

## **AC7 Operating Instructions**

### **Contents**

<b>Health and Safety</b>	<b>1</b>
<b>Statement of Conformity</b>	<b>1</b>
<b>Measurement Range &amp; Accuracy</b>	<b>1</b>
<b>Contact Us</b>	<b>1</b>
<b>Description of AC7</b>	<b>2</b>
<b>Connection Procedure</b>	<b>3</b>
<b>Disconnection Procedure</b>	<b>3</b>
<b>Menu Map</b>	<b>4</b>
<b>On-Screen Messages / Warnings</b>	<b>5</b>
<b>Commissioning Menu</b>	<b>8</b>
<b>Preferences Menu</b>	<b>9</b>
<b>Display Menu</b>	<b>11</b>
<b>System Setup Menu</b>	<b>14</b>

### **Appendices**

<b>Glycol / Water Specific Gravity Chart</b>	<b>A1</b>
<b>Recommended User Maintenance Procedures</b>	<b>A2</b>



## Health and Safety

Comdronic Ltd takes every reasonable precaution to ensure that **AC7** Electronic Commissioning Meters are designed, constructed, calibrated and tested for safe and trouble-free operation when used in accordance with these operating instructions.

**It is the user's responsibility to be aware of the general hazards associated with the systems being commissioned (e.g. high pressures; high / low temperatures; the presence of flushing / cleaning / antifreeze agents; etc.) and to use appropriate personal protective equipment / clothing for the hazards potentially present.**

## Statement of Conformity

This is to certify that the Comdronic **AC7** Electronic Commissioning Meter is manufactured in the UK and conforms to the published specification. It is both CE-marked & UKCA-marked, in accordance with the relevant EU/UK legislation.

## Measurement Range & Accuracy

<b>Model:</b>	<b>AC7-SP+ (STANDARD-PRESSURE)</b>	<b>AC7-HP+ (HIGH-PRESSURE)</b>
<b>Accuracy (% of reading):</b>	+/- 1% of reading or +/- 0.10 kPa (whichever is greater)	+/- 1% of reading or +/- 0.20 kPa (whichever is greater)
<b>Max Allowable Static Pressure:</b>	10 bar	20 bar
<b>Measurement Range:</b>	0.5 kPa to 250 kPa	1.0 kPa to 800 kPa

Factory calibration is carried out, in controlled conditions, using reference equipment which has been independently calibrated to UKAS standards.

Generally, it is recommended that **AC7** handsets are serviced and calibrated annually – please 'Contact Us' for further information. However, this is not a fixed period and shorter service intervals may be necessary for extremely high-use meters or for meters which are regularly used on very dirty systems or on systems that contain high concentrations of cleaning agents / treatments.

Between services, there are some simple user-maintenance procedures which can be performed to help prolong the accuracy and performance of the **AC7** – please refer to **Appendix II** for further information.

## Contact Us

For all sales, technical or troubleshooting enquiries:

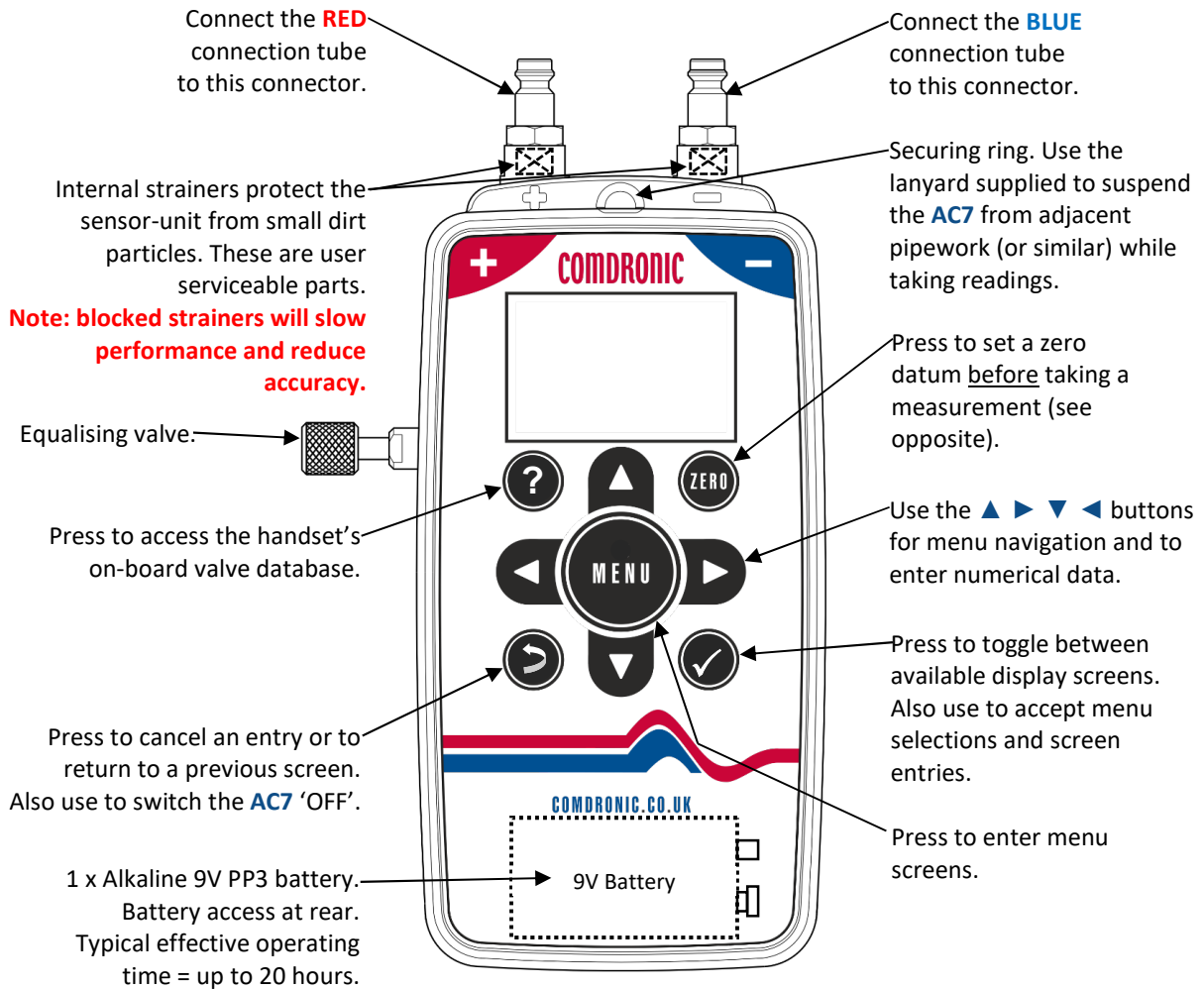
Email: [enquiries@comdronic.co.uk](mailto:enquiries@comdronic.co.uk)

Web: [www.comdronic.co.uk](http://www.comdronic.co.uk)

Address: Unit 7 Alpha Terrace, West Road, Ipswich, Suffolk, IP3 9FD, UK

## Description of AC7

Press ANY button to switch the AC7 'ON'.



