AC7 Operating Instructions

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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 CE Marked in accordance with the relevant EU legislation.

Measurement Range & Accuracy

Accuracy (% of reading):	+/- 1% of reading or +/- 0.20 kPa (whichever is greater)
Max Allowable Static Pressure:	20 bar
Measurement Range:	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 maintenance procedures which can be performed to help prolong the accuracy and performance of the **AC7** – please refer to **Appendix II** for further information.
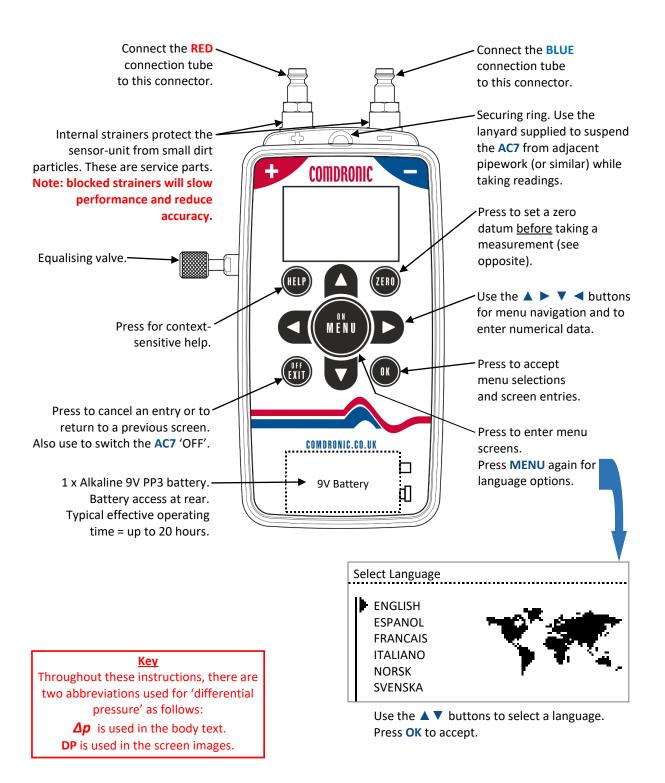
Contact Us

For all sales, technical or troubleshooting enquiries:

Email: enquiries@comdronic.co.uk
Tel: +44 (0) 1473 715589
Address: Unit 7 Alpha Terrace, West Road, Ipswich, Suffolk, IP3 9FD, UK

Description of AC7

Press & hold the **MENU** button to switch the **AC7** 'ON'.

Connect the **RED** connection tube to this connector.

Connect the **BLUE** connection tube to this connector.

Internal strainers protect the sensor-unit from small dirt particles. These are service parts. **Note: blocked strainers will slow performance and reduce accuracy.**

Securing ring. Use the lanyard supplied to suspend the **AC7** from adjacent pipework (or similar) while taking readings.

Equalising valve.

Press to set a zero datum before taking a measurement (see opposite).

Press for context-sensitive help.

Use the ▲ ► ▼ ◄ buttons for menu navigation and to enter numerical data.

Press to accept menu selections and screen entries.

Press to cancel an entry or to return to a previous screen. Also use to switch the **AC7** 'OFF'.

Press to enter menu screens. Press **MENU** again for language options.

1 x Alkaline 9V PP3 battery. Battery access at rear. Typical effective operating time = up to 20 hours.

9V Battery

Select Language

► ENGLISH
ESPANOL
FRANCAIS
ITALIANO
NORSK
SVENSKA

Use the ▲ ▼ buttons to select a language. Press **OK** to accept.

Key
Throughout these instructions, there are two abbreviations used for 'differential pressure' as follows:
Δp is used in the body text.
DP is used in the screen images.

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The **AC7** handset is supplied in a lightweight carrycase 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 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 Δp.

*If the Δp 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 moved or adjusted after a datum has been set. A lanyard is provided and can be used to suspend the AC7 from adjacent pipework, as appropriate.

