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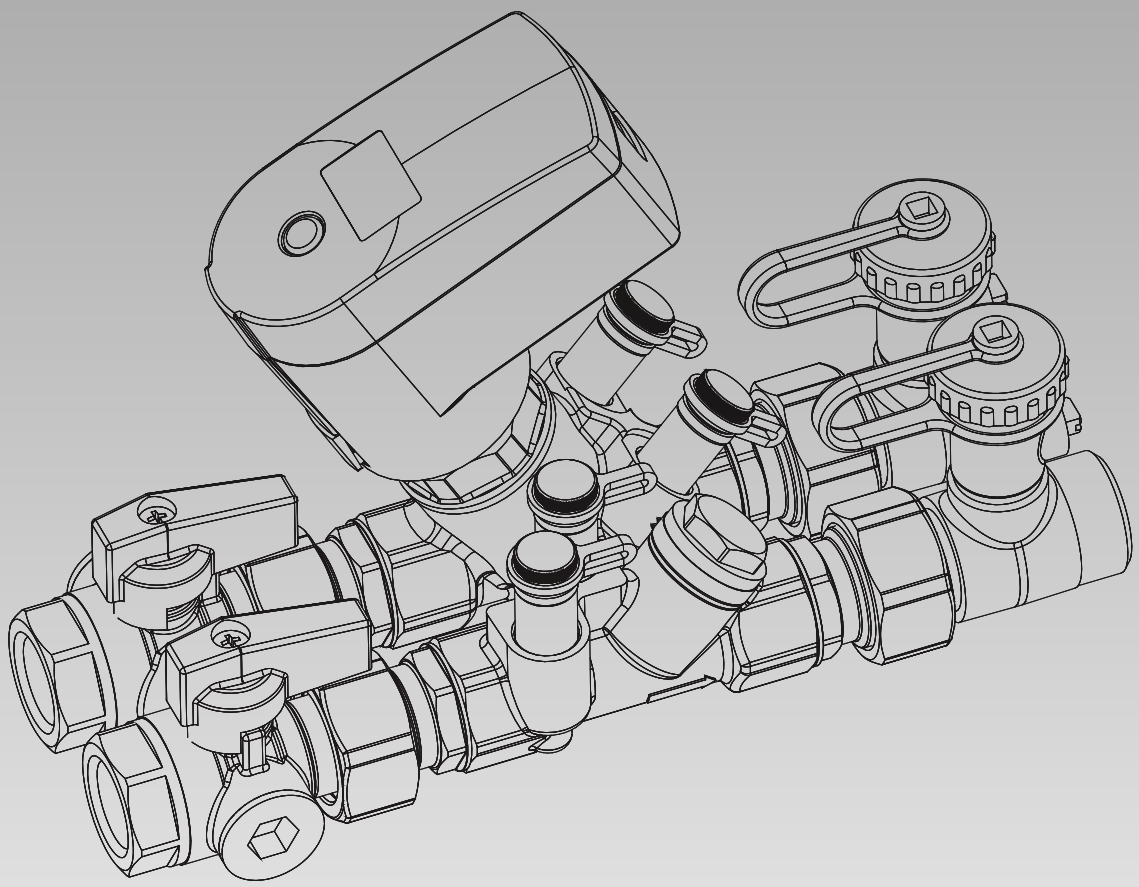

FCVA – Fan Coil Valve Assembly

Installation, Operation and Maintenance (IOM)

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Contents

1. Key symbols and safety instructions 3

1.1 Key to symbols 3

1.2 General safety instructions 3

2. FCVA information 4

2.1 General Information 4

2.2 Intended use 4

2.3 Misuse 5

2.4 Declaration of conformity 5

2.5 Dimensions and hydraulic connections 5

2.6 Internal layout 6

2.7 Standard modes of operation 7

2.8 Advanced modes of operation 8

2.9 Technical specification 9

3. Regulations 9

3.1 General 9

3.2 Standards and guidelines 9

3.3 Inspection and maintenance 9

4. Pre-Installation requirements 10

4.1 General 10

4.2 System preparation 10

4.3 Cleaning primary system 10

4.4 Application location and clearances 10

4.4.1 Location 10

4.4.2 Installation and maintenance clearances 10

5. Installation 11

5.1 Fan coil installation 11

5.2 Test points: 13

5.3 Application example 13

5.4 FCVA electrical actuator installation 13

6. Pre-commissioning 16

6.1 FCVA pre-commissioning checklist 16

6.2 Water quality & pipe corrosion (initial fill with mains water and chemical treatment used in operation) 16

6.3 Water quality & pipe corrosion (initial fill with demineralised water with a controlled pH within VDI parameters and treatment following VDI 2035 Parts 1 & 2) 18

7. Commissioning 19

8 Handover 22

9. Maintenance 23

9.1 Draining the FCVA & filter removal 23

9.2 PICV Cartridge Replacement 25

10.0 Appendix 26

10.1 Appendix A1: Table A – PICV flow rate settings 26

10.2 Appendix A2: Pressure loss graphs 27

10.3 Appendix A3: Table B – Venturi specification 28

10.4 Appendix A4: Actuator technical details 28

1. Key symbols and safety instructions

1.1 Key to symbols

Warnings

	Warnings in this document are identified by the warning triangle adjacent. Keywords are used at the start of a warning triangle to indicate both the type, and seriousness of the risk identified, if measures to prevent the risk are not taken.

Essco Group have defined the following Keywords and used them in this document:
• **NOTICE** Indicates a situation that could result in damage to property or equipment.
• **CAUTION** Indicates a situation that could result in minor to medium injury.
• **WARNING** Indicates a situation that could result in severe injury or death.
• **DANGER** Indicates a situation that will result in severe injury or death.

1.2 General safety instructions

Guidelines

- Adhere to national and regional regulations, technical rules, and guidelines always.
- Observe the safety instructions and warnings identified and take appropriate care.
- Before starting the installation, any installation instructions (fan coil, heating controls, FCVA etc.) should be carefully read through.
- Record all work carried out.

Risk of electrical shock

- Due to risk of electrical shock any electrical work or maintenance must only be carried out by qualified / registered personnel.
- Before carrying out any work on electrical components, isolate them from the power supply (fuse, circuit breaker) and secure against unintentional reconnection.

FCVA operation
Cleaning and user maintenance should only ever be carried out by competent and authorised personnel.

Important handling instructions
Care should be taken when transporting, lifting, and carrying products, particularly when loads are still palletised.

- Use a means of transport suitable for handling bulk product (e.g., sack truck with strap, stair climbing or step trolley).
- When handling products in bulk, secure them against a fall.
- Let only trained personnel undertake the handling.
- The correct method for handling heavy objects should be strictly observed, always.

General handling guidelines
Only remove packaging at the time of the final installation to protect products from damage.

Always assess the weight of products before attempting to lift on your own. During handling and unpacking, wear safety gloves to prevent injuries to your hands through sharp-edged components.

Dispose of packaging materials appropriately.

Packaging
The following points should be observed during unpacking:

- Check the delivery immediately upon receipt for completeness and transport damage.
- In the event of transport damage, the delivery should only be accepted conditionally.
- Do not use damaged components for assembly.
- Carefully unpack the unit(s).

Siting and installation
Correct siting, assembly and installation of the product is the fundamental requirements for safe and economical operation of the product.

- Only trained contractors are to site and install the FCVA and its components.
- The product must only be installed in rooms and locations that meet the manufacture's requirements.

Commissioning

- The FCVA must only be commissioned by a competent person.
- Check all connections for leakages prior to starting up the heating system.
- All fixings and fittings must be checked and tightened if required after the unit has been installed.

Risk of damage due to operator error
Operator errors can result in injury and damage to property.

- Ensure that only personnel who can operate this product correctly have access to it.
- Inspection, maintenance, and repairs must only be carried out by competent persons.
- Use only original spare parts from the manufacturer. The manufacturer can assume no liability for damage caused by spare parts not supplied by the manufacturer.

Electrical work
Electrical work must only be carried out by a qualified electrician:

- Before starting electrical work
  - Ensure that the electricity supply is safely isolated and secure to prevent inadvertent re-connection.
  - Information on safe isolation can be found in the Health and Safety Executive Guidance HSG85.
  - Using test equipment approved to GS38 confirm that the electricity supply is disconnected.

- Refer to the manufacturer's information when installing other components with Essco equipment within the system.

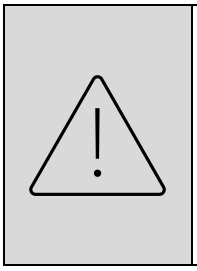
Danger of burns and scalds

- Surfaces of individual components, connections and leaking water can be very hot and cause severe burns and scalds.
- Do not touch hot surfaces.
- Caution should be taken not to touch any leaking water or drained system water unless the temperature is known and safe.

Leakage

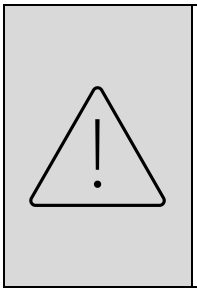
If leaks are observed:

- Fully isolate FCVA immediately.
- Ensure all leaks are repaired by a suitably qualified professional.



Caution:
The heat network side of the FCVA can be operated with high pressure and high temperature systems.

Please apply extreme caution and wear the appropriate safety equipment (PPE) when working on suspected leaks.



Notice:
The pressure differential across the primary circuit of the FCVA must not exceed the maximum stated for the flow cartridge fitted.

Please refer to the technical specification section for operating range of pressure or contact an Essco technical representative.

Instructing the customer

- When handing over, instruct the user how to operate the product correctly and inform them about its operating conditions.
- Explain how to operate the heating system and draw the user's attention to any safety-relevant action.
- Explain that modifications and repairs must only be carried out by an authorised contractor.
- Hand customers the product documentation for safekeeping.

2. FCVA information

2.1 General Information

The Essco Fan Coil Valve Assembly (FCVA) can be used on fan coils, ceiling conditioning systems and cold beams. For the purposes of this manual, we have focussed on fan coils as this is the most common application and should cover most of what needs to be covered in this document.

This document must be read in conjunction with any relevant IOM material from the fan coil or system manufacturer. Any installation and maintenance must also be carried out by trained and competent engineers in accordance with CIBSE Commissioning Code W:2010 and in line with BSRIA BG 29/2012 Pre-Commission Cleaning of Pipework Systems.

Main features

- Compact and space saving.
- Preassembly means less installation time required on site, with only four connections to make.
- One assembly suitable for both heating and cooling applications.
- Range of assembled options for handed installation.
- Flow limitation cartridges allow for a much larger range of flow rates through the same metering station.
- Supplied pre-tested to save time on site.
- Robust, with minimal service and maintenance requirements.
- Control via a standalone thermostat or Building Management System (BMS).

2.2 Intended use

The FCVA is a multi-function valve assembly, designed to perform the following tasks:

- Supply of heating or cooling within a dwelling which uses a terminal unit such as fan coil unit (FCU), ceiling conditioning system or cold beams etc, supplied either directly or indirectly via a heat network.
- Accurate flow rate control regardless to changes in system pressures, within the operating range of pressure permitted by the PICV.
- Protection of PICV via inline strainer fitted within assembly.
- Primary bypass for flushing and cleaning of primary circuit.
- Forward flushing of system debris from terminal unit.
- Back flushing of system debris using primary return, as necessary.
- Full assembly isolation when needed for maintenance or removal.
- Measurement of dP across the terminal units.
- Validation of pressure at index circuit across bonnet of PICV.
- Validation of terminal unit flow rate across venturi metering station.