### Key

Throughout these instructions, there are two abbreviations used for 'differential pressure' as follows:

**$\Delta p$**  is used in the body text.

**DP** is used in the screen images.

The **AC7** handset is supplied in a lightweight carry case with the following accessories:

- A pair of connection tubes, complete with manually-operated isolation valves.
- A pair of angle-pattern Binder-style connection adaptors with 3.3mm/2.8mm diameter needles.
- A pair of angle-pattern Binder-style connection adaptors with 2.0mm diameter needles.
- A set of hex keys (3mm, 4mm & 5mm) and a screwdriver.
- A lanyard to suspend the handset from pipework whilst in use.
- A strainer maintenance kit.
- A spare battery.
- Operating Instructions, a Quick-Start Guide and a Factory Calibration Certificate.

## Connection Procedure

Note: each connection tube is fitted with an isolating valve and it is a matter of user-preference whether the tubes are used with the isolating valves adjacent to the **AC7** or, alternatively, adjacent to the subject measuring valve / device.

1. Select the correct connection adaptors for the valve / device being measured and attach them to the connection tubes.
2. Ensure that both isolating valves on the connection tubes are in the **CLOSED** position.
3. Attach the connection adaptor on the **RED** connection tube to the high-pressure (upstream) test point on the subject measuring valve / device.
4. Attach the connection adaptor on the **BLUE** connection tube to the low-pressure (downstream) test point on the subject measuring valve / device.
5. Ensure that the equalising valve on the **AC7** is **OPEN**.
6. Attach the free ends of the **RED** and **BLUE** connection tubes to the colour-coded connection points on the **AC7**.
7. **OPEN** the isolating valves on the connection tubes to allow the line fluid to purge any air from inside the tubes.\*
8. **CLOSE** the isolating valves on the connection tubes.
9. Find a safe and static position for the **AC7**.\*\*
10. Switch the **AC7** 'ON' and press the **ZERO** button to set the datum at zero.\*\*\*
11. **OPEN** the isolating valves on the connection tubes and **CLOSE** the equalising valve on the **AC7**.
12. The **AC7** will now be reading  $\Delta p$ .

*\*If the  $\Delta p$  across the valve / device is low, the purging process will be slow due to the internal resistance of the **AC7**.*

*\*\*The **AC7** is very sensitive and readings will be affected if the position of the handset is adjusted after a datum has been set. A lanyard is provided and can be used to suspend the **AC7** from adjacent pipework, as appropriate.*

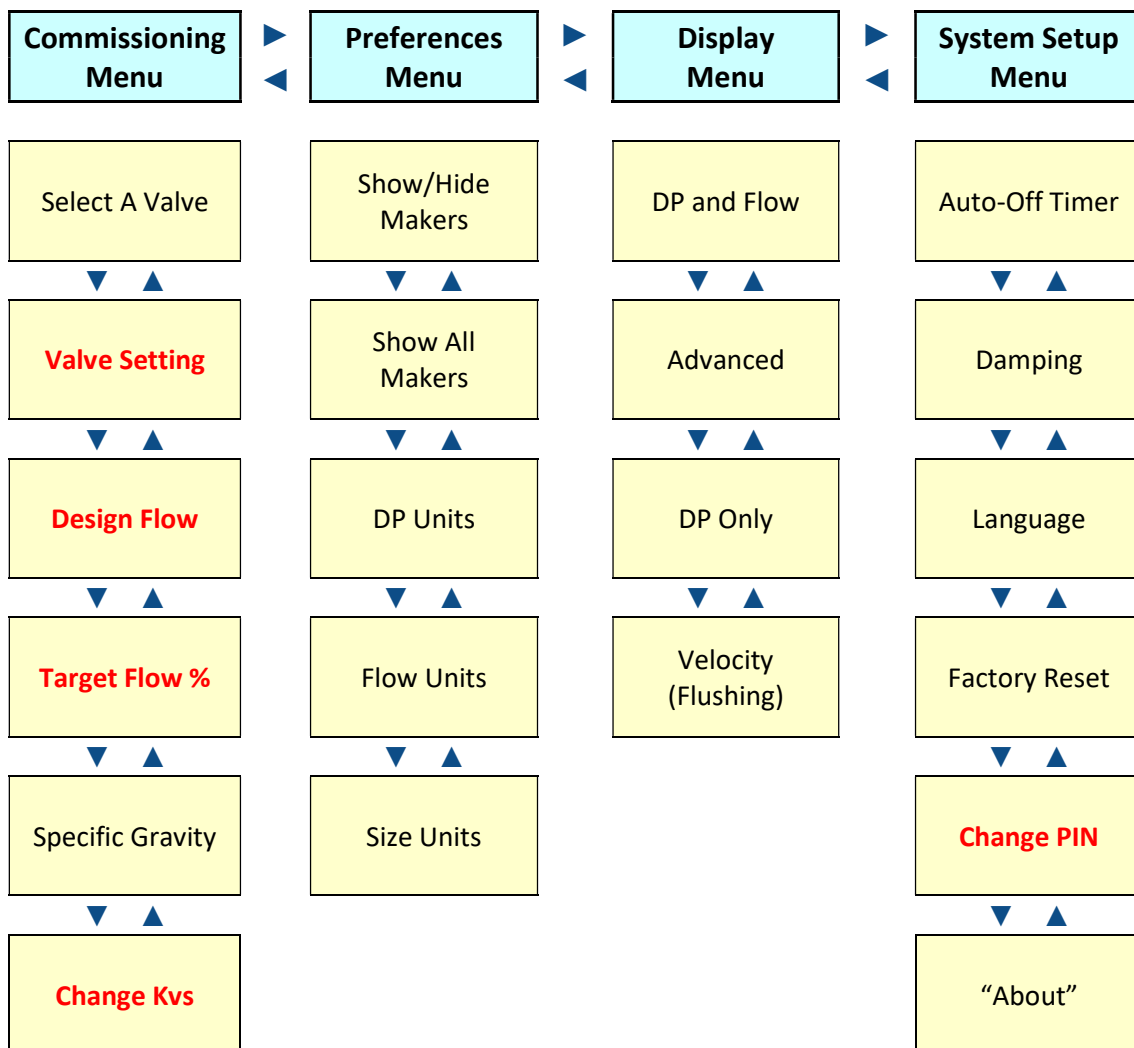
*\*\*\*If the **AC7** is being subjected to an extreme change of temperature at this point, the datum may drift from zero as the internal temperature of the meter changes and, in these circumstances, it will be necessary to repeat this step until the internal temperature has stabilised and a zero datum is maintained.*