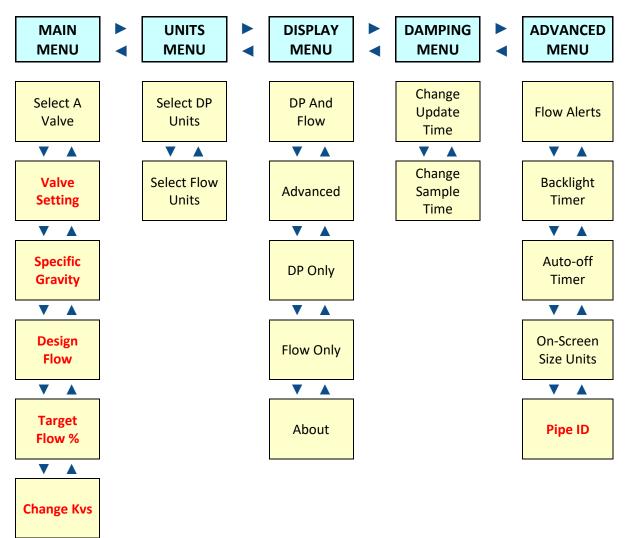****If the AC7 is being subjected to an extreme change of temperature at this point, the datum may drift from zero as the internal temperature of the meter changes and, in these circumstances, it will be necessary to repeat this step until the internal temperature has stabilised and a zero datum is maintained.*

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.

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Menu Map

The **AC7** has five menus for ease of use:

MAIN MENU	► ◄	UNITS MENU	► ◄	DISPLAY MENU	► ◄	DAMPING MENU	► ◄	ADVANCED MENU
Select A Valve		Select DP Units		DP And Flow		Change Update Time		Flow Alerts
▼ ▲		▼ ▲		▼ ▲		▼ ▲		▼ ▲
Valve Setting		Select Flow Units		Advanced		Change Sample Time		Backlight Timer
▼ ▲				▼ ▲				▼ ▲
Specific Gravity				DP Only				Auto-off Timer
▼ ▲				▼ ▲				▼ ▲
Design Flow				Flow Only				On-Screen Size Units
▼ ▲				▼ ▲				▼ ▲
Target Flow %				About				**Pipe ID**
▼ ▲								
Change Kvs								

Note: menu options shown in **red** will require numerical data to be entered and this is achieved using the buttons on the keypad. The default starting digit is always zero – then use the ▲ ▼ buttons to change the value. Use the ► button to add a digit and the ◄ button to remove a digit. If a decimal point is required, press the ▼ button when the zero digit is showing. To enter a negative number, press the **ZERO** button before any number is added. The following example shows how a user would set a Design Flow of 1.05:

        MENU enters the Main Menu
        ▼ ▼ ▼ moves the cursor down to the Design Flow option
        OK accepts the Design Flow option
        ▲ changes the value of the first column to 1
        ► selects the next column
        ▼ selects a decimal point
        ► selects the next column
        ► selects the next column
        ▲ ▲ ▲ ▲ ▲ changes the digit to 5
        OK accepts the on-screen value of 1.05
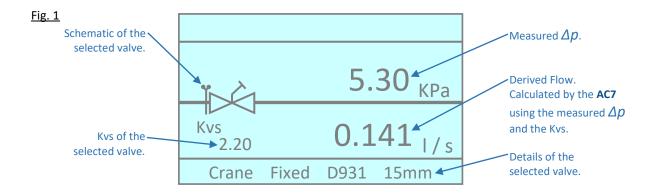   **EXIT** returns to the chosen display screen

