted IQeco31/24VAC will comply with EN61010-1. A DIN rail mounted IQeco31/24VAC or IQeco230, IQeco35, IQeco38 must be mounted inside an enclosure conforming to EN61010-1 (to eliminate the need to install in a panel the IQeco/IQL Secondary Terminal Cover can be installed over these units).

The IQeco units are the same size and have the same mounting points as the equivalent IQL controller, but please note that the cabling requirements of MS/TP are different to LonWorks.

The IQeco installation involves the following procedure:

Mount the unit in position
Connect power input (do not switch on)
Earth (ground) unit
Connect MS/TP BACnet network
Terminate I/O channels (leave unconnected).
Switch on power input to unit
Set up IQeco address using IQTool Addressing Task
Check IQ system communications
Configure strategy using SET (programmable unit only)
Test strategy by using Controller Simulation Mode in SET
Download strategy file using SET (fixed strategy unit to change for alternative strategy, or programmable unit)
Connect I/O
Configure strategy parameters if required using IQTool
Test unit
Check BACnet communications using SET
Configure rest of system and test system

The installation procedure is covered by either:
IQeco31/24VAC Installation Instructions - Mounting, TG201223.
IQeco31/230 Installation Instructions - Mounting, TG201224
IQeco35, 38 Installation Instructions - Mounting, TG201177
and IQeco31, 35, 38 Installation Instructions - Configuration, TG201222
IQeco/IQL Secondary Terminal Cover Installation Instructions, TG201243

If supplied with an installed strategy, also see appropriate strategy installation instructions.
**INSTALLATION**

**CONNECTIONS**

IQeco31/24VAC

**MS/TP network**

Ground screen at one end and tape back at other

120 ohms (normally)

If BINC is on the end of 120 ohm cable, use its built-in terminator. Otherwise switch it out and put a terminator on end of the cable

The bus must be terminated at each end with a resistor matched to cable characteristic impedance

120 ohms (normally)

Tape back screen this end

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

For further details see page 6

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

---

**Input Power**

24 Vac

**WARNING:** This apparatus must be earthed (grounded), using earth (ground) terminal.

---

**Input Power** 24 Vac

**Input** Universal

0 to 10 V, 0 to 20 mA, thermistor, or digital thermistor inputs

**Inputs**

universal input

0 to 10 V, 0 to 20 mA, thermistor, or digital thermistor inputs

**Analogue Output**

0 to 10 V at 20 mA from -40 °C to +40 °C, -40 °F to 104 °F, and at 10 mA (from -40 °C to +60 °C, 104 °F to 140 °F).

- Ensure correct polarity
- Panel/enclosure ground.

**Example Sensor Connection**

- Ensure correct polarity
- Panel/enclosure ground.

For analogue inputs use 18 AWG (0.8 mm²) 2 wire twisted screened cable with the screen connected to the panel/enclosure ground, unterminated at far end.

See strategy data sheet for input/output connection details.

---

**Digital Outputs**

Relay

- NO relay
- 250 Vac, 5 A
- 24 Vac, 0.4 A maximum for a channel
- 0.4 A maximum shared between all 4 channels

**Solid State**

- 24 Vac, 0.4 A maximum
- 0.4 A maximum shared between all 4 channels

---

**USB (local supervisor)**

Micro connector

---

**Wallbus**

Twisted pair. Max length 60 m (200 feet)

Polarity independent

UL Listed, Class 2, 24 Vac transformer

Earth (ground) 24 vac supply neutral at transformer

---

**Ground Screen**

At one end and tape back at other

---

**Example Sensor Connection**

- Ensure correct polarity
- Panel/enclosure ground.

---

**Example Load Connection**

- Use 18 AWG (0.8 mm²) 2 wire twisted screened cable with the screen connected to the panel/enclosure ground, unterminated at far end.

Connect return to "C" terminal.

---

**MS/TP network**

Ground screen at one end and tape back at other

120 ohms (normally)

If BINC is on the end of 120 ohm cable, use its built-in terminator. Otherwise switch it out and put a terminator on end of the cable

The bus must be terminated at each end with a resistor matched to cable characteristic impedance

120 ohms (normally)

Tape back screen this end

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

For further details see page 6

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

---

**Input Power** 24 Vac

**WARNING:** This apparatus must be earthed (grounded), using earth (ground) terminal.

---

**Digital Outputs**

Relay

- NO relay
- 250 Vac, 5 A
- 24 Vac, 0.4 A maximum for a channel
- 0.4 A maximum shared between all 4 channels

**Solid State**

- 24 Vac, 0.4 A maximum
- 0.4 A maximum shared between all 4 channels

---

**USB (local supervisor)**

Micro connector

---

**Wallbus**

Twisted pair. Max length 60 m (200 feet)

Polarity independent

UL Listed, Class 2, 24 Vac transformer

Earth (ground) 24 vac supply neutral at transformer

---

**Ground Screen**

At one end and tape back at other

---

**Example Sensor Connection**

- Ensure correct polarity
- Panel/enclosure ground.