## Disconnection Procedure

1. **OPEN** the equalising valve on the **AC7**.
2. **CLOSE** both isolating valves on the connection tubes.
3. Disconnect the tubes from both the **AC7** and the valve / device.

## Menu Map

The AC7 has four menus for ease of use:



Note: menu options shown in **red** may or may not appear in the menu lists, depending on the selected valve and the precise setup of the handset being used, as follows:

- **Valve Setting** will only show if an adjustable valve has been selected.
- **Design Flow & Target Flow %** will only show for Fixed Orifice- and Variable Orifice Balancing Valves.
- **Change Kvs** will only show if a Fixed Orifice Balancing Valve has been selected.
- **Change PIN** will not show if PIN functionality has been disabled within the 'Factory' settings of the handset ("Contact Us" for more information).

## On-Screen Messages / Warnings

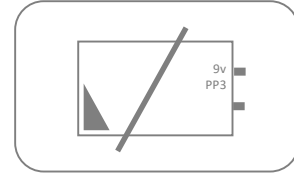
### Battery Status



Remaining battery power has dropped below 7.0 volts.  
[Displayed top-left of screen.]



Remaining battery power has dropped below 6.6 volts.  
[Displayed top-left of screen.]



Remaining battery power has dropped below 6.2 volts.  
[Displayed full-screen.]  
**Action: FIT A NEW BATTERY.**

### While Taking Readings

#### ZERO

The **ZERO** button will need to be pressed to set a datum before a reading can be taken.  
[Displayed top-left of screen.]

#### SG

Specific Gravity has been set to a value other than 1.0, and readings are being auto-corrected for SG.  
[Displayed top-left of screen.]

#### TEMP HIGH

Temperature of the fluid inside the handset > 50°C, which is too high for readings to be temperature-compensated.  
[Displayed top-left of screen.]



DP < 0.60 kPa and, as such, is too low for Flow to be derived.  
[Displayed top-right of screen.]



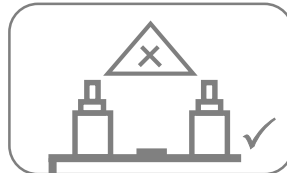
0.60 < DP < 0.95 kPa and, although this might be a little lower than ideal, Flow is now being derived and displayed.



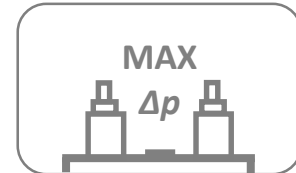
If the selected valve is line-size, pipe-losses are being assessed as being extremely high.  
[Displayed top-right of screen.]

#### - Δp

DP is unexpectedly NEGATIVE.  
[Displayed top-left of screen.]  
**Action: DOUBLE-CHECK INSTALLATION / CONNECTIONS.**

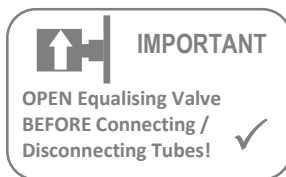


Sensor Signal Error.  
[Displayed full-screen.]  
**Action: If problem persists, 'Contact Us' for further advice.**

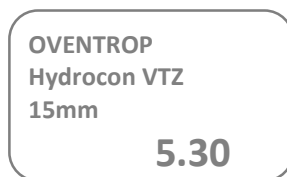


Measured DP > Range-of-Operation.  
[Displayed full-screen.]  
**Action: Proceed with caution.**

### Reminders at Turn ON / OFF



Crucial for the protection of the pressure-sensor, and is displayed at every turn ON & turn OFF.  
[Displayed full-screen.]



Details of the selected valve – plus its setting, if applicable – are displayed at every turn ON.  
[Displayed full-screen.]

## Commissioning Menu

The Commissioning Menu is concerned with the various selections / parameters that a user may wish to enter depending on the valve / device being measured and the commissioning techniques being utilised.

### Select A Valve

**TIP: Whilst in any screen, press ? on the keypad as a shortcut to this menu option.**

The performance characteristics of over 6,500 valves – from 80+ manufacturers / brands – are pre-programmed into the AC7 and this data is updated as a matter of course whenever an AC7 is serviced by Comdronic.

Use ▲ & ▼ to select a parameter.

Use ◀ & ▶ to scroll through the available options for each parameter.

◆
CRANE

Fixed Orifice

D902

15mm

Maker / Manufacturer / Brand.

Valve Type e.g. Fixed, Variable, PICV, etc.

Valve Model / Fig. No.

Valve Size.

Make selections for all four parameters (i.e. **Maker, Type, Model & Size**) before pressing the ✓ button to accept them. Or, press the ↶ button to exit and retain the previous selection.

**Note: whilst every effort is made to ensure that stored valve data is correct, valve manufacturers invariably reserve the right to modify their products, without notice, and so Comdronic cannot be held responsible for any inaccuracies or omissions.**

### Valve Setting

**TIP: Whilst in any Display screen, press ▲ on the keypad as a shortcut to this menu option.**

When variable orifice valves or adjustable automatic balancing valves are being measured, the handwheel position / cartridge setting must be entered so that the correct flow characteristics are used for the derivation of flow.

Maximum & Minimum usable settings for the selected valve.

Use ◀ to remove a digit.

Press BACKARROW to exit and retain the current setting.

MAX 8
MIN 2

◀ 2 . 4 ▶

↶ = 8
✓

Use ▲ to increase a value.

Use ▼ to decrease a value. {▼ at zero for a decimal point.}

Use ▶ to add a digit.