The flow rate is pre-set on the PICV during commissioning based on the maximum load required, then signal from room temperature sensor / other is used to modulate the PICV actuator to achieve the required flow rate to the terminal unit to meet the comfort level required. Actuators are available in 230v, 24v, 2-point / 3-point control and proportional control (0-10v). Wiring diagrams can be found for each variation later in this guide.

2.3 Misuse

This product must be used as per the intended use statement. Operation outside the parameters of the intended use is considered misuse and could cause harm to people and damage to property. Using the product outside of its intended use may also invalidate the manufacturer's guarantee.

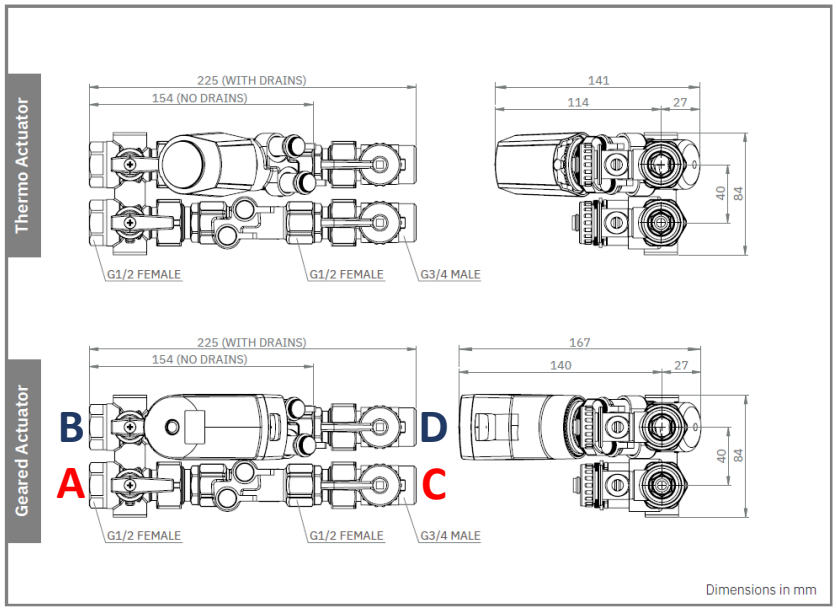
2.4 Declaration of conformity

This product, in design and operation, conforms to the European Directives and supplementary national requirements.

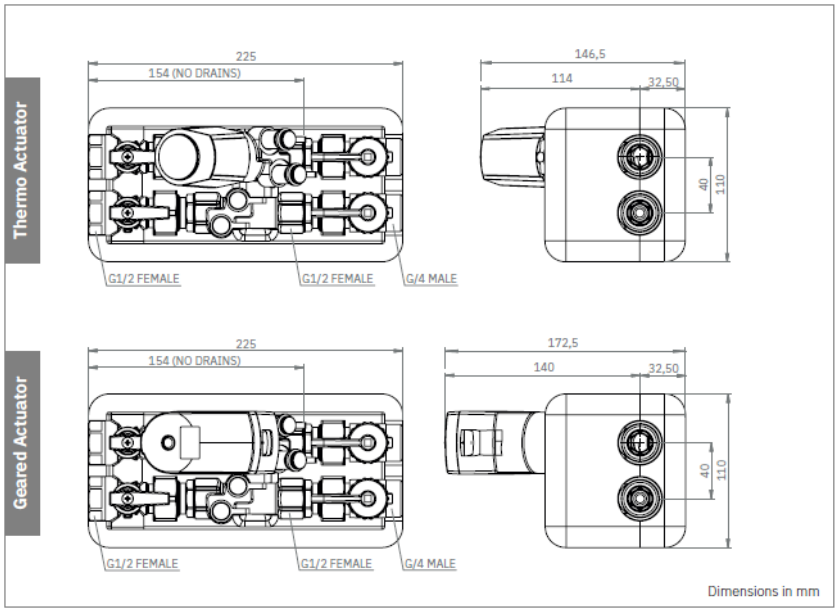
You can request the declaration of conformity for the product. To do so, send your request to the address on the back of the manual.

2.5 Dimensions and hydraulic connections

Excluding Insulation

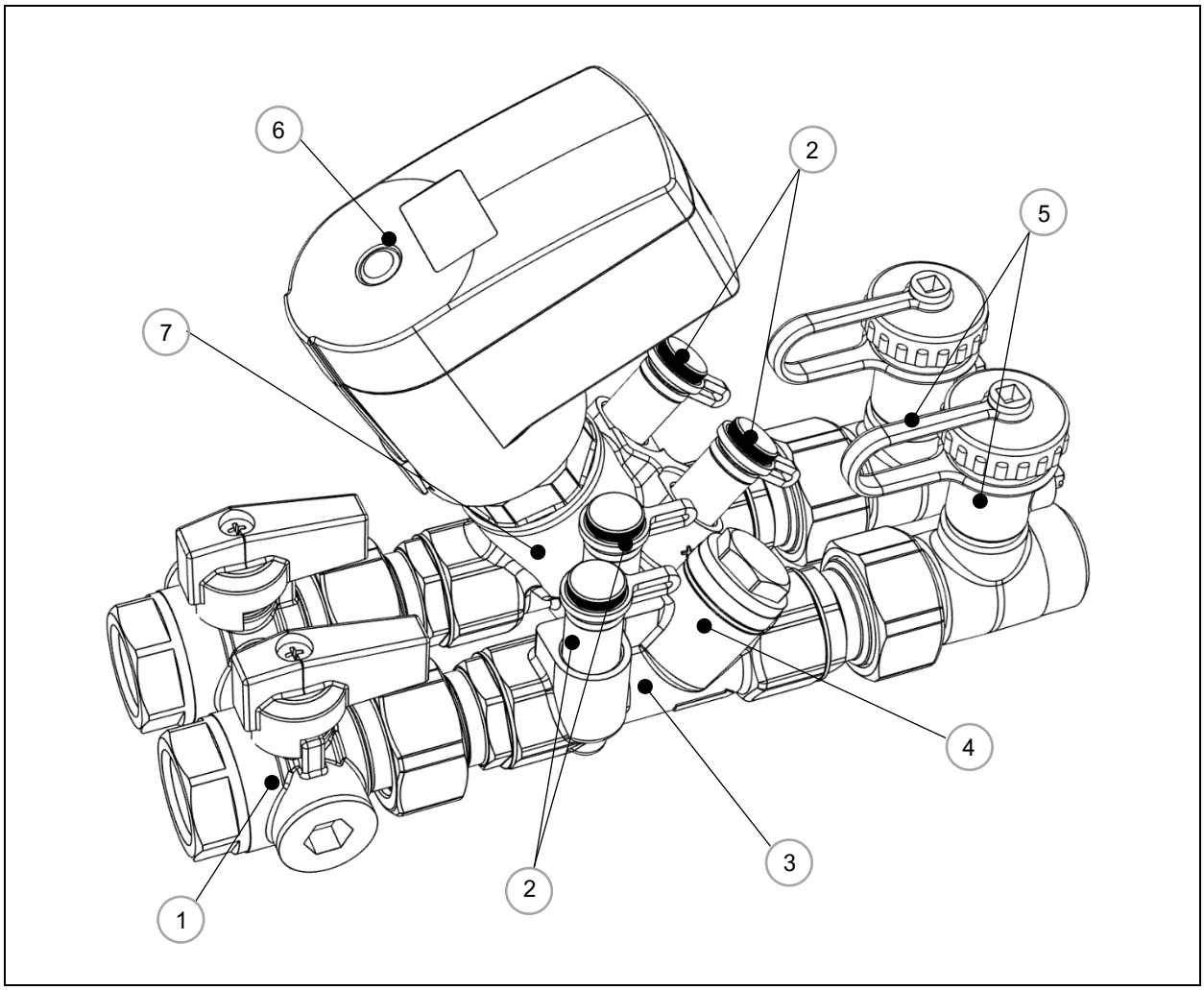


Including Insulation *(optional, order separately)*



Connections	
Primary	**Secondary**
A – Primary Flow **B** – Primary Return	**C** – Terminal Unit Flow **D** – Terminal Unit Return

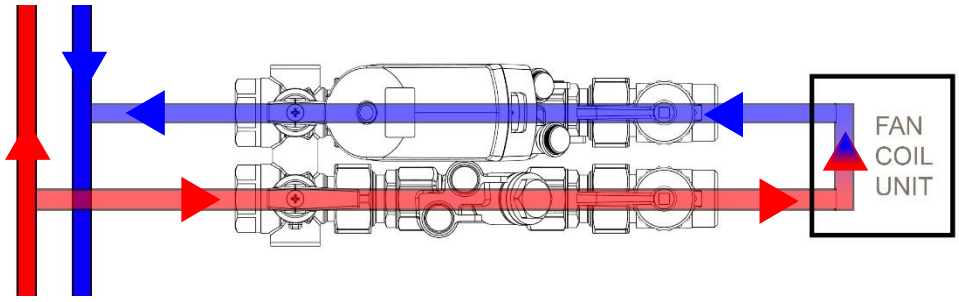
2.6 Internal layout



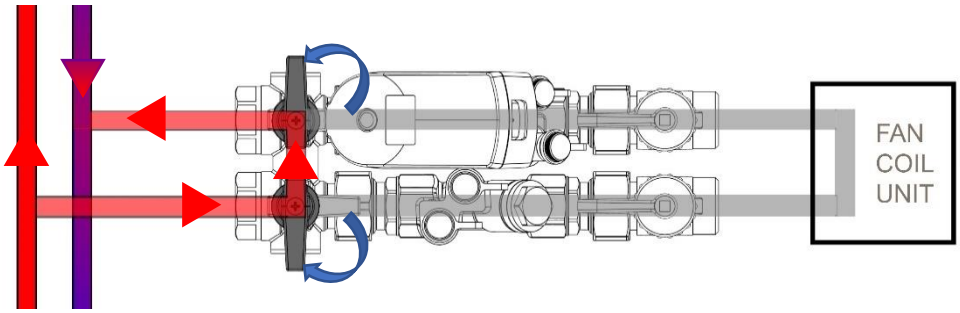
Item No.	Component Description
[1]	Bypass / Isolation Valve
[2]	Test Points
[3]	Venturi Metering Station
[4]	Strainer
[5]	Flush & Drain Modules
[6]	Actuator
[7]	PICV

2.7 Standard modes of operation

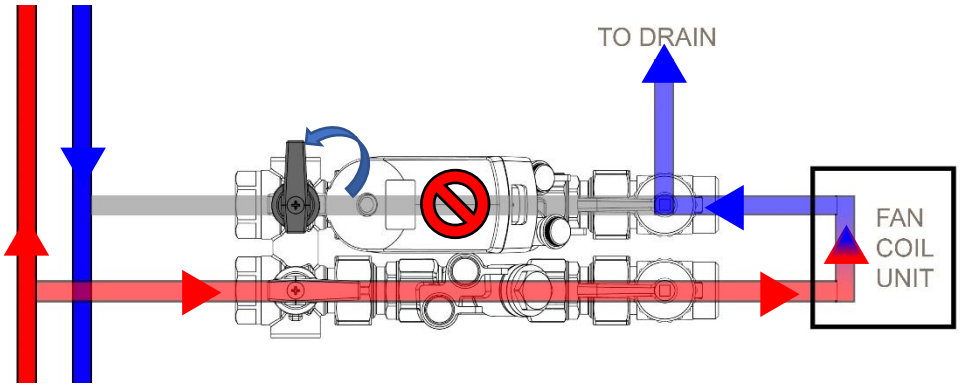
1	**Normal Operation:** Both isolation valve handles in horizontal orientation (open, with direction of flow). Purpose: The room requires heating or cooling so the PICV actuator is open / modulating to pull flow from the heat network, to achieve the comfort level required.