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. The four display formats are described below but, first, it is important to explain some automatic alerts which may appear on any of these screens as and when certain circumstances exist as follows:
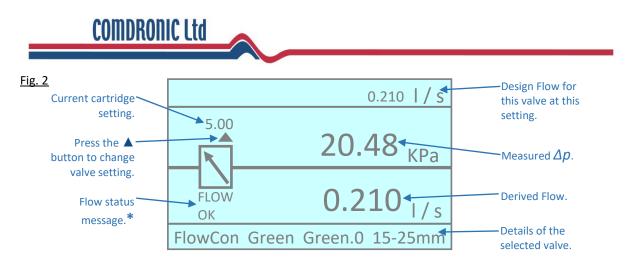
ZERO DP	SG	TEMP HIGH
The **ZERO** button will need to be pressed to set a datum (see Connection Procedure on page 3) before readings can be taken.	Specific Gravity is <u>not</u> set to 1.0, so readings are currently being auto-corrected for SG.	The temperature of the fluid <u>inside the handset</u> is too high for readings to be temperature-compensated.*****

		REPLACE BATTERY.
This symbol will show when the remaining battery power drops below 8.0 volts. This is for INFORMATION ONLY as there is still plenty of run-time available.	This symbol will show when the remaining battery power drops below 7.5 volts. Action: ensure that a replacement battery is on-hand.	Remaining battery power has dropped below 6.5 volts and is too low for the **AC7** to function. Action: FIT A NEW BATTERY.

***The pressure sensor within the **AC7** ceases to compensate for temperature at temperatures above 50°C. However, as long as purge times are kept to a minimum, the temperature of the fluid within the meter is usually closer to ambient than the temperature of the line fluid.*

DP And Flow Display

The DP And Flow Display is suitable for most general commissioning purposes. Fig. 1 shows an example of displayed data when a fixed orifice valve has been selected and fig. 2 shows an example of displayed data when an automatic balancing valve has been selected.

<u>Fig. 1</u>

Schematic of the selected valve.

Measured Δp.

Derived Flow. Calculated by the **AC7** using the measured Δp and the Kvs.

Kvs of the selected valve.

Details of the selected valve.

Kvs 2.20

5.30 KPa

0.141 l / s

Crane   Fixed   D931   15mm

Fig. 2

Current cartridge setting.

Press the ▲ button to change valve setting.

Flow status message.*

Design Flow for this valve at this setting.

Measured Δp.

Derived Flow.

Details of the selected valve.

```
                           0.210  l / s
    5.00
     ▲              20.48 KPa
    ┌─┐
    │╱│
    └─┘             0.210
   FLOW                   l / s
   OK
   FlowCon  Green  Green.0  15-25mm
```
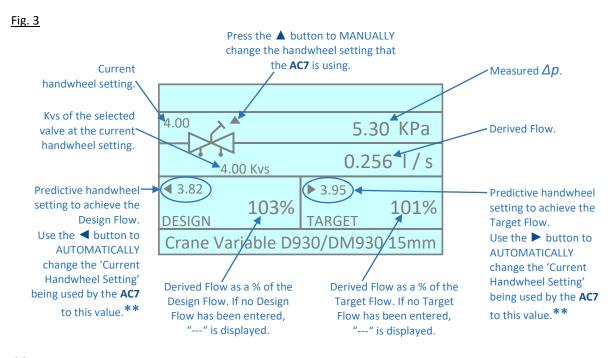
*If the measured Δp reaches the design Δp for the selected valve, the flow status message will be **FLOW OK**. However, if the design Δp is not met the flow status message will be **LOW FLOW**.
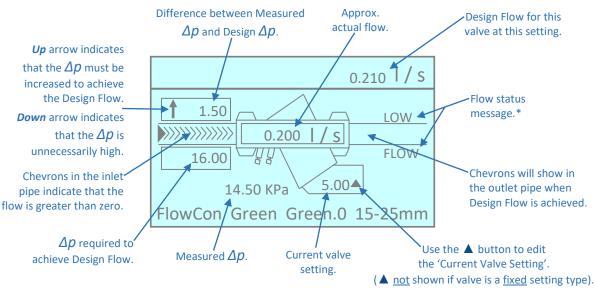
Advanced Display

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. Fig. 3 shows an example of displayed data when a variable orifice valve has been selected and fig. 4 shows an example of displayed data when an externally adjustable automatic balancing valve has been selected.