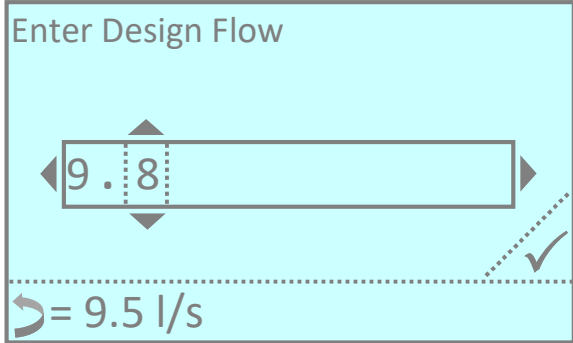
Press ✓ to accept the new value.

Current setting.



## Design Flow

The Design Flow for the selected valve can be entered / edited in this screen. When a value is entered, the derived flow will be calculated as a percentage of the Design Flow and this will be displayed on the Advanced Display in the Design Flow box.



Use **▲** to increase a value.  
Use **▼** to decrease a value.  
{ **▼** at zero for a decimal point. }

Use **▶** to add a digit.

Press **✓** to accept the new value.

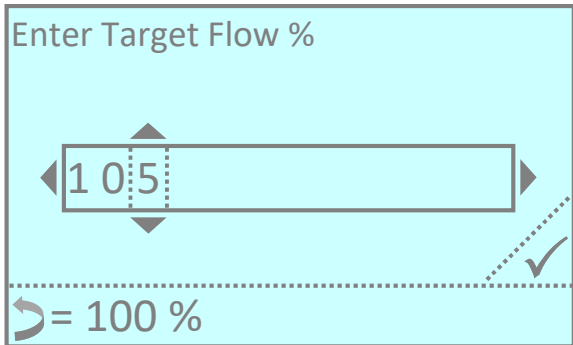
Use **◀** to remove a digit.

Press **BACKARROW** to exit and retain the current setting.

Current setting. **↶ = 9.5 l/s**

## Target Flow %

The Target Flow % for the selected valve can be entered / edited in this screen. When a value is entered, it will be displayed on the Advanced Display in the Target Flow box. Target Flow must be entered as a percentage and is generally required when carrying out 'proportional' balancing. Typically, the value used will be the same as the calculated Design Flow percentage on the index circuit. Balancing to 100% target on subsequent valves will ensure that valves adjacent to the index valve are 'balanced'.



Use **▲** to increase a value.  
Use **▼** to decrease a value.  
{ **▼** at zero for a decimal point. }

Use **▶** to add a digit.

Press **✓** to accept the new value.

Use **◀** to remove a digit.

Press **BACKARROW** to exit and retain the current setting.

Current setting. **↶ = 100 %**

## Specific Gravity

**TIP: SG can be adjusted within the range  $0.9 \leq SG \leq 1.2$ .**

This menu option allows the user to enter the Specific Gravity (SG) of the line fluid. Typically, this would be necessary when glycol (or similar) is present in the system. Please refer to **Appendix I** for further information.

Use ◀ to remove a digit.

Press BACKARROW to exit and retain the current setting.

Enter SG

◀ 1.0:8 ▶

↶ = 1

Current setting.

Use ▲ to increase a value.  
Use ▼ to decrease a value.  
{▼ at zero for a decimal point.}

Use ▶ to add a digit.

Press ✓ to accept the new value.

**Note: while SG is set to a value other than 1.0, "SG" will show at the top of the chosen display screen as a reminder to the user that readings are being subjected to a correction. It is strongly recommended that users regularly check that the set value for SG is appropriate for the system being commissioned.**

## Change Kvs

If the valve / device is not listed in the **AC7**'s database, this menu option enables the user to manually enter a Kvs value so that a derived flow can still be calculated by the **AC7**.

Use ◀ to remove a digit.

Press BACKARROW to exit and retain the current setting.

Enter New Kvs

◀ 0.6 ▶

↶ = 0.5 Kvs

Current setting.

Use ▲ to increase a value.  
Use ▼ to decrease a value.  
{▼ at zero for a decimal point.}

Use ▶ to add a digit.

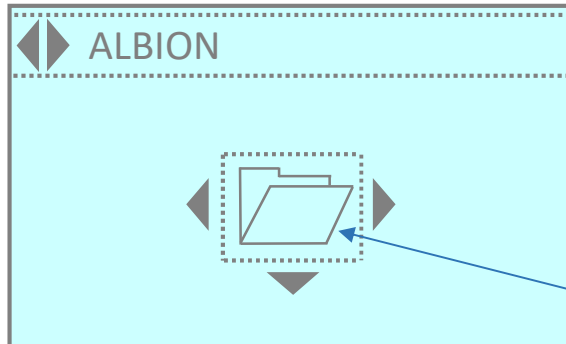
Press ✓ to accept the new value.

## Preferences Menu

### Show/Hide Makers

**TIP: No Makers will be DELETED via this operation!**

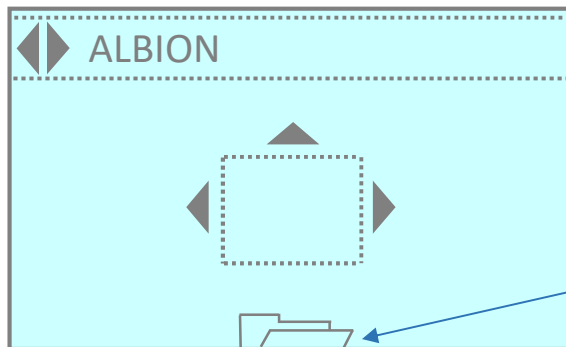
Use ◀▶ to scroll through the available Valve Makers.



As per individual preference, press ▼ to remove the shown Maker from the 'live' list.

As shown, Maker = ALBION will appear in the 'live' list.

Press ▲ to reverse the above operation and put the shown Maker back into the 'live' list.

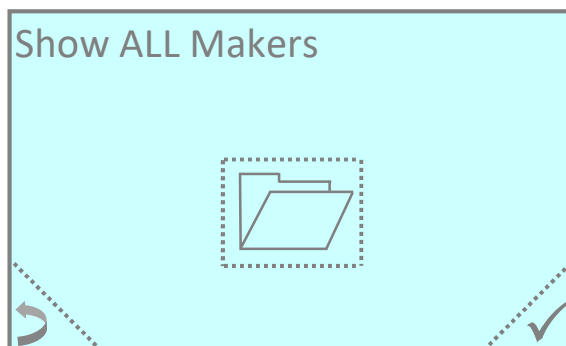


As shown, Maker = ALBION has been removed from the 'live' list.