2	**Bypass Mode:** Both isolation valve handles in vertical orientation (closed, perpendicular to direction of flow). Purpose: To flush & clean primary circuit.

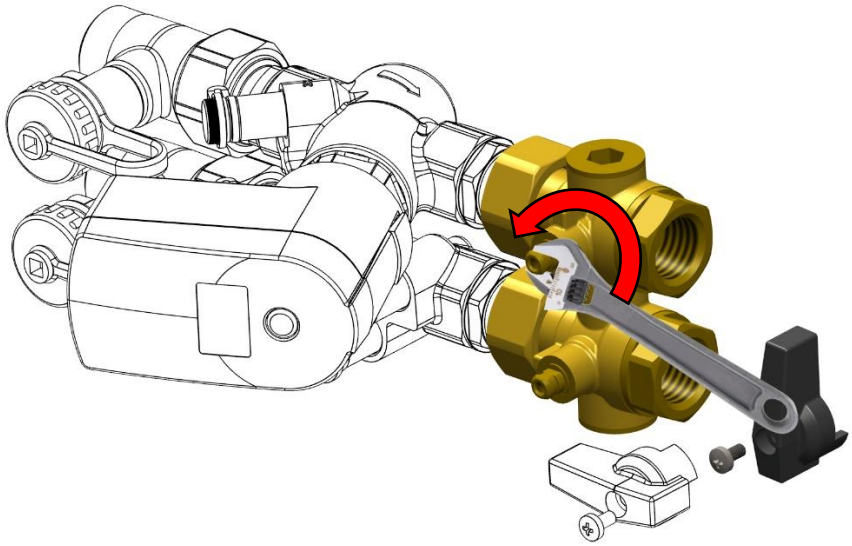


3	**Forward-Flushing:** Flow handle in direction of flow (open), return handle perpendicular (closed). Return drain module opened to drain. Note: care must be taken to ensure PICV is closed. Purpose: To flush any system debris from FCU using primary flow.

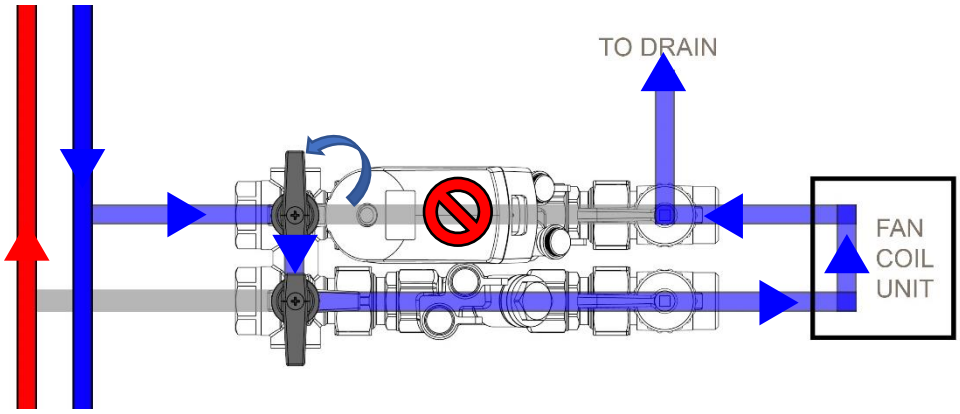


2.8 Advanced modes of operation

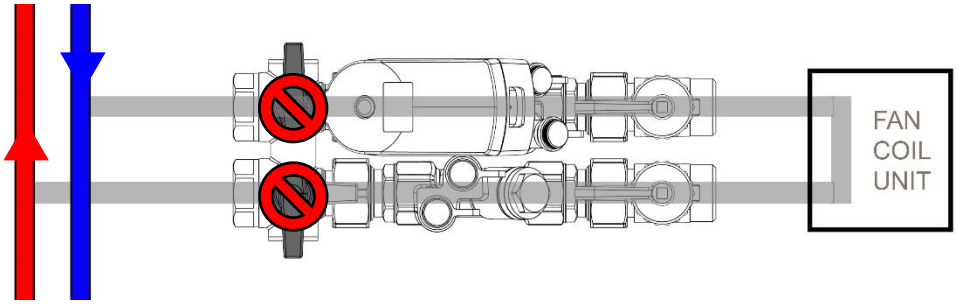
Note: These options are only possible through removal of the isolation ball valve handle(s) using a crosshead screwdriver, then turning the internal ball 180ºC using an 8mm / adjustable wrench and refitting the handle. To return to a standard mode of operation, the ball valve position must be reset to the standard position.



4	**Back-Flushing**: Flow ball valve removed and rotated, both handles set perpendicular to flow direction. Return drain module opened to drain. Note: care must be taken to ensure PICV is closed. Purpose: To back-flush any system debris from FCU, as necessary.



5	**Full Isolation**: Both ball valves removed and rotated, then both handles set perpendicular to flow direction (closed to primary side). Purpose: For FCU maintenance / cleaning of FCVA strainer.



2.9 Technical specification

Description	Units		Exc. Insulation	Inc. Insulation
General				
Height	mm		84	110
Width	mm		225	
Depth	mm	c/w thermic actuator	141	146.5
		c/w geared actuator	167	172.5
Total weight	kg*	c/w thermic actuator	2.28	2.38
		c/w geared actuator	2.32	2.42
Operating temperature range	°C		-10 – 120	
Maximum working pressure	bar		25	
Maximum dP with actuator	bar		1	
Operating pressure range (low flow cartridge)	kPa		16.5 – 400	
Operating pressure range (medium / high flow cartridge)	kPa		26 – 400	
Flow rate regulation range (low flow cartridge)	l/h		15 – 190	
Flow rate regulation range (medium flow cartridge)	l/h		64 – 280	
Flow rate regulation range (high flow cartridge)	l/h		378 – 1390	
Maximum percentage of Glycol	%		30	
Thermal conductivity of insulation (where ordered) at 10°C	W/mK		0.0320	
Thermal conductivity of insulation (where ordered) at 40°C	W/mK		0.0404	
Fire resistance of insulation (where ordered) to DIN 75200	mm/min		<100	
Density of bottom insulation shell	Kg/m^3		30	
Density of top insulation shell	Kg/m^3		80	

**** Weights tolerance ± 5%.*** *If venturi valve has been ordered to exclude strainer, subtract 0.04kg from totals shown.*

3. Regulations

3.1 General

The installation and maintenance of the unit must be performed by a qualified person in accordance with regulations and rules of the local area where installation is to take place.

3.2 Standards and guidelines

When installing and operating, please refer to country-specific regulations and standards, note in particular:

- The local standards and regulations on the installation conditions.
- The provision for the electrical connection to the power supply.
- The standards and regulations relating to the safety equipment of the water heating system.

3.3 Inspection and maintenance

The heating system should be inspected regularly for the following reasons:
To achieve and maintain a high efficiency.
To ensure operational safety.
The recommendation from BSRIA BG62/2015 is a maintenance check every 3 years should be sufficient, however water quality should be checked frequently, and strainers checked/emptied as often as required.

Notice: Risk of system damage!

Damage to the system caused by lack of, or insufficient cleaning and servicing.

- Ensure that the heating system is inspected regularly by an authorised heating engineer.
- Carry out any repairs immediately to avoid any damage to the system.

4. Pre-Installation requirements

4.1 General

Notice:
The pressure differential across the primary circuit of the FCVA must not exceed the maximum stated for the flow cartridge fitted.

Please refer to the technical specification section for operating range of pressure or contact an Essco technical representative.

4.2 System preparation

Water system and pipework

- Any plastic pipework used on the central heating system must have a polymeric oxygen barrier coating and at least 1000mm length of copper or steel pipe connected to the FCVA.

The minimum cooling flow temperature of the product is -10°C.

The maximum heating flow temperature of the product is 120°C

4.3 Cleaning primary system

Notice: Risk of damage to system or product.
Debris from the system can damage the product and reduce efficiency. Failure to comply with the guidelines for the use of water treatment with the FCVA will invalidate the product warranty.

- Before installation, ensure that the central heating system is cleaned and thoroughly flushed in accordance with the standards and guidelines of the country of installation.

4.4 Application location and clearances

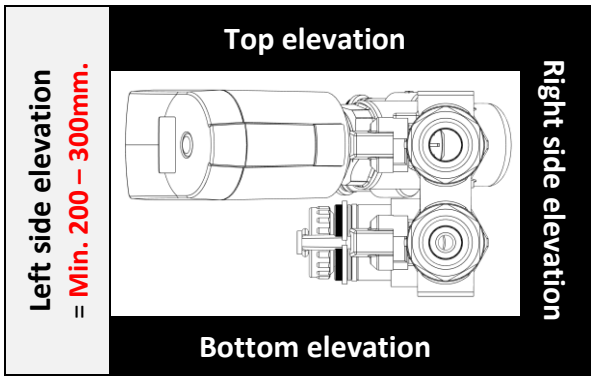
4.4.1 Location

- Follow local regulations for the location within the property that the product is to be installed.
- This product is only suitable for installing internally within a property at a suitable location onto fan coil pipework, capable of supporting the product weight.
- The product is not suitable for external installation.

4.4.2 Installation and maintenance clearances

When the FCVA is fitted to a fan coil, the top, bottom, and rear of the assembly will not need to be accessible unless for product removal or dropping of hose when flushing.

The components requiring access for maintenance or measurement are on the side profile as shown below. For this reason, it is necessary to provide sufficient space on this side for access. Note the side requiring access changes for handed assemblies (image below is for a heating FCVA, LH assembly). Essco recommend a minimum of 200 – 300mm to get tools into this space for adjustment and consideration should also be made on how hose pipe could be taken into this area for draining purposes.



5. Installation

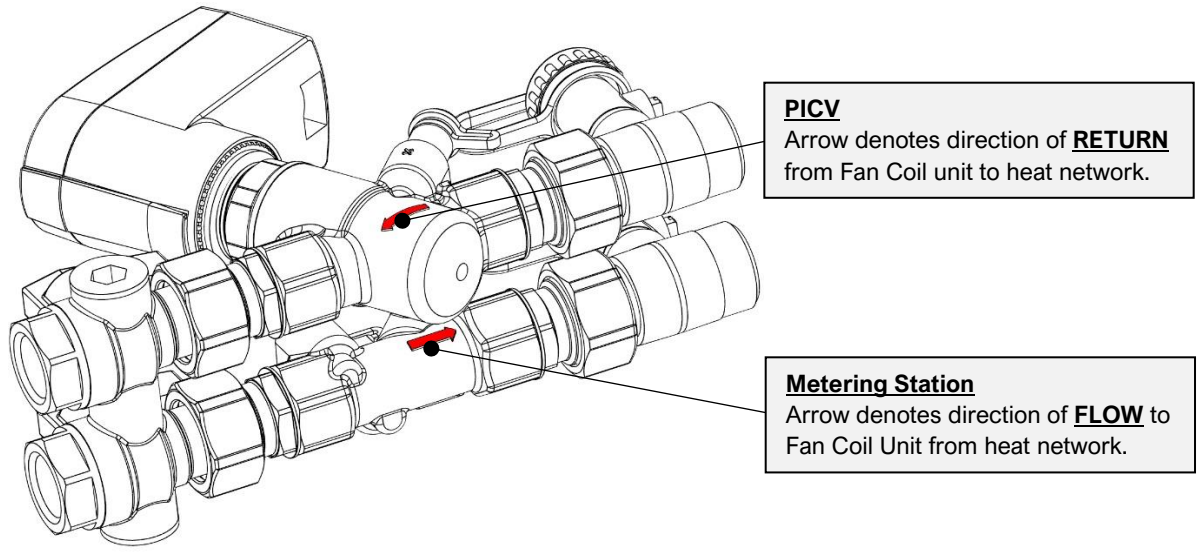
5.1 Fan coil installation

The FCVA has been designed with 40mm connection spacing to allow direct connection to a Fan Coil. Valves are also turned horizontally to minimalise assembly height when fitted.