Fig. 3

Current handwheel setting.

Press the ▲ button to MANUALLY change the handwheel setting that the **AC7** is using.

Measured Δp.

Kvs of the selected valve at the current handwheel setting.

Derived Flow.

Predictive handwheel setting to achieve the Design Flow. Use the ◄ button to AUTOMATICALLY change the 'Current Handwheel Setting' being used by the **AC7** to this value.**

Predictive handwheel setting to achieve the Target Flow. Use the ► button to AUTOMATICALLY change the 'Current Handwheel Setting' being used by the **AC7** to this value.**

Derived Flow as a % of the Design Flow. If no Design Flow has been entered, "---" is displayed.

Derived Flow as a % of the Target Flow. If no Target Flow has been entered, "---" is displayed.

```
    4.00        ▲          5.30 KPa
     ┌─◁▷─┐
     └───┘              0.256 l / s
      4.00 Kvs
    ◄ 3.82          ► 3.95
        103%            101%
   DESIGN           TARGET
   Crane Variable D930/DM930 15mm
```

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 ◄ or ► button on the **AC7, the physical handwheel setting of the valve will also need to be changed to match the new value.

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Fig. 4

Difference between Measured Δp and Design Δp.

Approx. actual flow.

Design Flow for this valve at this setting.

Up arrow indicates that the Δp must be increased to achieve the Design Flow.

Down arrow indicates that the Δp is unnecessarily high.

Chevrons in the inlet pipe indicate that the flow is greater than zero.

Flow status message.*

Chevrons will show in the outlet pipe when Design Flow is achieved.

Δp required to achieve Design Flow.

Measured Δp.

Current valve setting.

Use the ▲ button to edit the 'Current Valve Setting'. (▲ not shown if valve is a fixed setting type).

Display values shown: 0.210 l / s, 1.50, 0.200 l / s, LOW, 16.00, FLOW, 14.50 KPa, 5.00▲, FlowCon Green Green.0 15-25mm

*The Design Flow for any automatic balancing valve will be achieved if the Δp across the valve reaches (or exceeds) the design value. If the Design Δp is met, the displayed message will be **FLOW OK**. If the Design Δp is not met, the displayed message will be **LOW FLOW**.

DP Only Display

The DP Only Display (shown in fig. 5) is the simplest option available and may be preferred when the **AC7** is being used as a simple manometer.

Fig. 5

4.27 — Measured Δp.

| KPa — Units of measure.

Flow Only Display

The Flow Only Display (shown in fig. 6) would normally only be the preferred display screen when fluid velocities are being measured for the purposes of system flushing.

Fig. 6

16.1mm — Internal Pipe Diameter being used to calculate the fluid velocity.

1.37 — Calculated Fluid Velocity.

Kvs= 2.3

| m/s — Units of measure.

'About'

The 'About' menu option (shown in fig. 7) gives the unique serial number of the **AC7** (please quote this in any correspondence with Comdronic) plus the installed firmware version.

Fig. 7

Unique serial number. → SNO-0123   (A29D) 6.03.210 ← Firmware version.
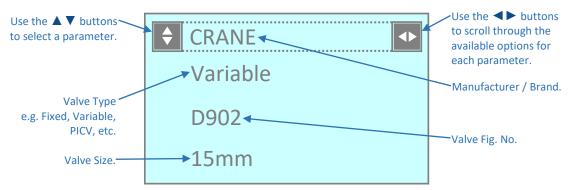
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Main Menu

The Main 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

The performance characteristics of over 5,000 valves – from 70+ manufacturers / brands – are pre-programmed into the **AC7** and this data is automatically updated whenever an **AC7** is serviced by Comdronic.

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.

Fig. 8

Use the ▲ ▼ buttons to select a parameter.

Use the ◄ ► buttons to scroll through the available options for each parameter.

CRANE — Manufacturer / Brand.