---

**Example Load Connection**

- Use 18 AWG (0.8 mm²) 2 wire twisted screened cable with the screen connected to the panel/enclosure ground, unterminated at far end.

Connect return to "C" terminal.
**Data Sheet**

**IQeco31, 35, 38**

### CONNECTIONS (continued)

**IQeco31/230, 35, 38**

**Additional Analogue Outputs**

IQeco38 only.

0 to 10 V at 20 mA from -40 °C to +40 °C, -40 °F to 104 °F, and at 10 mA (from +40 °C to +60 °C, 104 °F to 140 °F).

**example sensor connection.**

Ensure correct polarity panel/enclosure ground.

Use 18 AWG (0.8 mm²) 2 wire twisted screened cable with the screen connected to the panel/enclosure ground, un terminated at far end. Connect return to "C" terminal.

**Input Power**

24 Vac: see IQeco31/24VAC

230 Vac

**WARNING:** This apparatus must be earthed (grounded), using earth (ground) terminal.

**Relay Outputs**

High Current

250 Vac 8 A

Standard Current

250 Vac 5 A

**Solid State Digital Outputs**

IQeco 35, 38/24VAC - see IQeco31/24VAC

IQeco 31, 35, 38/230:

24 Vac (synthesised), 0.4 A maximum for a channel

0.4 A maximum shared between all 4 channels

**24V Auxiliary Output**

24 Vdc ±15%, uses part of combined supply. Available from AUX and analogue input ‘+’ terminals

**MS/TP network**

See IQeco31/24VAC

**Wallbus**

See IQeco31/24VAC

**USB (local supervisor)**

See IQeco31/24VAC

**Analogue Output**

See IQeco31/24VAC

**Inputs**

Universal input

0 to 10 V, 0 to 20 mA, thermistor, or digital

Thermistor inputs

Digital input

**Example sensor connection.**

Panel/enclosure ground.

For analogue inputs use 18 AWG (0.8 mm²) 2 wire twisted screened cable with the screen connected to the panel/enclosure ground, un terminated at far end.

**See strategy data sheet for input/output connection details**
## ORDER CODES

### IQeco31, 35, 38 Basic Order Code Structure:

\[ \text{IQEn/\langle Prog\rangle/BAC/\langle Strat\rangle/\langle Fan\rangle/\langle Type\rangle/\langle Relay\rangle/\langle Library\rangle} \]

<table>
<thead>
<tr>
<th>IQEn</th>
<th>Prog</th>
<th>Fan</th>
<th>Type</th>
<th>Relay</th>
<th>Library</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQE31</td>
<td>C</td>
<td>3SFAN: 3 Speed Fan</td>
<td>AR2: Airside Heat/Cool Damper</td>
<td>Null: no additional output</td>
<td>E: Entry</td>
<td>24VAC</td>
</tr>
<tr>
<td>IQE35</td>
<td>F</td>
<td>ECFAN: Electronically Commutable Fan</td>
<td>WR2: Water side Raise/Lower 2 pipe</td>
<td>E: Electric heater output</td>
<td>B: Basic</td>
<td>230</td>
</tr>
<tr>
<td>IQE38</td>
<td>P</td>
<td>1SFAN: 1 Speed Fan</td>
<td>WT2: Water side Thermic 2 pipe</td>
<td>E: Electric heater &gt;99% demand</td>
<td>P: Plus</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** All 230 Vac models available Quarter 1, 2012

### Available Order Codes

- **IQE31/F/BAC/1SFANAR2B/24VAC**: This is an IQeco31 with a fixed strategy from the basic library requiring a 24 Vac supply. The fixed strategy is 1 speed fan airside with heat/cool damper.

### IQE31/C/BAC/Custom/230VAC: These controllers are supplied with a custom strategy; they are programmable only. <Custom> is the custom strategy name.

### IQE31/F/BAC/3SFANAR22B/24VAC: This is an IQeco31 with a fixed strategy from the basic library requiring a 24 Vac supply. The fixed strategy is 1 speed fan airside with heat/cool damper.
As explained in the Library/Programmable Strategies section above, fixed strategy controllers can be re-configured using a standard strategy solution from the same library by downloading from SET. Programmable controllers may also be re-configured using any of the strategy solutions. In both cases the solutions may not be compatible with the IQeco variant.

The above table shows the compatibility of the standard solutions both with the fixed strategy libraries, and with the IQeco variants. Combinations which have a † prefix can be ordered from the factory. Other valid combinations may be downloaded using SET.

†: These combinations can be ordered from the factory (see order codes - previous page).