Care should be taken to design adequate access to the FCVA for setting, adjustment, and draining / maintenance. When tube cutting, mounting brackets/supports or jointing pipework, risk assessments are recommended along with appropriate PPE.

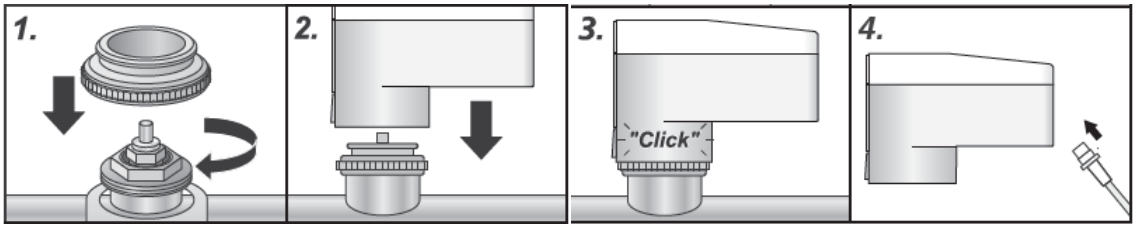
The following instructions are guidelines and will not cover all installation scenarios. If unsure, please contact an Essco Group technical representative before installation.

1	Fit the FCVA to the FCU pipework, correctly in the direction of flow as indicated on the brass bodies.



For threaded connections to the FCVA: Essco recommend using thread sealant (Permabond A1044 or equivalent). When using Teflon tape Essco also recommend 4-6 layers of tape wrapped around the thread in a clockwise direction.

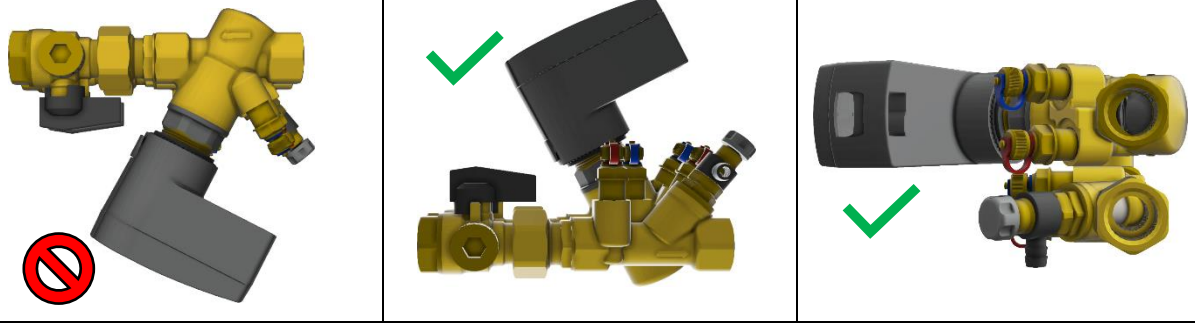
2	Fit the Essco FCVA actuator ordered to the PICV body. No attempt to connect or disconnect actuators should be made when actuators are energised, to avoid possible damage or personal injury / shock.



All wiring should conform to local codes and must be completed by authorised and competent personnel. In the event of any damage or actuator issue, no repair should be attempted, instead contact an Essco Group Technical representative.

Please see Appendix A4 for Essco FCVA actuator technical details & Section 5.4 for wiring diagrams, respectively.

Care must also be taken to ensure the PICV actuator is fitted in the correct orientation and not facing downwards:



3	Ensure that the system has been properly flushed in accordance with BSRIA BG 29/2020

Recommendation: "…it is recommended…that an additional drain point be located between the two-port valve and coil connection to allow the coil to be flushed directly at full flow without the flow passing through the two-port valve…."

Rationale: The PICV within the FCVA is sized to ensure good water flow control, regardless of changes of system pressure. A PICV will have an inherently narrow flow path however which makes it unlikely that even with the PICV fully open, that there will be sufficient flow velocities for FCU flushing. It is also more likely that debris will be introduced and can block flow paths and hinder controllability.

Solution: In line with BSRIA recommendations, the Essco FCVA has a flushing point located between the FCU and the PICV when it is supplied with the Drain Modules. This allows the FCU to be flushed through without the need to restrict velocity by passing through the PICV.

4	Check the system has been filled fully and all air has been vented using air vents fitted at the top of risers and where applicable on the FCU's themselves. Once vented ensure vents are closed to prevent leaks.
5	The LF and HF versions of the Essco FCVA operate between a minimum and maximum pressure drop, as detailed in the technical specification. Care must be taken to ensure that system pressures are checked and maintained to be within these limits.
6	Essco FCVA's have an integral strainer within the metering station component to help protect the PICV and other installed components. Where more adequate protection is required due to water quality issues, allowances must be introduced at plant level.

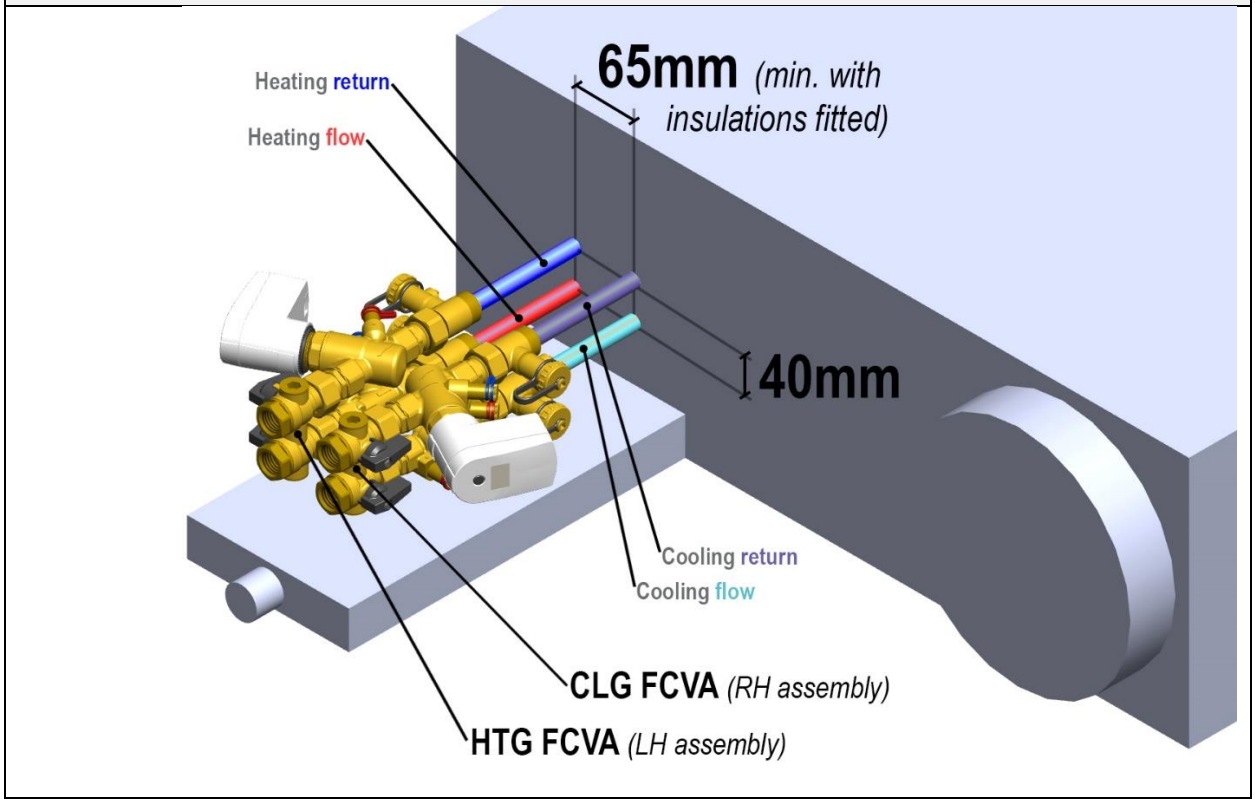
5.2 Test points:
The Essco FCVA has two sets of binder test points on its assembly. One pair is fitted on the PICV and designed solely to verify the differential pressure across the PICV bonnet. This is to ensure that there is sufficient pressure for the valve to operate (typically 16-30kPa), which is particularly important at the index circuit.

The second pair is fitted on the metering station, to obtain accurate flow readings. Essco do not recommend measuring flow rate across the PICV as Δp measurements across this device are less reliable and based on theoretical Kv figures.

Finally, it is also possible to check the Δp across the FCU if required. This can be done using one test point on the PICV and a second on the metering station.

5.3 Application example

Two FCVA's fitted to a ceiling mounted fan coil unit (FCU). One FCVA controlling flow rate to the heating coil of the FCU, the second FCVA controlling flow rate to the cooling coil of the FCU.



5.4 FCVA electrical actuator installation

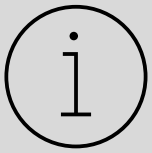
Electrical considerations

Warning: Risk of electrical shock!

- Before carrying out any work on electrical components, isolate them from the power supply (Fuse, circuit breaker) and secure against unintentional reconnection.
- All work must be in line with country specific and local standard and regulations.
- Information on safe isolation can be found in the health and safety executive guidance HSG85.
- Using test equipment approved to GS38 confirm that the electrical supply is disconnected.

DANGER: Risk of fire from electrical components. Hot components can damage electrical cables.

- Ensure all electrical cables are in the correct cable guides and away from hot components.



Actuators

Essco warranty is voided using actuators other than those supplied by Essco Group.

24v systems (generally):
We recommend the following cable lengths for a 24v system:

Cable	Section	Length
Standard DDC line	0.22 mm²	20 m
J-Y(ST)Y	0.80 mm²	45 m
NYM / NYIF	1.50 mm²	136 m

Transformer / power supply
A safety isolating transformer according to EN 61558-2-6 (for the AC variant) or a switching power supply according to EN 61558-2-16 (for DC variant) must always be used.

230v systems (generally):
We recommend the following cable lengths for a 230v system:

Cable	Section
Light plastic-sheathed cable	NYM 1.50 mm²
Flat webbed building wire	NYIF 1.50 mm²

Cable routing

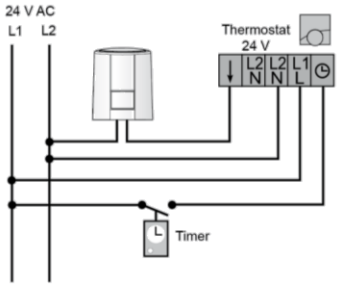
- Route cables through the insulation box where applicable and back to source.
- Run power cables separately from any signal cables where also applicable. Interference from power cables, ensure that there is at least 100mm separation from each other.
- Ensure that cables are of sufficient length to allow for removal when required.