### Show All Makers

**TIP: Requires a minimum battery voltage of 7 volts to run.**

Press BACKARROW to exit and abandon the operation.



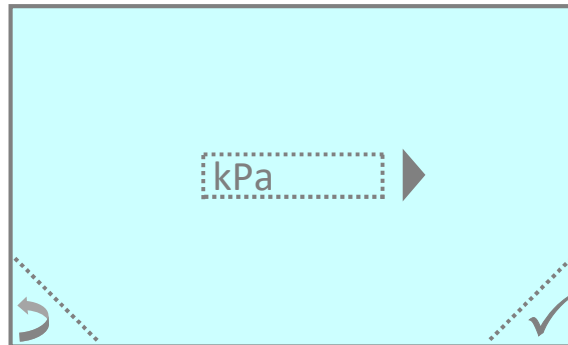
Press ✓ to proceed and put ALL Makers back into the 'live' list.

## DP Units

**Default = kPa**

Available options are kPa, psi, bar, cmH<sub>2</sub>O, IWGA (inches water gauge), Ft HD (feet head) or Pa.

Press BACKARROW to exit and abandon the operation.



Use ► to scroll through the available units for DP.

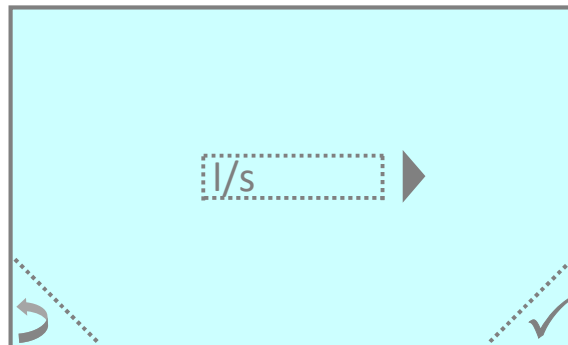
Press ✓ to accept the new DP Unit.

## Flow Units

**Default = l/s**

Available options are l/s, l/m, l/h, USGPM, UKGPM, m<sup>3</sup>/h, m<sup>3</sup>/m or m<sup>3</sup>/s.

Press BACKARROW to exit and abandon the operation.



Use ► to scroll through the available units for Flow.

Press ✓ to accept the new Flow Unit.

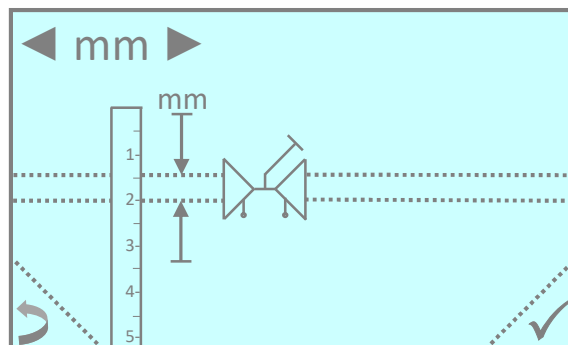
## Size Units

**Default = mm**

This menu option allows the user to specify the preferred units (millimetres/inches) for viewing/selecting valve sizes.

Use either of the ◀ or ▶ buttons to toggle between millimetres & inches.

Press BACKARROW to exit and abandon the operation.



Press ✓ to accept the new Size Unit.

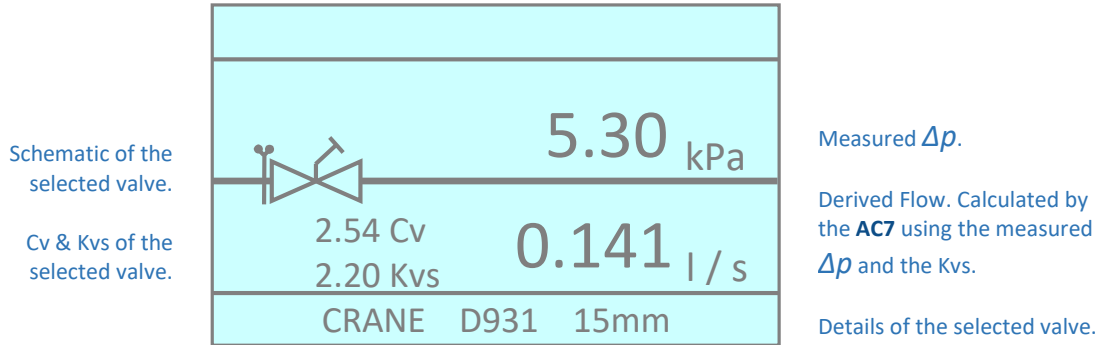
## Display Menu

There are four different display formats available for the **AC7**. The most appropriate format will depend on the type of valve / device being measured and the commissioning method being applied.

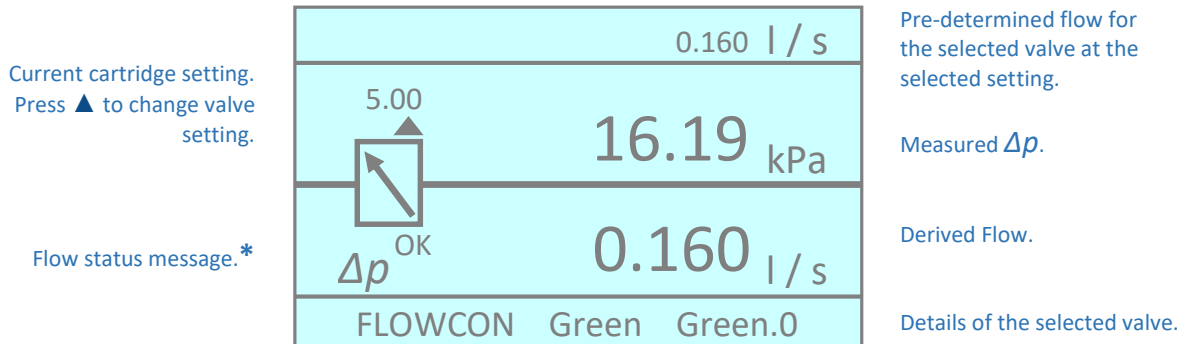
### DP And Flow



The DP And Flow Display is suitable for most general commissioning purposes.