Variable

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

D902 — Valve Fig. No.

Valve Size. → 15mm

Make selections for <u>all</u> four parameters (i.e. **Manufacturer**, **Type**, **Fig. No.** & **Size**) before pressing **OK** to accept them.

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Valve Setting

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 data is used for the derivation of flow.

Fig. 9

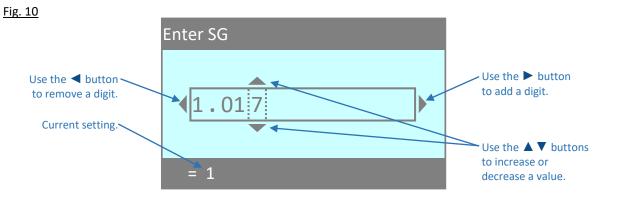Min.* & Max. usable settings for the selected valve.

Use the ◄ button to remove a digit.

Current setting.

Min = 1 Max = 4

2 . 4

= 4

Use the ► button to add a digit.

Use the ▲ ▼ buttons to increase or decrease a value.

Once the new value is correct on the screen, press **OK** to accept it. Or, press **EXIT** to exit the screen and <u>retain the current setting</u>.

***The minimum handwheel position shown ensures that the valve maintains reasonable accuracy.*

Specific Gravity

This menu option allows the user to enter the 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.

Fig. 10

Use the ◄ button to remove a digit.

Current setting.

Enter SG

1 . 01 7

= 1

Use the ► button to add a digit.

Use the ▲ ▼ buttons to increase or decrease a value.

Once the new value is correct on the screen, press **OK** to accept it. Or, press **EXIT** to exit the screen and <u>retain the current setting</u>.

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.

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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.
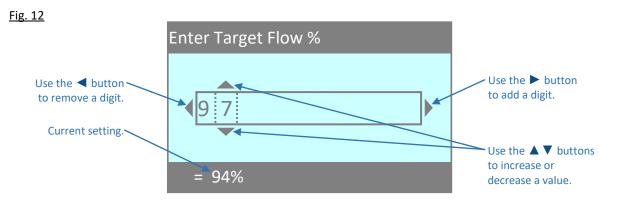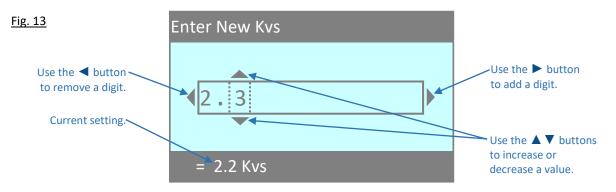
Fig. 11

Use the ◄ button to remove a digit.

Current setting.

Enter Design Flow

10 . 8

= 10.2 l/s

Use the ► button to add a digit.

Use the ▲ ▼ buttons to increase or decrease a value.

Once the new value is correct on the screen, press **OK** to accept it. Or, press **EXIT** to exit the screen and <u>retain the current setting</u>.

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 advanced 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'.

Fig. 12

Use the ◄ button to remove a digit.

Current setting.

Enter Target Flow %

9 7

= 94%

Use the ► button to add a digit.

Use the ▲ ▼ buttons to increase or decrease a value.

Once the new value is correct on the screen, press **OK** to accept it. Or, press **EXIT** to exit the screen and <u>retain the current setting</u>.

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Change Kvs

If the valve / device is <u>not</u> 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**.
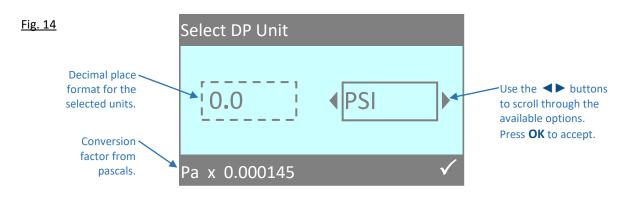
Fig. 13

Use the ◄ button to remove a digit.

Current setting.