Actuator options
Depending on the project requirements, Essco can supply any one of the following actuator options. These have all been pre-configured to control the PICV correctly, based on the pin-stroke required for the Essco FCVA:

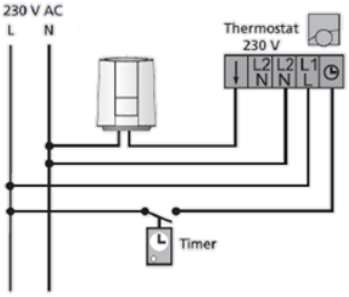
Thermic (T)		Geared (G)	
Part Code Differentiator	**Description**	**Part Code Differentiator**	**Description**
T-24-2P	24V 2-Point	G-24-2/3P	24V 2/3-Point
T-230-2P	230V 2-Point	G-230-2/3P	230V 2/3-Point
T-24-0-10V	24V 0-10V	G-24-0-10V	24V 0-10V

Thermic Actuators Wiring Diagrams:

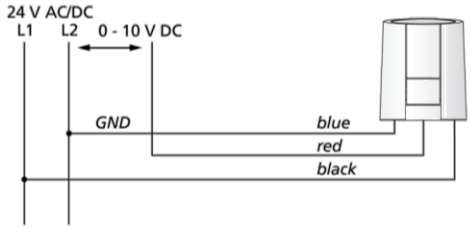
Thermic 24V 2-Point Control (T-24-2P)



Thermic 230V 2-Point Control (T-230-2P)



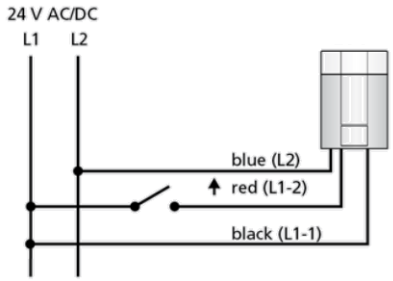
Thermic 24V Proportional Control (T-24-0-10V)



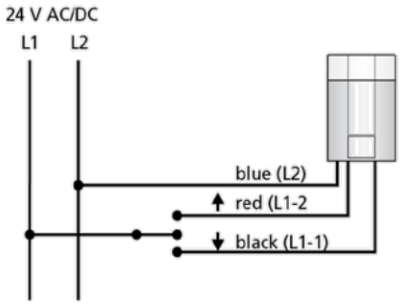
Geared Actuators Wiring Diagrams:

Geared 24V 2/3 Point Control = G-24-2/3P

2-Point Control (2P)

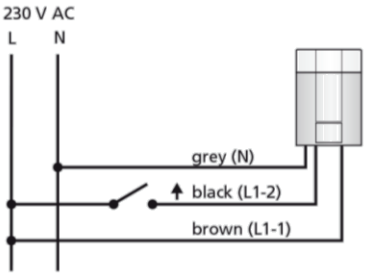


3-Point Control (3P)

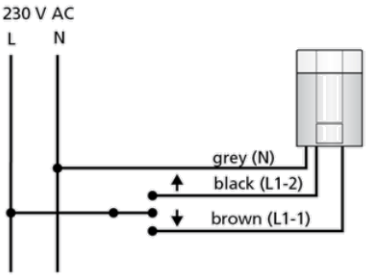


Geared 230V 2/3 Point Control = G-230-2/3P

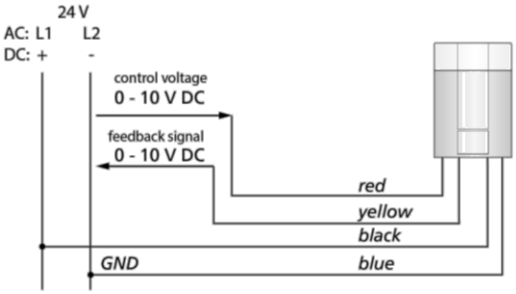
2-Point Control (2P)



3-Point Control (3P)



Geared 24V 0-10V Control = G-24-0-10V



6. Pre-commissioning

6.1 FCVA pre-commissioning checklist

Pre-commissioning checklist		
1	Primary network and plant room fully operational and complete (Inc. water treatment) *	
2	Secondary system fully operational (Inc. water treatment) *	
3	FCVA installed as per the hydronic connections.	
4	Electrical connections and supply are in place and all controls are functional.	
5	Design schedule of flow rates (heating and/or cooling) prepared for finding FCVA commissioning settings	

* The pipework systems connected to Essco FCVA's must have been cleaned and flushed in accordance with the relevant standards and regulations.

While Essco have summarised guidance from CIBSE CP1 2020 below in tables 6.2 and 6.3, engineers should refer to this guide, BSRIA BG29/2020 & VDI-2035 European water quality standards in full, for complete guidance on water quality requirements.

6.2 Water quality & pipe corrosion (initial fill with mains water and chemical treatment used in operation)

Parameter	Units	Control limit	Monitoring frequency	Reasons for using this parameter
Visual	-	Clear with no suspended solids or gassing	Monthly	A photograph of the system water in a clear container should be taken as soon as possible following sampling. An extended period before a visual check can lead to changes in appearance, e.g., precipitation of dissolved iron when contacting with oxygen.
Odour	-	No strong sulphurous or ammoniacal smell	Monthly	Sulphide smells indicate potential growth of sulphide-reducing bacteria (SRB). Ammonia smells can indicate growth of nitrate-reducing bacteria (NRB) (some inhibitors have a mild ammonia smell).
pH (control range defined by least noble part of system metallurgy)	-	Aluminium < 8.5 Iron-based 9.2 – 10.0 Copper and brass 7.5 – 10.0	Weekly (or continuous)	Sudden changes in pH can indicate changes in system water quality, therefore continuous monitoring is advised. pH control should be based on the metallurgy of the system. Note: Where aluminium and steel are used in the same system the pH value shall be less than 8.5 to avoid corrosion of the Aluminium.
Conductivity	µS/cm	See note 1	Weekly (or continuous)	Sudden changes in conductivity can indicate changes in system water quality, therefore continuous monitoring is advised.
Oil and grease	mg/l	Not present	Annually	Oil and grease being present indicates contamination of the system water.
Chloride measured at 80°C	mg/l	< 100	Monthly	Excess chlorides in the heat network will increase the potential for corrosion, particularly stress corrosion cracking in stainless steels and dezincification in brass fittings.
Sulphate	mg/l	-	Monthly	Monitoring of trends recommended as changes can indicate bacterial growth
Iron total	mg/l	< 15.0 (see note 2)	Monthly	Monitoring of trends recommended as changes can indicate potential corrosion issues.
Iron dissolved	mg/l	< 3.0	Monthly	Monitoring of trends recommended as changes can indicate potential corrosion issues.
Copper dissolved	mg/l	< 1.0	Monthly	Monitoring of trends recommended as changes can indicate potential corrosion issues.
Aluminium total	mg/l	<1.0	Monthly	Monitoring of trends recommended as changes can indicate potential corrosion issues. Only relevant if aluminium used in the system.
Calcium harness	mg/l	See note 3	Monthly	High levels of hardness in the system will increase precipitation of calcium carbonate scale onto heat

				exchanger surfaces, which will reduce efficiency. It also increases the surface temperatures of the exchangers, which may lead to the potential for stress corrosion.
Total alkalinity	mg/l	> 250, < 1250	Monthly	Low levels of alkalinity indicate a lack of protection against corrosive water. High levels of alkalinity indicate the potential for caustic embrittlement.
Ammonia	mg/l	<30	Monthly	Increasing trend of ammonia in the system water is an indication of bacteria growth.
Oxygen	mg/l	See note 4	Monthly (or continuous)	Increases in dissolved oxygen content indicates ingress of oxygen which will potentially drive corrosion, therefore continuous monitoring is advised.
Suspended solids	mg/l	< 30	Monthly	Suspended solids indicate poor system water quality and further filtration, and treatment is required.
Settled solids	mg/l	As defined in BSRIA BG 29/2020 and BS 8552: 2012 – limits as specified for pipework at extremes of the system and for terminal units.	Monthly	Not all detrimental solids are in suspension, therefore it is also essential to test for settled solids. Settled solids can reduce flow rate and can lead to greater risk of corrosion.
Inhibitor(s)		Inhibitor levels should be checked in accordance with the water treatment specialist's and manufacturers' guidance.	Monthly	Inhibitor reserves should be monitored to ensure adequate reserves are present to minimalise the potential for corrosion.
TVC (total viable count)	cfu/ml	<10,000 at 30°C and no increasing trend	Monthly	Increasing trends of bacteria indicate poor water quality.
Pseudomonads	cfu/ml	< 1,000 at 30°C and no increasing trend	Monthly	Increasing levels of pseudomonads indicate poor water quality and potential biofilm production.
SRB (sulphate-reducing-bacteria) at 5 days	cfu/ml	Absent	Monthly	Counts of SRB indicate poor water quality and potential for pitting corrosion under deposits and biofilms.

Note 1: Although it is important to monitor conductivity, a hard limit is not considered necessary.
Note 2: This value is from Table 5 of BG29/2020 (BSRIA, 2020), which also states that lower limits may be used.
Note 3: Total hardness will depend on the amount and type of softening applied.
Note 4: Oxygen limits are not defined in BG 29/2020 but should be as low as possible. BG 50/2013 (BSRIA, 2013) states that a value > 2 mg/l would indicate a problem with air entering the system.

6.3 Water quality & pipe corrosion (initial fill with demineralised water with a controlled pH within VDI parameters and treatment following VDI 2035 Parts 1 & 2)

Parameter	Units	Control limit	Monitoring frequency	Reasons for using this parameter
Visual	-	Clear with no suspended solids or gassing	Monthly	A photograph of the system water in a clear container should be taken as soon as possible following sampling. An extended period before a visual check can lead to changes in appearance, e.g., precipitation of dissolved iron when contacting with oxygen.
Odour	-	No strong sulphurous or ammoniacal smell	Monthly	Sulphide smells indicate potential growth of sulphide-reducing bacteria (SRB). Ammonia smells can indicate growth of nitrate-reducing bacteria (NRB) (some inhibitors have a mild ammonia smell).
pH (control range defined by least noble part of system metallurgy)	-	Aluminium < 8.2-8.5 Iron-based 8.2 – 10.0 Copper and brass 8.2 – 10.0	Weekly (or continuous)	Sudden changes in pH can indicate changes in system water quality, therefore continuous monitoring is advised. pH control should be based on the metallurgy of the system. Note: Where aluminium and steel are used in the same system the pH value shall be less than 8.5 to avoid corrosion of the Aluminium. Magnesium sacrificial anode technology may be used, which would allow a higher pH limit to be adopted.
Conductivity	µS/cm	> 50, < 100	Weekly (or continuous)	Sudden changes in conductivity can indicate changes in system water quality, therefore continuous monitoring is advised.
Oil and grease	mg/l	Not present	Annually	Oil and grease being present indicates contamination of the system water.
Chloride measured at 80°C	mg/l	< 10	Monthly	Excess chlorides in the heat network will increase the potential for corrosion, particularly stress corrosion cracking in stainless steels and dezincification in brass fittings.
Sulphate	mg/l	-	Monthly	Monitoring of trends recommended as changes can indicate bacterial growth
Iron total	mg/l	-	Monthly	Monitoring of trends recommended as changes can indicate potential corrosion issues.
Iron dissolved	mg/l	< 0.10	Monthly	Monitoring of trends recommended as changes can indicate potential corrosion issues.
Copper dissolved	mg/l	< 0.02	Monthly	Monitoring of trends recommended as changes can indicate potential corrosion issues.
Aluminium total	mg/l	-	Monthly	Monitoring of trends recommended as changes can indicate potential corrosion issues.
Total harness	mg/l	> 10, < 200	Monthly	High levels of hardness in the system will increase precipitation onto heat exchanger surfaces, which will reduce efficiency. It also increases the surface temperatures of the exchangers, which may lead to the potential for stress corrosion.
Total alkalinity	mg/l	-	Monthly	Low levels of alkalinity indicate a lack of protection against corrosive water. High levels of alkalinity indicate the potential for caustic embrittlement.
Ammonia	mg/l	-	Monthly	Increasing trend of ammonia in the system water is an indication of bacteria growth.
Oxygen	mg/l	< 0.1	Monthly (or continuous)	Increases in dissolved oxygen content indicates ingress of oxygen which will potentially drive corrosion, therefore continuous monitoring is advised.
Suspended solids	mg/l	< 1.0	Monthly	Suspended solids indicate poor system water quality and further filtration, and treatment is required.
TVC (total viable count)	cfu/ml	<10 for 48 hours at 37°C and 72 hours at 22°C	Monthly	Increasing trends of bacteria indicate poor water quality.
Pseudomonads	cfu/ml	-	Monthly	Increasing levels of pseudomonads indicate poor water quality and potential biofilm proliferation in the system.
SRB (sulphate-reducing-bacteria) at 5 days	cfu/ml	Absent	Monthly	Counts of SRB indicate poor water quality and potential for pitting corrosion under deposits and biofilms.