The IQeco variant compatibility applies to both fixed and programmable controllers. The 3 Speed Fan strategies are only compatible with IQeco 35 (because they use the 3 standard relay outputs); however, they can be downloaded into IQeco 31, 38 where the 3 fan control outputs will be ignored.

Fixed strategy controllers can only use strategies from their library (entry, basic, or plus). However, there is a version of each strategy in the libraries superior to its own. For example, the FCU 3 speed fan AR2 strategy can only be purchased as an entry level strategy, but can be downloaded into an IQeco fixed for either a basic or plus library. On the other hand the electronically commutated fan strategies are purchased as a plus level strategy and cannot be loaded into an IQeco fixed for either a entry or basic library.

All the above strategies use metric units. If one of the above IQecos is intended for use with imperial units (e.g. for USA), the IQeco should be reprogrammed with the equivalent strategy in imperial units; these can be installed in SET by selecting a custom input power supply. Includes MSTP/BINC option.

For example, IQE31/<Prog>/BAC/1SFANAR2B/<Power> has the FCU 1 Speed Fan AR2 strategy solution (b= basic library) in the 1 Speed Fan - Imperial section. This should be reprogrammed by the standard solution which has the same name (but with a # suffix) from the basic library in the 1 Speed Fan - English section.

IQE/PROG/UP Upgrade licence to convert a fixed strategy controller to a programmable controller

IQ3xact/00/MSTP/BINC/100-240: Web enabled controller with no inputs or outputs, non expandable by the I/O bus. 100 to 240 Vac input power supply. Includes MSTP/BINC option.

IQ3xact/00/MSTP/BINC/24: Web enabled controller with no inputs or outputs, non expandable by the I/O bus. 24 Vac or 24 to 36 Vdc input power supply. Includes MSTP/BINC option.

IQ3xact/12/MSTP/BINC/100-240: Web enabled controller with 12 input or output points, non expandable by the I/O bus. 100 to 240 Vac input power supply. Includes MSTP/BINC option.

IQ3xact/12/MSTP/BINC/24: Web enabled controller with 12 input or output points, non expandable by the I/O bus. 24 Vac or 24 to 36 Vdc input power supply. MSTP/BINC option.
**SPECIFICATIONS**

**ELECTRICAL**

- **Power Input Voltage**
  - IQeco/24VAC: 24 Vac ±15%, 50/60 Hz
  - IQeco/230: 230 Vac ±15%, 50/60 Hz

- **Power Input Consumption**
  - Up to 22 VA which consists of 3.6 VA internal power plus power to solid state digital outputs and the combined supply (auxiliary outputs, wall bus, and analogue outputs).

- **Combined Supply**
  - IQeco31/24VAC: 50 mA maximum available to be shared between auxiliary output supply (+ terminal), wallbus, and analogue output.
  - IQeco31/230, IQ35: 120 mA maximum available to be shared between auxiliary output supply (+, AUX terminals), wallbus, and analogue output.
  - IQeco38: 175 mA maximum available to be shared between auxiliary output supply (+, AUX terminals), wallbus, and analogue outputs.

- **Auxiliary power output**: Part of combined supply defined above, used to supply I/O devices e.g. sensors

- **Battery**: No battery required (data stored in flash memory)

- **Clock**: Software clock (1 second resolution)

- **BACnet MS/TP**
  - Distance: Dependent on cable type and wire gauge as specified 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 119

  **Note that the MS/TP network has different requirements to the IQL LonWorks network**

**Inputs**

- **IN1, IN7, IN8, IN9**: Universal inputs: (IN7, IN8 only available on IQeco35, 38; IN9 only available on 38). Can be set by software to voltage input (0 to 10 V), thermistor input (0 to 200 kohms), or digital input (volt free contact/open collector).
  - **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 0.5% of span.
  - **Current input**: Minimum 60 dB series mode rejection at input power supply frequency. 0 to 10 mA, input resistance 100 ohms, accuracy 0.5% of span (i.e. 100 μA). Can connect either loop powered or external powered sensors. Supply to loop powered sensors by ‘+’ terminal, uses part of combined supply defined above.
  - **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 12 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 12 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.)

IN2, IN3, IN6: Thermistor inputs: (IN6 only available on IQeco35, 38). (potentiometer, thermistor, fan speed control). 0 to 200 kohms 12 bit resolution. Minimum 60 µA series mode rejection at input power supply frequency. Thermistor bridge resistor 100 kohms, accuracy 0.5% (200 ohms to 200 kohms). Bridge supply 3.3 V.

IN4, IN5: Digital inputs: (IN5 only available on IQeco35, 38). (volt free contact, open collector (or drain)). Count rate 30 Hz (minimum pulse width of 16.6 ms). 5 V supply through 1.5 kohms.

Volt free contact input: Wetting current = 3 mA nominal. (ON = closed contact.)
Open collector (or drain) input: Must be able to sink 3 mA. Must be earthed (grounded) to same earth (ground) as IQeco. Polarity dependent. (ON = transistor/FET conducts.)