An example of displayed data when a fixed orifice valve has been selected is as follows:



An example of displayed data when an automatic balancing valve has been selected is as follows:

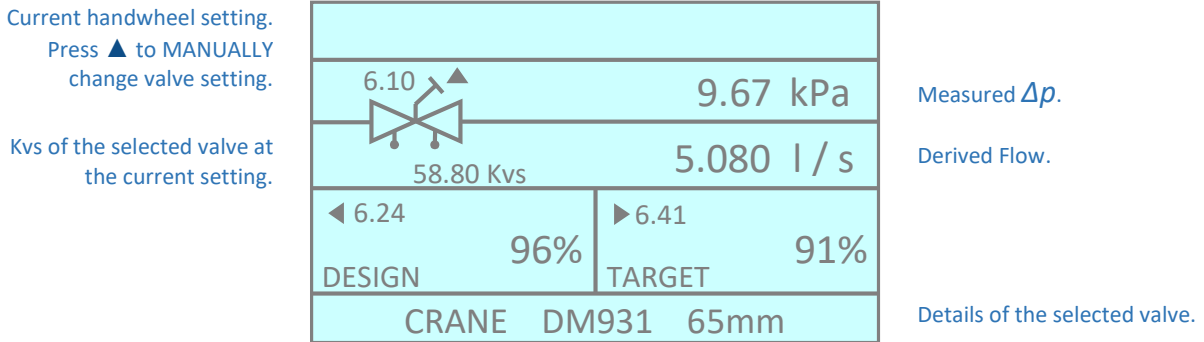


\*If the measured  $\Delta p$  exceeds the minimum required for the selected valve (at the selected setting) to deliver the pre-determined flow, the flow status message will be  $\Delta p$  OK. However, if the required  $\Delta p$  is not present the flow status message will be  $\Delta p$  . In the unlikely event that the measured  $\Delta p$  exceeds the recommended maximum for the valve, the flow status message will be  $\Delta p$  .

## Advanced

The Advanced Display can show more complex commissioning data and it may be preferred to the DP And Flow Display if automatic balancing valves are being measured or if a system of proportional balancing is being adopted.

An example of displayed data when a variable orifice valve has been selected is as follows:

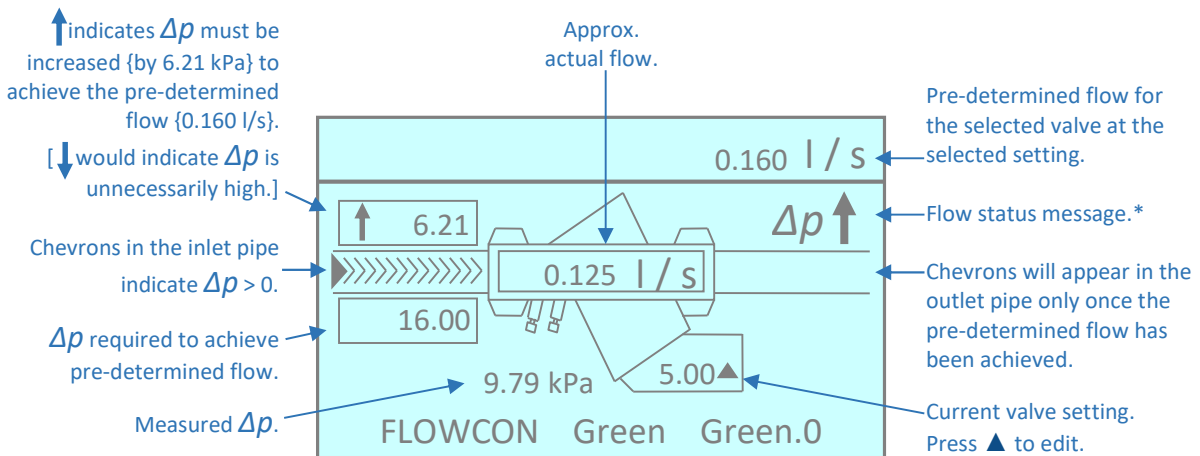


The "DESIGN" box contains:  
The Derived Flow as a % of the Design Flow. If no Design Flow has been entered, "---" will be displayed.  
The predicted handwheel setting to achieve the Design Flow. Press ◀ to AUTOMATICALLY change the 'Current Handwheel Setting' being used by the AC7 to this value.\*\*

The "TARGET" box contains:  
The Derived Flow as a % of the Target Flow %. If no Target Flow % has been entered, "---" will be displayed.  
The Predictive handwheel setting to achieve the Target Flow %. Press ▶ to AUTOMATICALLY change the 'Current Handwheel Setting' being used by the AC7 to this value.\*\*

**\*\*These are iterative processes due to the unknown valve authority in the circuit and so 2-3 attempts may be required to achieve the desired reading. Please also note that in conjunction with pressing the ◀ ▶ buttons on the AC7, the physical handwheel setting of the valve will also need to be changed to match the new value.**

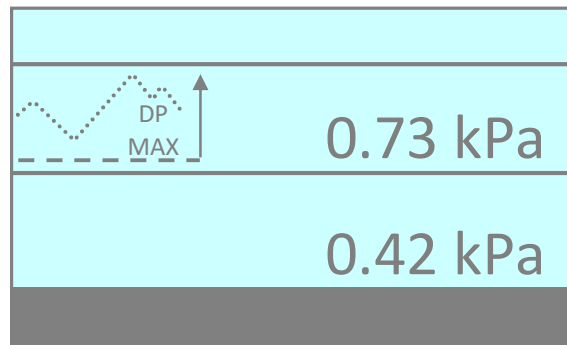
An example of displayed data when an adjustable automatic balancing valve has been selected is as follows:



**\*If the measured  $\Delta p$  exceeds the minimum required for the selected valve (at the selected setting) to deliver the pre-determined flow, the flow status message will be  $\Delta p$  OK. However, if the required  $\Delta p$  is not present the flow status message will be  $\Delta p$  ↑. In the unlikely event that the measured  $\Delta p$  exceeds the recommended maximum for the valve, the flow status message will be  $\Delta p$  ↓.**

## DP Only

The DP Only Display is the simplest option available and may be preferred when the **AC6** is being used as a simple manometer.



Max.  $\Delta p$  since last 'ZERO'.

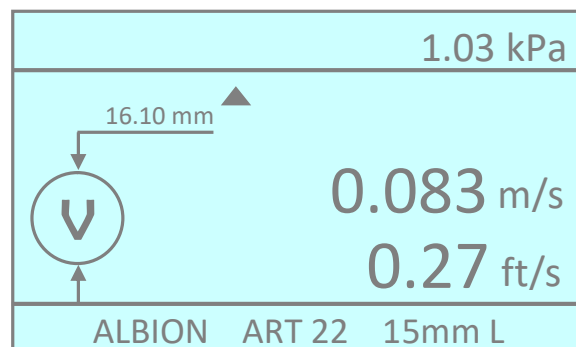
Instantaneous  $\Delta p$ .