Note: Specialist advise should be sought when adopting the VDI 2035 approach

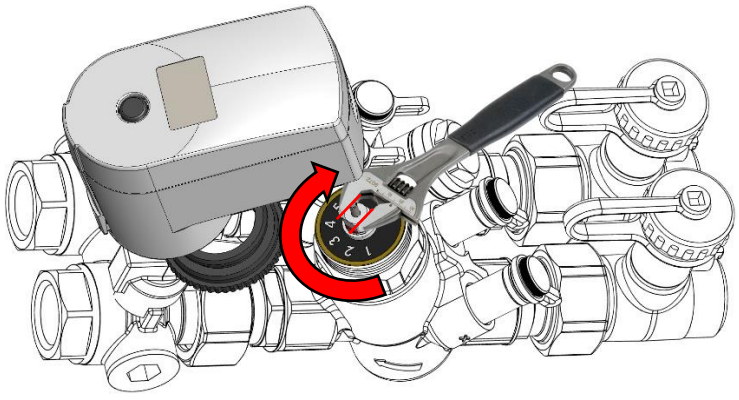
7. Commissioning

1	**Determining PICV setting required to achieve the design flow rates.** The PICV setting can be looked up from **Table A** in **Appendix A1**. If calculating flow rates, be mindful of using the correct ΔT for heating / cooling circuits.

For example:
FCU001 requires a flow rate (Q) of 104 l/h
FCVA LF is selected by designer (working range of 15 – 190 l/h).
Setting can then be found from Table A in Appendix A1 (select setting 3.2 in table below from data sheet):

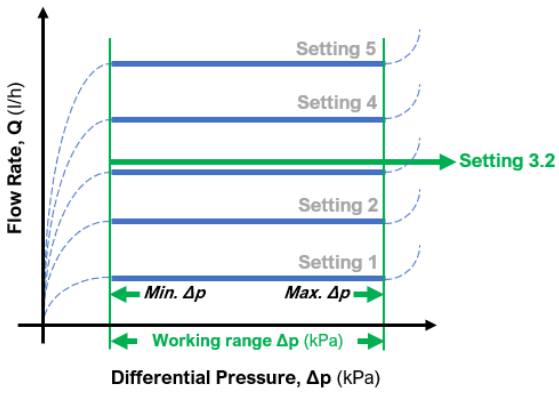
Setting	FCVA LF			FCVA MF / HF		
	Δp: 16.5-400 kPa			Δp: 26-400 kPa		
	l/s	l/h	Δp min	l/s	l/h	Δp min
1.0	0.004	15	16.5	0.018	64	26
1.2	0.009	32	16.5	0.033	118	26
1.4	0.011	40	16.5	0.058	210	26
1.6	0.014	52	16.5	0.078	280	26
1.8	0.017	60	16.5	0.105	378	26
2.0	0.018	64	16.5	0.129	466	26
2.2	0.019	68	16.5	0.154	554	26
2.4	0.022	80	16.5	0.168	606	26
2.6	0.024	88	16.5	0.181	650	26
2.8	0.026	92	16.5	0.199	718	26
3.0	0.028	100	16.5	0.216	778	26
3.2	0.029	104	16.5	0.228	822	26
3.4	0.029	106	16.5	0.241	866	26

2	**Adjust the PICV setting dial to required setting.** a. This can be done before or after installation of the FCVA. b. With the actuator & adaptor collar removed and using an 8mm / adjustable wrench, adjust the setting dial on the PICV to achieve the specified design flow rate as illustrated below. c. Record this setting on the Essco FCVA Label Tag.



Example: Setting 3.2
Large number denotes whole number & small number is decimal for setting.

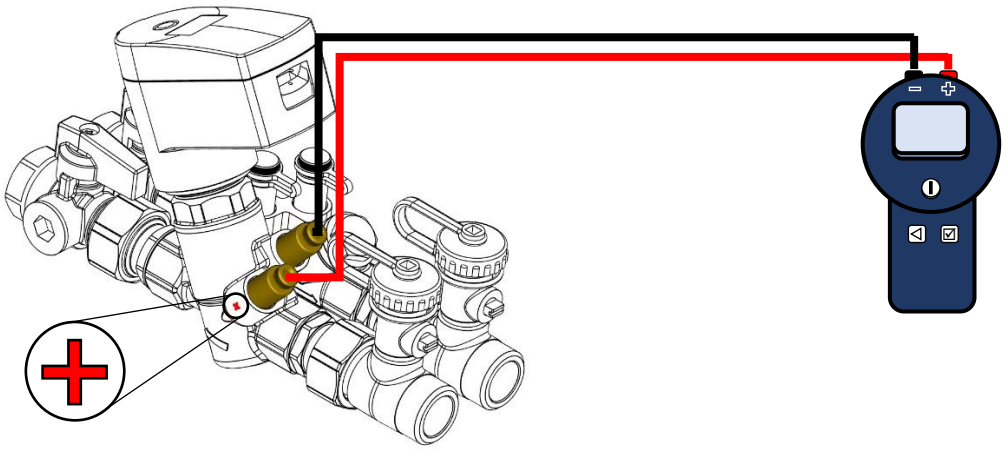
As the system Δp changes within the ranges permitted, flow rate is kept constant through the operation of the PICV when set-up correctly. **This can be seen adjacent**:



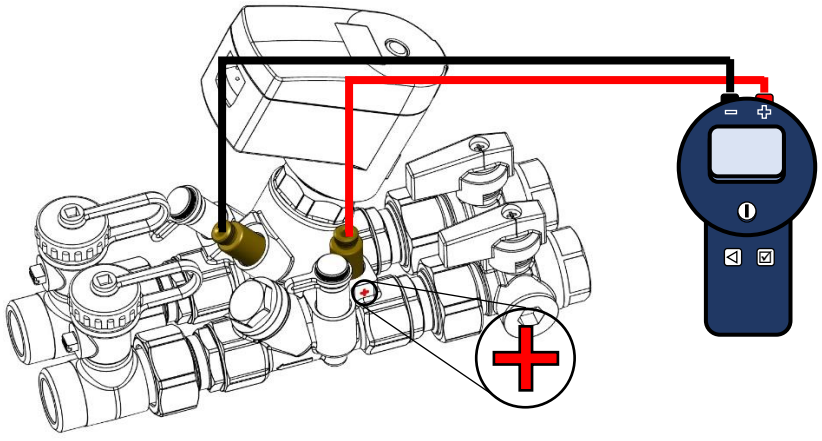
3	**Validate Δp of index circuit:** Using an electronic differential pressure gauge, measure the differential pressure across the PICV when fully open (full load conditions). This helps to guarantee optimum performance by ensuring Δp readings are carried out in worst case flow conditions. If recorded Δp is found to be outside of the pressure differential operating range stated for the PICV, alter primary pump speed until Δp is within the permitted range.

Note: the index circuit is usually either the furthest FCVA from the pump, or the terminal unit with the highest resistance. It is recommended to check that the Δp is higher for other FCVA's, to confirm that the index circuit has been correctly identified. When connecting the electronic differential pressure gauge to the FCVA, be sure to connect **positive to positive (red)** and **negative to negative (black)**. Testing polarity can be found on the brass bodies as shown below.

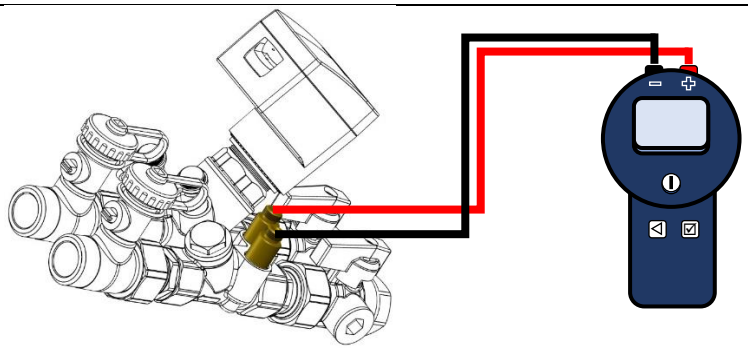
Refer to Appendix A1 Table A for minimum ΔP_{PICV}.



It is also possible to check there is sufficient differential pressure across the fan coil valve assembly ($\Delta P_{FCVA\text{-}min}$). This is demonstrated below, using the positive (red) binder point on the flow side the FCU circuit (metering station) and the negative (black) binder point on the return side (PICV). Again, testing polarity can be found on the brass bodies as shown below. To find the total ($\Delta P_{FCVA\text{-}min}$) add ΔP_{pipes} + ΔP_{FCU} to ΔP_{PICV}.



4	**Confirm sufficient flow rate at terminal units:** Using an electronic differential pressure gauge, insert the probes into the binder test points on the metering station, matching the cap colours / polarity.



Use the recorded Δp across the metering station ($\Delta \mathbf{p_{Venturi}}$) to then do the flow rate calculation and check against required design flow rate:

$$\mathbf{Q = Kv_{Venturi} \times \sqrt{\Delta p_{Venturi}} \times 0.1}$$

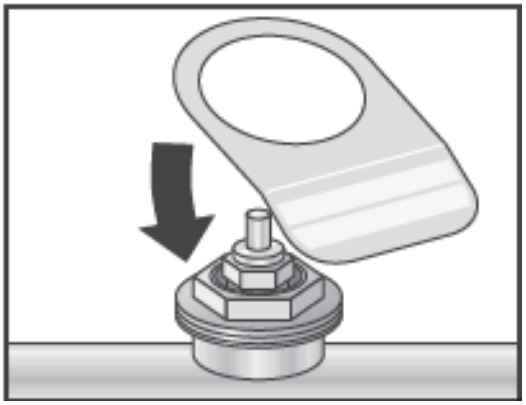
Refer to Table B in Appendix A3 for $\mathbf{Kv_{Venturi}}$ values specific for the version of FCVA being commissioned.

For example:
FCU002 has a HF FCVA fitted.
A Δp of 3.9 KpA is measured across the venturi metering station, so $\Delta \mathbf{p_{Venturi}}$ **= 3.9**.
Appendix A3 Table B shows that for HF FCVA, $\mathbf{Kv_{Venturi}}$ **= 2.41**

Substituting these figures into the flow rate calculation:

Q = 3.9 x 2.41 x 0.1
Q = 0.94 m3/h

6	Use **Essco FCVA Commissioning Label Tag** provided to record commissioning data, then fit around actuator collar.



8 Handover

- Complete the Essco FVCA commissioning label tags and fit around actuator collars.
- Set up the controls and show the customer how to operate all the control/s for central heating.
- Show the customer where the product information is when they call in with a problem.
- Show the customer how to safely isolate the FCVA.
- Advise the customer they can find information on the Essco website, https://esscogroup.co.uk/essco-oem/fan-coil-valve-assembly/.
- Ensure that the installation and maintenance manual and other details are provided as part of handover.