Outputs:

OUT1
IQeco31/24VAC: Relay output standard current. Normally open, make only, single pole relay contacts. 250 Vac at 5 A maximum. Arc suppression circuit (RC) should be fitted for inductive loads, see TG200208.

IQeco31/230, *IQeco35, 38: Relay output high current Changeover relay contacts. 250 Vac at 8 A maximum. Arc suppression circuit (RC) should be fitted for inductive loads, see TG200208.

OUT2, OUT3, OUT4
*IQeco35 only. Relay output standard current. Changeover relay contacts. 250 Vac at 5 A maximum. Arc suppression circuit (RC) should be fitted for inductive loads, see TG200208.

*Note that to meet safety requirements, for the 4 relays (OUT1 to OUT4) on IQeco35, those being used must all be switching either low voltage or mains and not a mixture of voltages. If switching mains, they must all switch the same phase and polarity.

OUT5, OUT6, OUT7, OUT8: Solid state digital outputs suitable for use with 24 Vac thermal type actuators, 24 Vac synchronous motors, and 24 Vac relays.

IQeco31, 35, 38 /24VAC: Solid state digital outputs equivalent to 24 Vac solid state relays. 24 Vac at 0.4 A maximum for a channel, 0.4 A total for all 4 channels. Only 2 channels shall be active at one time.

IQeco31, 35, 38 /230: Solid state digital outputs equivalent to 24 Vac solid state relays. 24 Vac synthesised, 0.4 A maximum for a channel, 0.4 A total for all 4 channels.

OUT9, OUT10, OUT11, OUT12: Analogue outputs: (OUT10, OUT11, OUT12 only available on IQeco36) 0 to 10 Vdc at up to 20 mA (over temperature range -40 °C to +40 °C, -40 °F to 104 °F), and up to 10 mA (from +40°C to +60 °C, 104 °F to 140 °F). Accuracy ±5% of span.


LED
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. This indicator is also used in service button mode as described above (see Service Button).

Service Button: Identification message generation, strategy cleardown facility, and service button mode to initiate strategy functions

Wallbus: Two wire bus for connection of a display unit (e.g RD-WMB). Bus supply to display is 50 mA maximum (RD-WMB consumes 10 mA max.). Polarity independent. Use twisted pair cable, up to 60 m (200 ft).

Supervisor Port (USB): Micro B connector. USB 2.0. Maximum cable length 5 m
### MECHANICAL

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQeco31/24VAC</td>
<td>170 mm (6.69”) x 89 mm (3.5”) x 45 mm (1.77”)</td>
</tr>
<tr>
<td>IQeco31/230, IQeco/35, 38</td>
<td>205 mm (8.07”) x 129 mm (5.08”) x 63 mm (2.48”)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box</td>
<td>Flame retardant ABS</td>
</tr>
<tr>
<td>Terminal Cover</td>
<td>Clear polycarbonate flap</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQeco31/24VAC</td>
<td>206 g (7.25 oz)</td>
</tr>
<tr>
<td>IQeco31/230, IQeco/35, 38</td>
<td>510 g (1 lb 2 oz)</td>
</tr>
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<table>
<thead>
<tr>
<th>Connections</th>
<th>Description</th>
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<tbody>
<tr>
<td>Electrical</td>
<td>5.0 mm (0.197”) two part connectors for 0.5 to 3 mm² (24 to 12 AWG) cable (18 AWG, 0.8 mm² typical)</td>
</tr>
<tr>
<td>USB</td>
<td>Micro B. Maximum cable length 5 m.</td>
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### ENVIRONMENTAL

<table>
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<tr>
<th>EMC</th>
<th>Description</th>
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<tbody>
<tr>
<td>Safety</td>
<td>EN61010-1: 2001</td>
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<table>
<thead>
<tr>
<th>Ambient limits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>storage</td>
<td>-40 °C (-40 °F) to +60 °C (140 °F)</td>
</tr>
<tr>
<td>operating</td>
<td>-40 °C (-40 °F) to +60 °C (140 °F)</td>
</tr>
<tr>
<td>humidity</td>
<td>0 to 95 %RH non-condensing</td>
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<tr>
<td>Protection</td>
<td>IP20, NEMA 1</td>
</tr>
<tr>
<td>Altitude</td>
<td>&lt; 2000 m (6562’)</td>
</tr>
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### VERSIONS

<table>
<thead>
<tr>
<th>Firmware</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Version 2.0</td>
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</table>

<table>
<thead>
<tr>
<th>Board</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>IQeco31/24VAC</td>
<td>50100941-001</td>
</tr>
<tr>
<td>IQeco31/230, IQeco/35, 38</td>
<td>AP107010 Issue 1</td>
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