Enter New Kvs

2 . 3

= 2.2 Kvs

Use the ► button to add a digit.

Use the ▲ ▼ buttons to increase or decrease a value.

Once the new value is correct on the screen, press **OK** to accept it. Or, press **EXIT** to exit the screen and <u>retain the current setting</u>.

Units Menu

Select DP Units   Default = kPa

Available options are kPa, psi, bar, cmH_2O, IWGA (inches water gauge), Ft HD (feet head) or Pa.

Fig. 14

Decimal place format for the selected units.

Conversion factor from pascals.

Select DP Unit

0.0   ◄ PSI ►

Pa x 0.000145   ✓

Use the ◄► buttons to scroll through the available options. Press **OK** to accept.

Select Flow Units   Default = l/s

Available <u>flow</u> options are l/s, l/m, l/h, USGPM, UKGPM, m^3/h, m^3/m or m^3/s.
Available <u>velocity</u> options are m/s or f/s.

Fig. 15

Decimal place format for the selected units.

Conversion factor from litres per second.

Select Flow Unit

0.00   ◄ l/m ►

l/s x 60   ✓

Use the ◄► buttons to scroll through the available options. Press **OK** to accept.
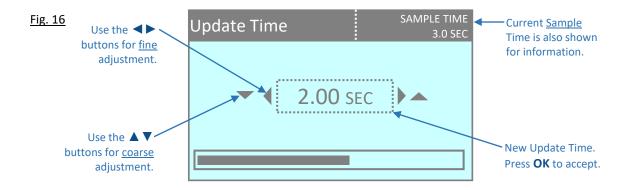
Damping Menu

Change Update Time   Default = 1.00 SEC

This screen allows the user to adjust the apparent sensitivity of the **AC7** by changing the time delay between each screen update from a minimum value of 0.1 SEC to a maximum value of 2.55 SEC. A long Update Time may be advisable on an unstable system in order to give a steadier reading.
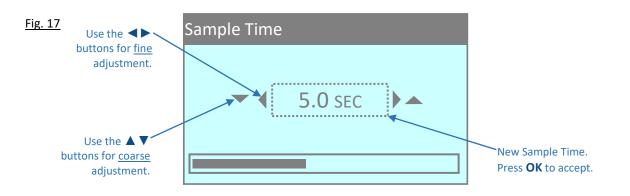
Fig. 16

Use the ◄► buttons for <u>fine</u> adjustment.

Use the ▲ ▼ buttons for <u>coarse</u> adjustment.

Update Time

SAMPLE TIME
3.0 SEC

Current <u>Sample</u> Time is also shown for information.

▼ ◄ 2.00 SEC ► ▲

New Update Time. Press **OK** to accept.

Once the new value is correct on the screen, press **OK** to accept it. Or, press **EXIT** to exit the screen and <u>retain the current setting</u>.

Change Sample Time   Default = 3.0 SEC

This screen allows the user to adjust the period of time over which readings are averaged, from a minimum value of 0.6 SEC to a maximum value of 11.0 SEC. Increasing the Sample Time will make the screen appear to update less frequently, but with a more stable reading.

Fig. 17

Use the ◄► buttons for <u>fine</u> adjustment.

Use the ▲ ▼ buttons for <u>coarse</u> adjustment.

Sample Time

▼ ◄ 5.0 SEC ► ▲

New Sample Time. Press **OK** to accept.

Once the new value is correct on the screen, press **OK** to accept it. Or, press **EXIT** to exit the screen and <u>retain the current setting</u>.

Advanced Menu

There are two Flow Alerts: **HIGH FLOW*** and **LOW FLOW** and these relate to the flow through the selected valve.

<u>Fig. 18</u>

High / Low Flow Alerts
☐ Enabled
⊙ Disabled

Use the ▲ ▼ buttons to move between the settings.
Press **OK** to accept.