Product guarantee
This product has a non-transferable 2-year guarantee from the date of delivery. This covers faulty product or workmanship to the terms and conditions that can be found on our website.

This O&M has been designed to provide recommendations throughout, which if carried out will help to prolong product lifespan and provide better functionality and accuracy. Essco recommend the use of over pressure limitation in any systems where the maximum operating valves of the FCVA might be exceeded.

Warranty will be voided where actuators used are not supplied or recommended by Essco Group. Similarly, if a valve fails and is returned to us for inspection and damage can be seen because of water quality or through overpressure, this will also void the warranty.

You can find our full terms and conditions by visiting our website - https://esscogroup.co.uk/wp-content/uploads/2021/04/Essco-B2B-Terms-Conditions-APRIL-2021.pdf.
Your statutory rights are not affected by the manufacturer's guarantee.

ELYSATOR engineering water

Water quality
Advanced heating systems need suitably treated water.

Technical applications demand high standards of water quality, which is why Sections 6.2 and 6.3 of this IOM provide the latest CIBSE CP1 2020 recommendations for controlling water quality and pipe corrosion.

Essco Group have partnered with Elysator to also provide customers with the very best products and advice needed to meet the latest VDI-2035 European Water Quality Standards. This ensures that gases, minerals, and pollutants are removed from water using environmentally responsible and chemical free processes, until the water is suitable for the required application.

Speak to one of our technical sales representatives to select a suitable product to avoid these common issues:

- Sludge deposits in systems and pipes due to the products of corrosion.
- Blocking of regulating valves and pumps.
- Corrosion holes and further system water damage to boilers and other heat sources.
- Excessive flow noise caused by corrosion related gas formation.
- Increased energy consumption due to irregular heat distribution.
- Increased maintenance costs.

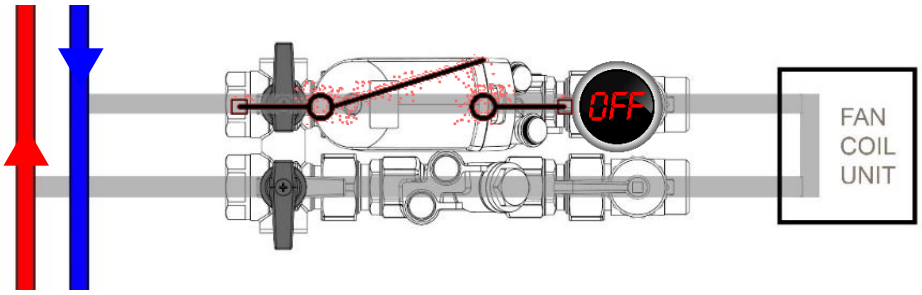
Product			System Volume (m^3)	Maximum Output (m^3/h)	Operating Pressure (bar)	Maximum Water Temperature (°C)
ELYSATOR© trio	ELYSATOR® trio 10		0.5 m^3	3 m^3/h	6 bar	90 °C
	ELYSATOR® trio 15		1.5 m^3	5 m^3/h		
	ELYSATOR® trio 25		5 m^3	7 m^3/h		
ELYSATOR© trio.1	ELYSATOR® trio 10.1		< 0.5 m^3	< 3 m^3/h	6 bar	90 °C
	ELYSATOR® trio 15.1		< 1.5 m^3	< 5 m^3/h		
	ELYSATOR® trio 25.1		< 5 m^3	< 7 m^3/h		
ELYSATOR© industrial	ELYSATOR® trio 50		15 m^3	0.30 – 0.60 m^3/h	10 bar	100 °C
	ELYSATOR® trio 75		25 m^3	0.48 – 0.90 m^3/h		
	ELYSATOR® trio 100		35 m^3	0.60 – 1.20 m^3/h		
	ELYSATOR® trio 260		70 m^3	1.50 – 3.00 m^3/h		
	ELYSATOR® trio 500		120 m^3	3.00 – 6.00 m^3/h		
	ELYSATOR® trio 800		220 m^3	4.80 – 9.60 m^3/h		

9. Maintenance

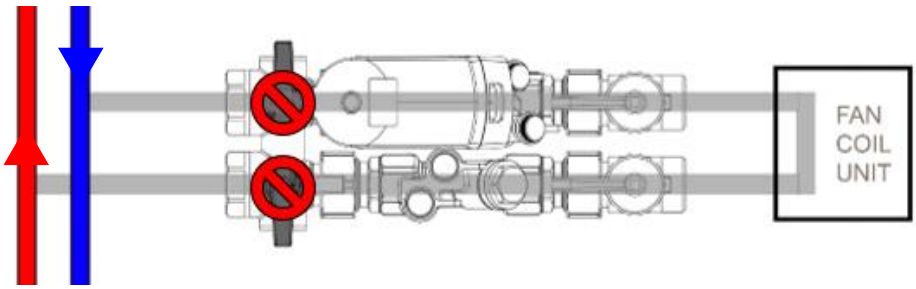
9.1 Draining the FCVA & filter removal

	Draining the FCVA. • Open any air vents at the top of the desired circuit to aid draining of the product. Typically, these will be on the FCU, or in the risers. • Ensure they are closed after draining has been completed.		**Notice:** Risk of water damage to product or property! Damage from disconnecting water pathways which may have retained some water. Take care after draining FCVA to protect equipment / property from residual water content within components.

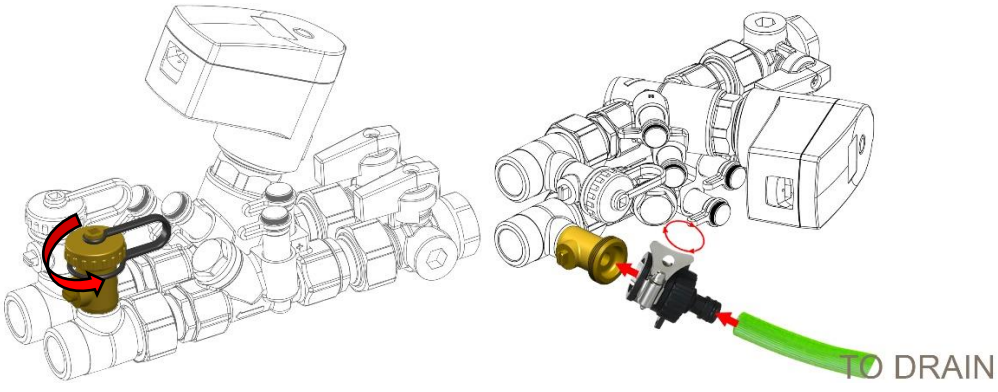
1	Ensure PICV actuator is closed and isolated electrically. Check there is no demand on the FCVA.



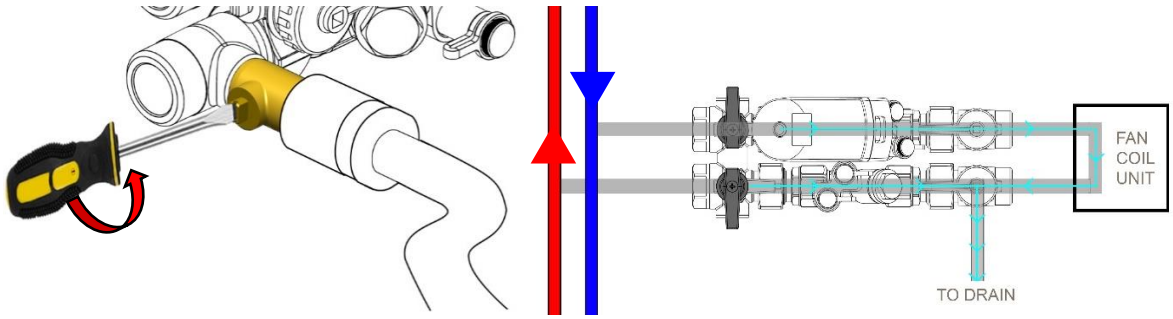
2	Fully isolate FCVA from the heat network *(see Section 2.8, 'advanced operations modes' for instruction).*



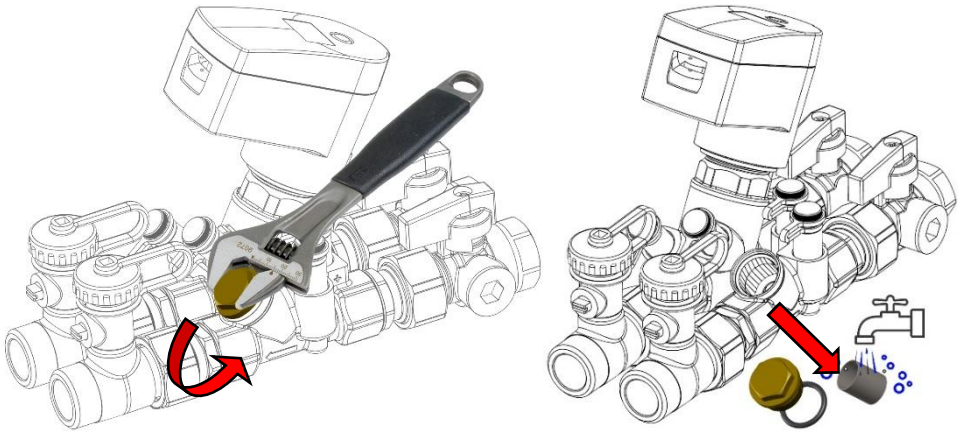
3	Allow water to cool before removing the drain cap on the flow side of the FCVA. Once removed, connect a suitable length of flexible hose pipe to the drain cock either using the thread provided, or a jubilee clip etc. to fasten securely. Take the opposite end of hose pipe to drain or alternatively to a bucket if safe to do so at installation height.



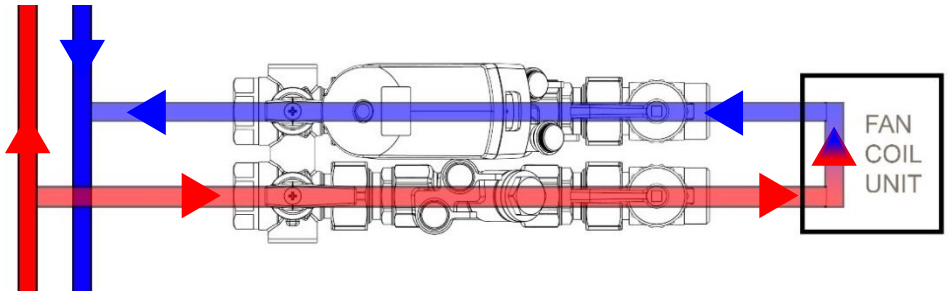
4	Open the drain cock valve using a flat-head screwdriver. Allow all the water content to drain fully from FCVA / FCU pipework.



5	Once drained, remove the strainer cap using an adjustable wrench. Then carefully remove the O-Ring and strainer and rinse under running water.