## Velocity (Flushing)

The Velocity Display would normally only be preferred when fluid velocities are being measured for the purposes of system flushing.

Pipe ID currently being used to derive pipe velocity.

If necessary, press  $\blacktriangle$  to change the pipe ID.



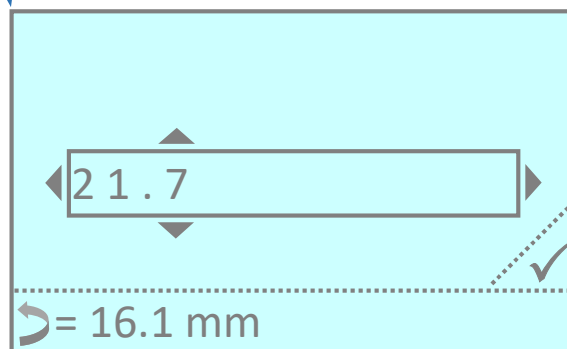
Measured  $\Delta p$ .

Derived Pipe Velocity (displayed in metric & imperial).

Details of the selected valve.

Use  $\blacktriangleleft$  to remove a digit.

Press BACKARROW to exit and retain the current setting.



Current setting.

Use  $\blacktriangle$  to increase a value.  
Use  $\blacktriangledown$  to decrease a value.  
{  $\blacktriangledown$  at zero for a decimal point. }

Use  $\blacktriangleright$  to add a digit.

Press  $\checkmark$  to accept the new value.

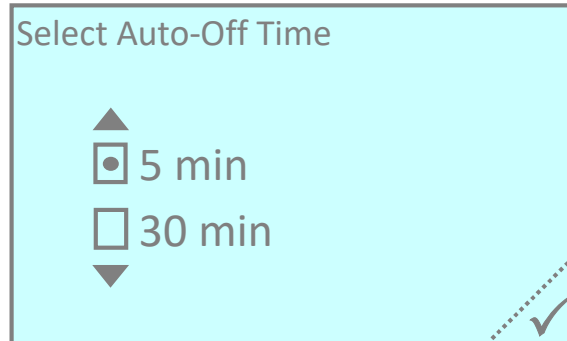
## System Setup Menu

### Auto-Off Timer

Default = 5 min

The Auto-Off Timer sets the period of time after which the AC7 will turn 'OFF' after a period of inactivity. A short time will preserve battery life.

Use ▲ ▼ to toggle between the settings.



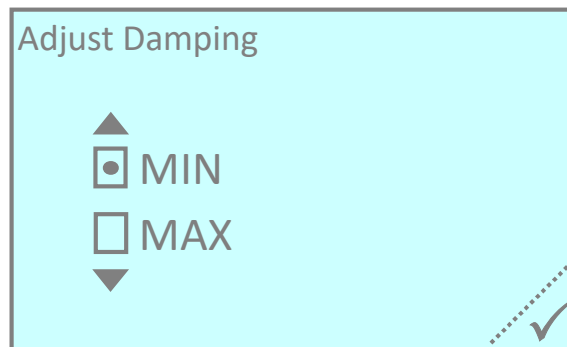
Press ✓ to accept the new setting.

### Damping

Default = MIN

This screen allows the user to adjust the apparent sensitivity of the AC7 by increasing the time delay between each screen update and extending the period of time over which readings are averaged. Damping = MAX may be advisable on an unstable system in order to give a steadier reading.

Use ▲ ▼ to toggle between the settings.



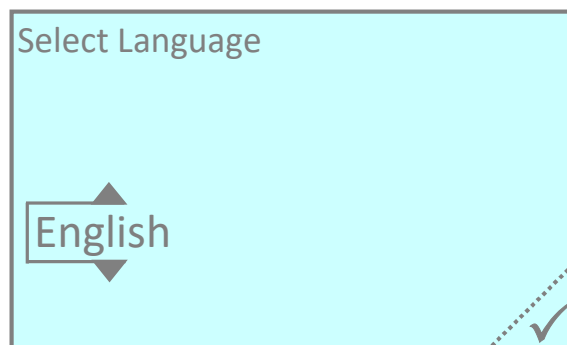
Press ✓ to accept the new setting.

### Language

Default = English

Available options are English, French, Italian or Spanish.

Use ▲ ▼ to scroll through the available languages.



Press ✓ to accept the new setting.



## Factory Reset

Restore Defaults

Press to exit and retain all current settings.

Press to proceed and restore 'factory' defaults.

Auto-OFF → 5 min      Design Flow → 0      Target Flow % → 0      Specific Gravity → 1  
 DP Units → kPa      Flow Units → l/s      Size Units → mm  
 Kvs & Pipe Size → Default for Selected Valve      Valve Setting → 'max' for Selected Valve

## Change PIN

**TIP: To special request, all PIN functions can be completely removed from a handset – please “Contact Us” for more information.**

As the default, the PIN Code is factory-set to “0” (zero), and when it is set to “0” it will never be asked for. But, if a PIN other than “0” is set it will be asked for at every battery change.

Any numerical value (including decimal places) is allowable. As an example, proceed as follows to change the PIN from “0” to “236.67”:

Enter NEW PIN

Use to remove a digit.

Use to add a digit.

Use to increase a value.  
 Use to decrease a value.  
 { at zero for a decimal point. }

Press to accept the new value.

Press BACKARROW to exit and retain the current PIN.

PIN = 236.67

Press BACKARROW to exit and abandon the operation.

Press to confirm the new PIN.

**TIP: If, after setting your own PIN, you decide to revert to the default, just reset it back to “0” and it will cease to be asked for.**

## 'About'

The 'About' menu option gives the unique serial number of the **AC7** (please quote this in any correspondence with Comdronic) plus the installed firmware version.

Serial Number of Handset.

AC7-1234

SP+

Pressure-Sensor  
Configuration.

WWW.COMDRONIC.CO.UK

Firmware Version in use.

P4.01-E0EB

81L/23-31

Valve Database Release.

**Appendix I**

**Glycol / Water Specific Gravity Chart**

Temperature °C	% Glycol Additive										
	0	10	20	30	40	50	60	70	80	90	100
80			0.991	1.003	1.017	1.026	1.036	1.046	1.054	1.062	1.068
70		0.990	1.000	1.010	1.023	1.034	1.042	1.053	1.062	1.069	1.075
60		0.995	1.007	1.017	1.030	1.041	1.050	1.060	1.070	1.076	1.083
50		1.000	1.013	1.023	1.035	1.048	1.057	1.067	1.077	1.084	1.090
40	0.990	1.004	1.018	1.029	1.042	1.054	1.064	1.074	1.085	1.091	1.098
30	0.996	1.007	1.022	1.034	1.047	1.059	1.070	1.080	1.092	1.099	1.105
20	0.999	1.010	1.026	1.038	1.052	1.065	1.076	1.088	1.099	1.106	1.114
10	1.000	1.013	1.028	1.042	1.056	1.070	1.082	1.094	1.105	1.113	1.120
0	1.000	1.015	1.029	1.045	1.061	1.075	1.088	1.100	1.112	1.120	1.128
-10				1.048	1.065	1.079	1.092	1.107	1.118	1.127	1.135
-20					1.068	1.083	1.097	1.113	1.124	1.133	1.136
-30						1.087	1.100	1.118	1.128	1.137	1.137
-40							1.102	1.122	1.133	1.138	1.138

E&OE

## Appendix II

### Recommended User Maintenance Procedures

#### Pressure Sensor Flushing

The pressure sensor within the **AC7** is protected from the majority of system-dirt by the presence of a strainer in each of the Red and Blue connection ports on the top of the unit. These strainers have been carefully selected and will prevent all but the smallest of dirt particles from entering the sensor-unit. They are vital for maintaining the proper performance of the **AC7**.

Over time, however, there may be a build-up of tiny dirt particles within the sensor-unit and if this is allowed to continue the performance of the **AC7** may become affected in two ways:

- A. Readings may be significantly less than the true value, and / or
- B. On-screen readings may change very slowly when adjustments are made to the balancing valve.

Regularly performing a **simple flush** will help to reduce any build-up of dirt within the sensor-unit:

1. Ensure that the equalising valve on the **AC7** is fully **OPEN**.
2. Hold the **AC7** upside down and connect a cool, clean, water supply to the Blue connector and allow the water to flow out of the Red connector. This is the back-flush and should always be done first.
3. Whilst keeping the **AC7** upside down, disconnect the water supply from the Blue connector and reattach it to the Red connector and allow water to flow out of the Blue connector. This is the forward-flush.

In addition to performing **simple flushes**, if the **AC7** is regularly used on extremely dirty systems it may also be necessary to periodically perform an **advanced flush**. An **advanced flush** is the same basic process as a **simple flush** but it is performed with the strainers temporarily removed (see strainer removal instructions opposite).

During an **advanced flush**, it is advisable to clean the strainers in a soapy solution and then flush them with a pressurised air / water source. However, if the strainers are in very poor condition it may be necessary to replace them with new (spare part order code = HS-STR-P).

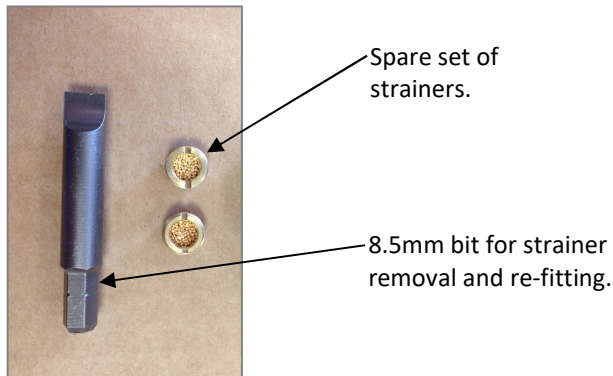
If an **AC7** continues to read incorrectly even after an **advanced flush** and strainer change, please 'Contact Us' for further advice.

#### Hose Maintenance

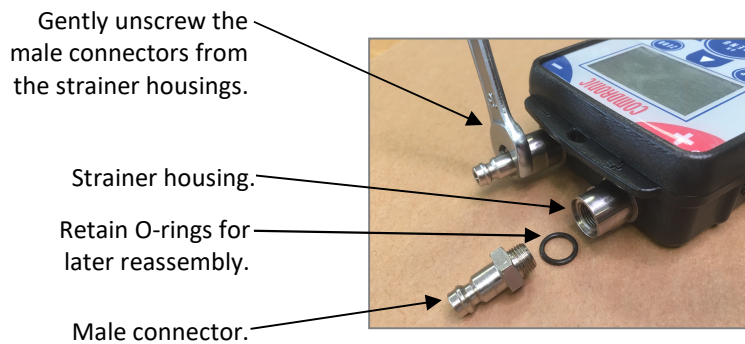
The connection tubes supplied with the **AC7** are fitted with snap-connectors on both ends. Over time, these snap-connectors may become a bit stiff to operate as system dirt accumulates in the 'snapping' mechanism and continued use may result in damage to the **AC7**. To avoid this, the regular application of a small amount of multi-purpose grease in each of the snap-connectors will help to keep them in good working order.

## Strainer Removal / Replacement

Parts Required:



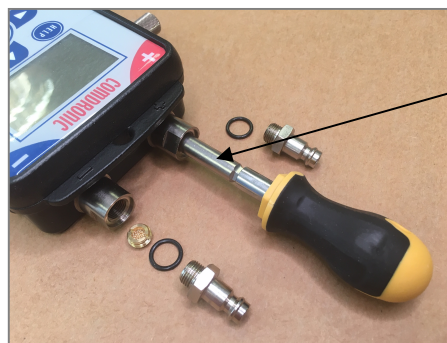
Step 1 – Remove the male connectors from the top of the meter using a 13mm wrench.



**IMPORTANT - Take care not to disturb (i.e. move) the strainer housings. If a male connector doesn't readily unscrew, use a 14mm wrench to hold the strainer housing in place before any additional force is applied.**

Step 2 – Remove the strainers from their housings using the 8.5mm screwdriver bit provided (or, alternatively, an 8.0mm screwdriver).

**IMPORTANT – Clean any dirt that may be present in the thread before attempting to remove the strainer. Any attempt to unscrew a strainer through a dirty thread may cause the strainer to become seized in its housing.**



Step 3 – If the strainers are being reused, clean them in a soapy solution and then flush them with a pressurised air / water source.

Step 4 – Refit the cleaned / new strainers.

Step 5 – Refit the male connectors so that they are firm, but not overtight (and don't forget the O-rings!).