For static balancing valves, **HIGH FLOW conditions would normally mean that the flow through the device is in excess of recommended maximum flows as quoted in BS7350. For automatic balancing valves, **HIGH FLOW** conditions would normally mean that the maximum working Δp for the device has been exceeded. The presence of the **HIGH FLOW** alert on the screen will almost certainly be accompanied by significant system noise.*

Note: if Flow Alerts are Enabled when working on an unstable system, the displayed alert may change, quite frequently, between the HIGH / LOW options and this may only serve to impede – rather than assist – the commissioning process. Hence, it is strongly recommended that Flow Alerts remain Disabled when work is being carried out on an unstable system, or on a system that has little regulation.

Backlight Timer   Default = 5 min

The Backlight Timer sets the period of time after which the backlight will turn off after a period of inactivity. A short time will preserve battery life.

<u>Fig. 19</u>

Select Light-On Time
☐ 1   min
☐ 5   min
⊙ 10 min
☐ Always On

Use the ▲ ▼ buttons to move between the settings.
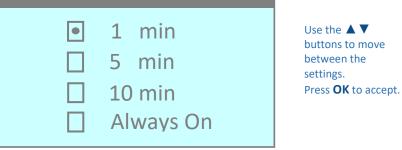Press **OK** to accept.

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.
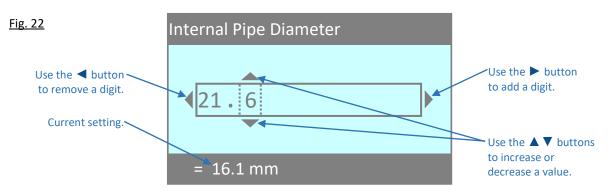
Fig. 20

Select Auto-Off Time
⦿ 1   min
☐ 5   min
☐ 10 min
☐ Always On

Use the ▲ ▼ buttons to move between the settings.
Press **OK** to accept.

On-Screen Size Units   Default = mm

This menu option allows the user to specify the preferred units for viewing and selecting valve sizes.

Fig. 21

View Size As
⦿ mm
☐ Inches

Use the ▲ ▼ buttons to move between the settings.
Press **OK** to accept.

Pipe ID

This is the internal pipe diameter of the pipework that the target measuring valve / device is installed in and it is used by the **AC7** to establish the velocity in the pipe for flushing purposes. Velocity units are available (m/s or f/s) and these can be selected in the Units Menu. A valve will need to be selected (see page 8) in order for this feature to be used.

Fig. 22

Use the ◄ button to remove a digit.

Use the ► button to add a digit.

Current setting.

Internal Pipe Diameter
◄ 21 . 6 ►
= 16.1 mm

Use the ▲ ▼ buttons to increase or decrease a value.

Once the new value is correct on the screen, press **OK** to accept it. Or, press **EXIT** to exit the screen and retain the current setting.

Quick-Valve Storing Function

Quick-Valve allows the user to quickly save commissioning data for individual valves to the **AC7**'s on-board memory. Within **Quick-Valve**, there are 1,000 storage locations and these are arranged in 50 groups of 20 valves.
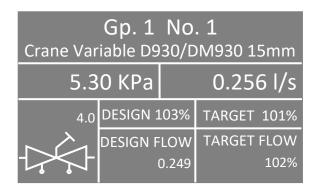
Quick-Valve can be accessed from any of the display screens (i.e. **DP And Flow Display**, **Advanced Display, DP Only Display** or **Flow Only Display**). Simply press **OK** whilst in any of these screens and the last-viewed storage location will be shown on the screen. At the first time of use, *Gp. 1, No. 1* will be the displayed storage location.