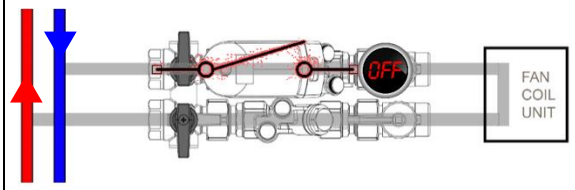


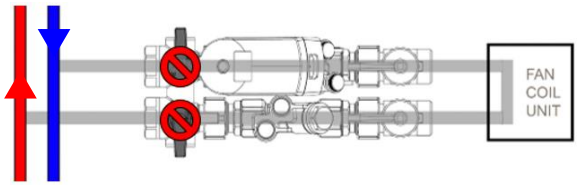
6	When complete, re-fit O-Ring, strainer, strainer cap and re-tighten to seal. Ensure O-Ring is still intact and undamaged, replace if necessary, before reversing steps (2) and (1) to return the FCVA back to normal operation mode.

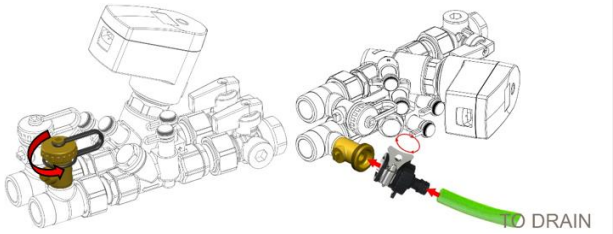


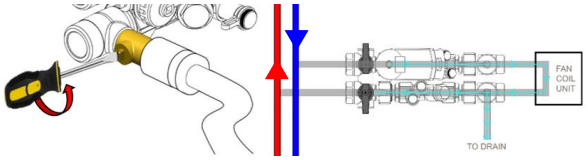
9.2 PICV Cartridge Replacement.

1	Carry out steps (1) to (4) as detailed in section 8.1 to safely isolate and drain FCVA.

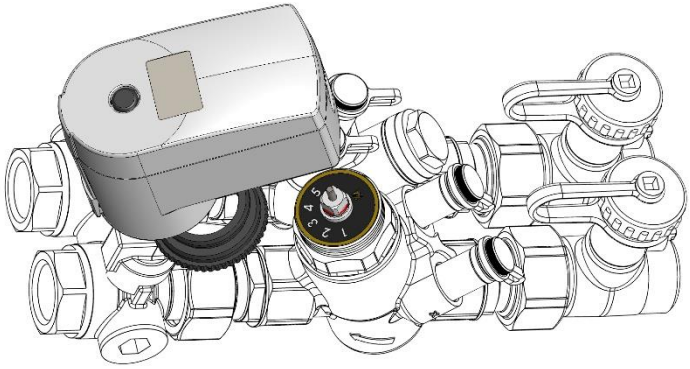


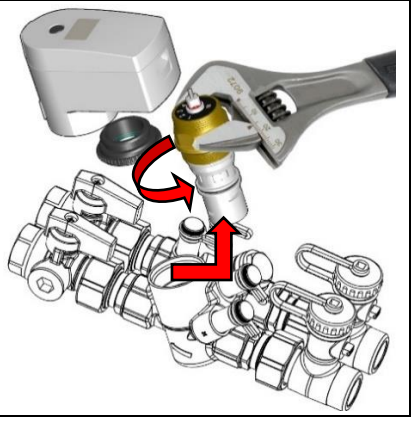






2	Remove the actuator and adaptor ring, then use an adjustable wrench to remove the PICV cartridge. Replace the cartridge, then reassemble before returning FCVA to normal operation mode (reversing steps above).





10.0 Appendix

10.1 Appendix A1: Table A – PICV flow rate settings

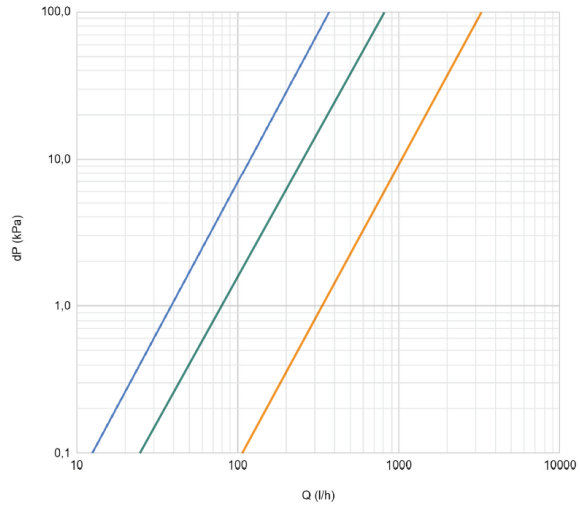
Setting	FCVA LF			FCVA MF / HF		
	Δp: 16.5-400 kPa			Δp: 26-400 kPa		
	l/s	l/h	Δp min	l/s	l/h	Δp min
1.0	0.004	15	16.5	0.018	64	26
1.2	0.009	32	16.5	0.033	118	26
1.4	0.011	40	16.5	0.058	210	26
1.6	0.014	52	16.5	0.078	280	26
1.8	0.017	60	16.5	0.105	378	26
2.0	0.018	64	16.5	0.129	466	26
2.2	0.019	68	16.5	0.154	554	26
2.4	0.022	80	16.5	0.168	606	26
2.6	0.024	88	16.5	0.181	650	26
2.8	0.026	92	16.5	0.199	718	26
3.0	0.028	100	16.5	0.216	778	26
3.2	0.029	104	16.5	0.228	822	26
3.4	0.029	106	16.5	0.241	866	26
3.6	0.031	110	16.5	0.253	912	26
3.8	0.034	124	16.5	0.280	1008	26
4.0	0.039	140	16.5	0.302	1086	26
4.2	0.042	150	16.5	0.312	1122	26
4.4	0.042	152	16.5	0.345	1242	26
4.6	0.044	158	16.5	0.364	1310	26
4.8	0.051	182	16.5	0.380	1368	26
5.0	0.053	190	16.5	0.386	1390	26

Accuracy:

- The Essco FCVA flow cartridge has improved closing capability with leakage rate meeting European Standard IEC 60534-4 class IV. Control accuracy will be the greatest of either +/-10% of controlled flow rate or +/-5% of maximum flow rate.
- ΔP min figures stated have been simulated and are believed to be within 5-10% of actual values.

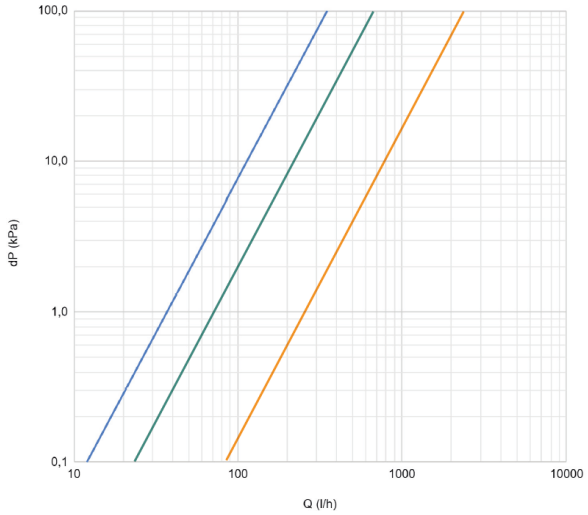
10.2 Appendix A2: Pressure loss graphs

By-pass Kit without Strainer - Low/Medium/High Flow (LF/MF/HF)

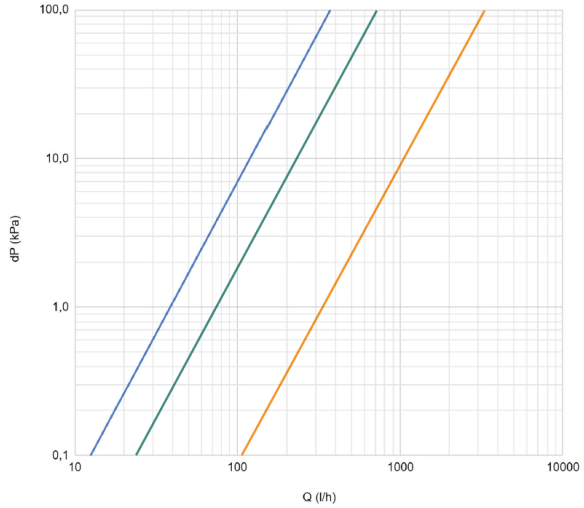


Low Flow (LF) - Kvs =0.37
Medium Flow (MF) - Kvs = 0.72
High Flow (HF) – Kvs = 3.37

By-pass Kit with Strainer - Low/Medium/High Flow (LF/MF/HF)



Low Flow (LF) - Kvs = 0.35
Medium Flow (MF) - Kvs = 0.68
High Flow (HF) – Kvs = 2.41



Low Flow (LF) - Kvs =0.37
Medium Flow (MF) - Kvs = 0.72
High Flow (HF) – Kvs = 3.37

10.3 Appendix A3: Table B – Venturi specification

Model	Flow Range (l/h)	Kv Bypass (Without strainer)	Kv Bypass (With strainer)
Low Flow (LF)	15 – 190	0.37	0.35
Medium Flow (MF)	64 – 280	0.72	0.68
High Flow (HF)	378 – 1390	3.37	2.41

10.4 Appendix A4: Actuator technical details

Thermal Type

Actuator	Thermic 0-10V	Thermic 24V 2-Point	Thermic 230V 2-Point
Supply voltage	24 V AC, -10 % to +20 %, 50-60 Hz 24 V DC, -20 % to +20 %	24 V AC/DC, +20% to -10%	230 V AC, -10 to +10 %, 50 Hz
Max. inrush current	< 320 mA for 2 min max.	< 300 mA for 2 min max.	< 550 mA for 100 ms max.
Power consumption	1W*		
Control signal	Analog 0-10V	24V	230V
Stroke	4mm		
Actuating force	100N +10%		
Operation time	Approx. 2 minutes for full stroke *(30 sec / mm)*	Approx. 3.5 mins for full stroke	
Ambient temperature	0°C to 60°C		
Media temperature	0°C to 100°C		
Storage temperature	0°C to +60°C	-25°C to +60°C	
Protection	IP54*, class III		IP54*, class II
Surge strength according to EN 60730-1	1.0 kV		2.5 kV
Cable	Light Grey PVC 3 x 0.22 mm² 1m length	Light Grey PVC 2 x 0.75 mm² 1m length	Light Grey PVC 3 x 0.22 mm² 1m length
Weight (inc. 1m cable)	111g	100g	
Features	• All round light to indicate valve opening. • CE conformity to EN 60730. • 100% protection against leaky valves.		

Geared Type

Actuator	Geared 24V 0-10V	Geared 24V 2/3-Point	Geared 230V 2/3-Point
Supply voltage	24 V AC, -10 % to +20 %, 50-60 Hz 24 V DC, -20 % to +20 %		230 V AC, -10 to +10 %, 50 Hz
Standby power	< 10 mA (end position)		< 5 mA
Power consumption	< 100 mA AC: < 110 mA DC: < 60 mA		< 15 mA
Control signal	Analog 0-10V	24V	230V
Stroke	4mm		
Actuating force	100 N at -20 to +40%		
Operation time	Approx. 2 minutes for full stroke *(30 sec / mm)*		
Ambient temperature	0°C to 50°C		
Media temperature	0°C to 100°C		
Storage temperature	-20°C to +70°C		
Protection	IP54*, class III		IP54*, class II
Surge strength according to EN 60730-1	1.0 kV		2.5 kV
Cable	Light Grey PVC 3 x 0.75 mm² 1m length		White PVC 3 x 0.22 mm² 1m length
Weight (inc. 1m cable)	155g		200g
Features	• Stroke setting can be set manually with flathead screwdriver 0.3x2mm. • Actuator features a display showing stroke setting. • Multi-coloured LED to indicate voltage, errors, and valve readiness. • Anti-theft feature. • CE conformity to EN 60730.		

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