Once **Quick-Valve** has been accessed, the storage locations are navigable by using the ▲ ▼ buttons to change the Group No. and the ◄► buttons to change the Valve No. As the various storage locations are viewed, the on-screen display will change depending on whether the location is 'empty' or whether it already contains stored data. Examples of these screens and the further feature options are shown below.
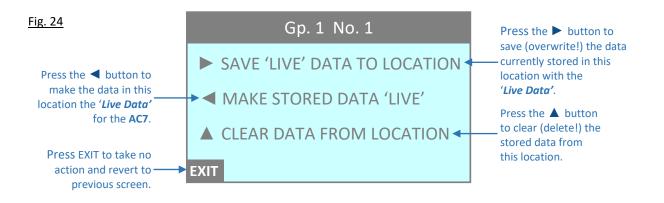
Note: even when a user is within the **Quick-Valve** screens, the **AC7** will be continuing to take readings (even if the **AC7** is not connected to a system it will still be taking a reading!) and it may have a valve selected or a manual Kvs entered. Also, values for Target Flow and / or Design Flow may have been entered. For the purposes of this section, this data will be referred to as the '*Live Data*'.

Example 1 – If the selected storage location already contains data, the stored data will be shown:
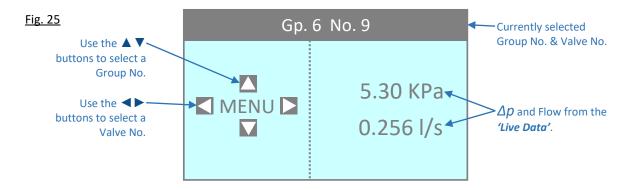
Fig. 23

With the above screen in view, pressing the **MENU** button will display the following options:
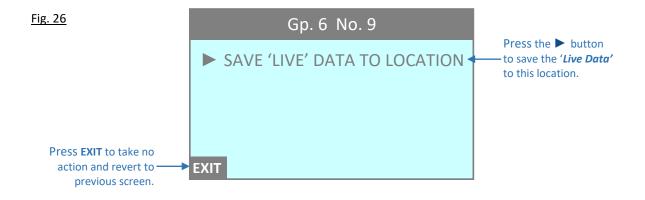
Fig. 24

Press the ◄ button to make the data in this location the '*Live Data*' for the **AC7**.

Press EXIT to take no action and revert to previous screen.

Press the ► button to save (overwrite!) the data currently stored in this location with the '*Live Data*'.

Press the ▲ button to clear (delete!) the stored data from this location.

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Example 2 – If the selected storage location is 'empty', the following screen will be displayed:

Fig. 25

Use the ▲ ▼ buttons to select a Group No.

Use the ◄ ► buttons to select a Valve No.

| Gp. 6 No. 9 |
| ▲ |
| ◄ MENU ► |
| ▼ |
| 5.30 KPa |
| 0.256 l/s |

Currently selected Group No. & Valve No.

Δp and Flow from the *'Live Data'*.

With the above screen in view, pressing the **MENU** button will display the following options:

Fig. 26

| Gp. 6 No. 9 |
| ► SAVE 'LIVE' DATA TO LOCATION |
| EXIT |

Press the ► button to save the *'Live Data'* to this location.

Press **EXIT** to take no action and revert to previous screen.

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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

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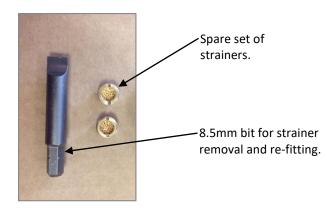
If an **AC7** continues to read incorrectly even after an **advanced flush** and strainer change, please 'Contact Us' for further advice.
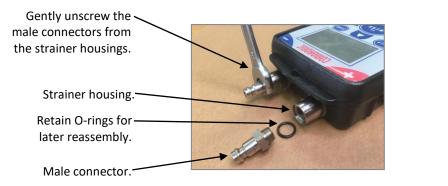
Hose Maintenance

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.

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Strainer Removal / Replacement

Parts Required:

Spare set of strainers.

8.5mm bit for strainer removal and re-fitting.

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

Gently unscrew the male connectors from the strainer housings.

Strainer housing.

Retain O-rings for later reassembly.

Male connector.

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.

Use the 8.5mm bit in the bit-holder to gently unscrew the strainers from their housings.

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!).

User Notes: