Measurement Features
CAM028L / CAM026L

Original Instruction Manual

Version B

⊘ minicam

Contents

Defect Clock Reference

Overview of the Concept

Observations using non-laser cameras require the user to enter a **Clock Reference** value, as a number from 1 through 12, representing the position of a defect in a pipe when the pipe is visualised on a clock face.

Using Minicam's CAM026L and CAM028L enables the user to access selectable or automated on-screen graphics instead, so that the CCU automatically selects the **Clock Reference** value.
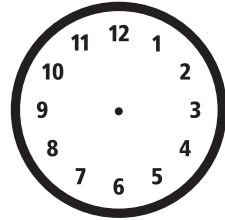
Example using non-laser equipped cameras

When user is not performing a WinCan or ProPIPE+ survey

Using a non-laser camera the user directly types in the text for the **Clock Reference** value, using their judgement of the position of the defect.

When user is performing a WinCan or ProPIPE+ survey

At present user selects a parameter that requires a **Clock Reference**, then...

Presses the **Left Arrow** / **Right Arrow** keys to scroll through the values from 1 O'clock to 12 O'clock.

The value that the user selects is based on their judgement of the position of the defect.
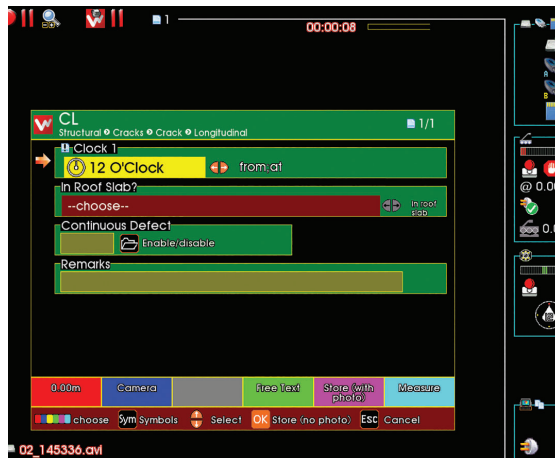
1 | Find a defect that requires a Clock Reference

Using Minicam's CAM026L and CAM028L enables the user to access selectable or automated on-screen graphics, so that the CCU automatically selects the **Clock Reference** value.

Using Laser Equipped Cameras

When user is not performing a WinCan or ProPIPE+ survey

Locate a pipe wall defect that requires a **Clock Reference**. If you desire, you can first type in some survey text to describe the defect For example,type in **Crack at:** Later on, after you've found the Clock Reference, the reference value text will automatically be inserted after your text on-screen, to make for example. **Crack at: 9 O'Clock**

Press the **Camera Settings** key to display the Camera menu.

Continued from previous page

F6	Press the **F6** key to display the **Camera** menu.
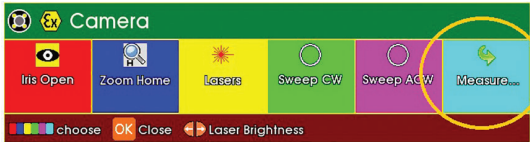
F4	Press the **F4** key to display the **Clock Reference**.
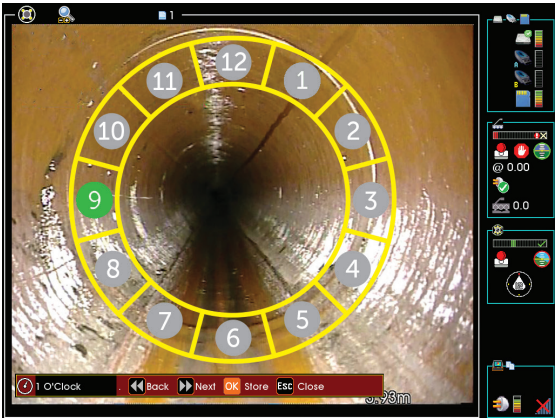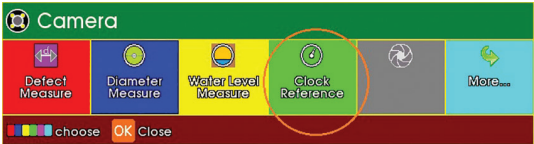
The camera picture view with **Clock Reference Facilities** is displayed. Now follow STEP 2 on page 12 *Choose the Clock Reference for the Defect*.

When user is performing a WinCan or ProPIPE+ survey

In the normal way, choose an observation **Defect Code** that requires a **Clock Reference**. The usual observation parameters entry box appears:

Press the **Up Arrow** / **Down Arrow** keys to select an observation parameter that requires a **Clock Reference** value.

Press the **F6** key.

The observation parameters entry box is removed from screen.

The camera picture view with **Clock Reference Facilities** is displayed. Now follow STEP 2 on page 12 *Choose the Clock Reference for the Defect*.

OK

When you have chosen the **Clock Reference**, press **OK**.
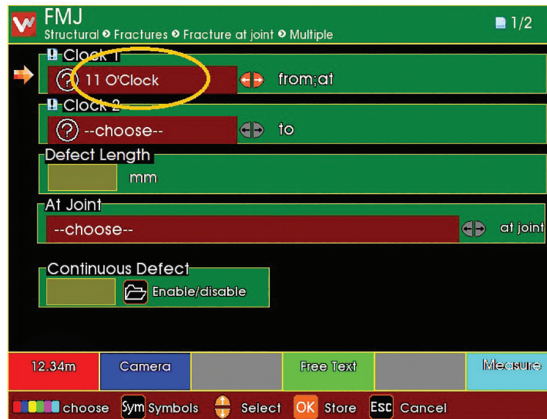
• The CCU remembers your chosen **Clock Reference**.

• The **Clock Reference Facilities** are removed from the screen.

Then the observation parameter entry box reappears:
• The **Clock Reference** you chose is automatically set into the selected parameter that required the **Clock Reference**.

The value can be manually changed if desired by pressing the **Left Arrow** / **Right Arrow** keys to scroll through from 1 O'clock to 12 O'clock.

You can repeat this process for any parameters that require a **Clock Reference**.

2 | Choose the Clock Reference for the Defect

The 'Clock Reference Facilities' allow you to choose the clock reference nearest to the defect.

If you have a Pan and Rotate Camera:
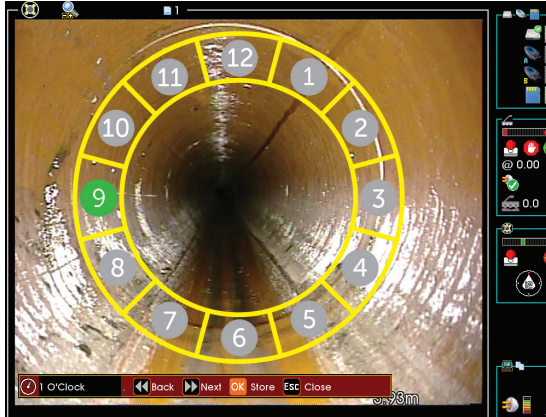• The **Clock Reference** selected automatically 'follows' the direction in which the camera is pointing. As you rotate or tilt the camera, the selected **Clock Reference** automatically changes to what you are looking at.
• You can still manually select the **Clock Reference** if you want to.
• The currently chosen Clock Reference is highlighted in green (see example above).

Press number keys **1** through to **9** to jump directly to choose that number of the **Clock Reference**. For double figures (10, 11 and 12) use the **Rewind/Fast Forward** keys as described below.

Press the **Rewind** key to move your choice **Anti-Clock-wise**.

Press the **Fast Forward** key to move your choice **Clockwise**. Now follow STEP 3 on page 13 *Completing the Clock Reference.*

3 | Completing the Clock Reference

When user is not performing a WinCan or ProPIPE+ survey

OK When you have chosen the **Clock Reference**, press **OK**.

• The CCU remembers your chosen **Clock Reference**.

• The **Clock Reference Facilities** are removed from the screen.

• The CCU automatically writes the **Clock Reference** into your survey text on-screen, to wherever your survey text editing cursor was previously positioned.

• You can then edit the survey text around this value if you desire.

Laser Defect Measurement

Overview of the Concept

Proteus™ Control Units (CCU) and crawlers, along with laser equipped Mini-cam cameras, allow you to measure the length of a defect, such as a crack or a joint displacement, and to automatically insert that measurement into your observations.

The defect measurements can be made within a *WinCan* or *ProPIPE+* survey, or outside of these surveys just using free-format survey text entry.

The basic principle is:
- Find a defect to measure
- Begin an observation of that defect
- Manually make the defect and lasers visible on-screen
- Manually locate the positions of the lasers and the defect on-screen
- Store the measurement into your observation

1 | Find a Defect to Measure

When user is not performing a WinCan or ProPIPE+ survey

Locate a pipe wall defect that requires **Measurement**.

Drive the crawler up to the defect.

To begin an observation of that defect:
If you desire, you can first type in some survey text to describe the defect
• For example, type in "**Crack:**"
• Later on, after you've done the defect measurement, the defect length value will automatically be inserted after your text on-screen, to make for example. **Crack at: 28mm**

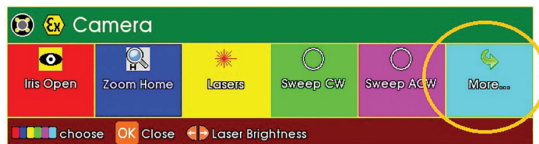Press the **Camera Settings** key to display the Camera menu.

Continued from previous page

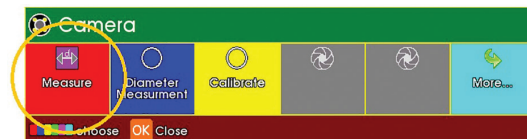Press the **Camera Settings** key to display the Camera menu.

Press the **F6** key to display the **Measure** options.

Press the **F1** key to **Measure** the defect**.**

• The camera picture view with **Measurement Facilities** becomes visible. Follow STEP 2 on page 17.
• The camera tilt is automatically angled to directly face the pipe wall.

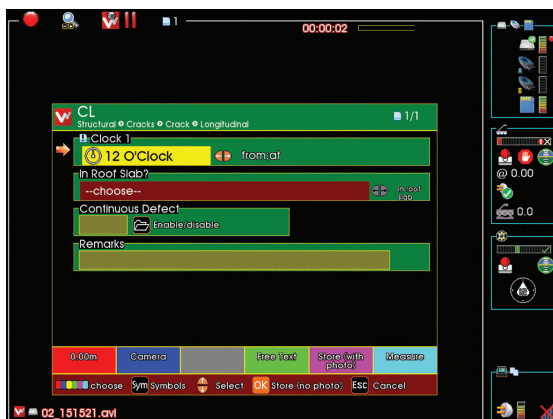## When user is performing a WinCan or ProPIPE+ survey

Locate a pipe wall defect that requires **Measurement**.

Drive the crawler up to the defect.

To begin an observation of that defect:
In the normal way, choose an observation **Defect Code** that requires the **Measurement**. The usual observation parameters entry box appears.

Press the **Up Arrow** / **Down Arrow** keys to select the observation parameter that requires a **Measurement** value.

Press the **F6** key to display the **Measure** options.

• The observation parameters entry box is removed from screen.
• The camera picture view with **Measurement Facilities** becomes visible. Follow STEP 2 on page 17.
• The camera tilt is automatically angled to directly face the pipe wall.

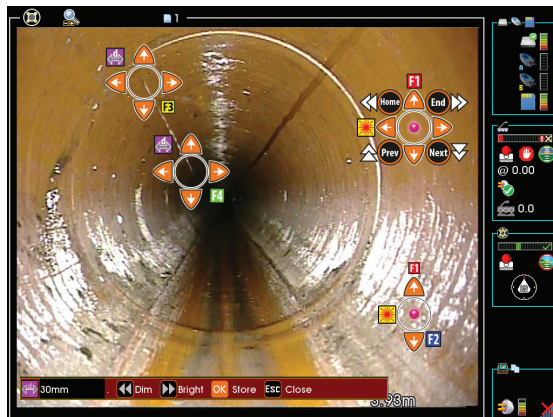## 2 | Make the Defect and Lasers Visible On-screen

The **Measurement Facilities** allow you to manually tell the CCU where the lasers and the ends of the defect appear on the screen.

First you need to position the crawler and camera such that the lasers and the defect are both visible on-screen.

Adjust the **crawler** position, and the camera **rotate** position, and camera **zoom** so that:
• The distance between the lasers is a far as possible, but still visible in the picture.
• The whole length of the defect to be measured is also visible
in the picture
Note You can't adjust the camera tilt, because it must face the pipe wall directly.

Use the **Rewind** and **Fast Forward** keys to adjust the brightness of the lasers and the camera lights if required.

3 | Locate the Positions of the Defect and Laser On-screen

Use the keys as indicated on-screen align the centre of the on-screen circles over:

• The start (use **F1**) and end (use **F2**) of the defect to be measured.
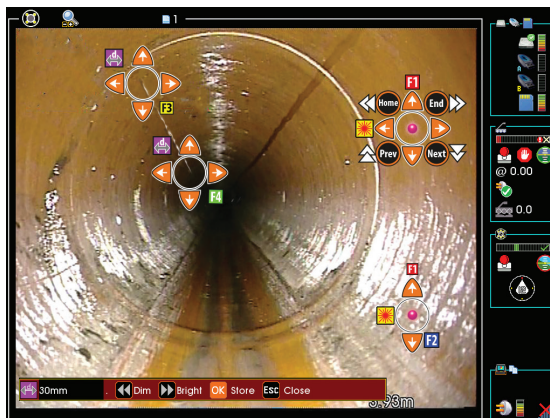
• The centres (**F3** and **F4**) of the two lasers.

As the defect measurement start and end position centres are moved:

• The defect length measurement between them is continuously updated on-screen.

Then press **OK** when finished entering references

4 | Completing the Measurement

When user is not performing a WinCan or ProPIPE+ survey

OK	When everything is positioned, press **OK**.

• The CCU remembers the defect length, measured be-tween
the measurement centres.
• The CCU automatically writes the defect length into your survey text on-screen, to wherever your survey text editing cursor was previously positioned.
• You can then edit the survey text around this value if you desire.

## When user is performing a WinCan or ProPIPE+ survey

OK — When everything is positioned, press **OK**.

• The CCU remembers the defect length, measured between the measurement centres.

Then the observation parameter entry box reappears
• The defect length is automatically inserted into the selected parameter that required the measurement.
• The value can then be manually edited if desired.
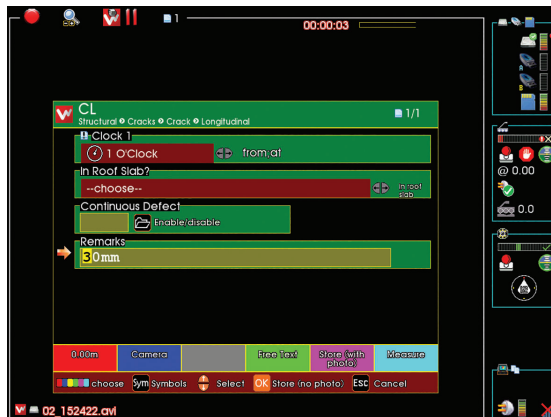
After taking the photo:
• The highlighted defect is removed from screen.

Measurement Facilities Screen Keys

For making the Defect and Lasers visible on-screen

KEYS	ACTIONS
🔍 + −	Adjust camera zoom, such that the lasers are as far apart as possible, and the defect is still fully visible

For Locating the Defect Measurement Start and End Positions

KEYS	ACTIONS	
To select the measurement point to move: **F1** Select first measurement point **F2** Select second measurement point	**Restores the saved** camera illumination level (if lasers were previously being adjusted). **First Measurement Point** is initially selected for positioning.	
	◀◀ ▶▶	Adjust **camera illumination brightness**
	Home	Jump measurement point 50 pixels to the **left**
	End	Jump measurement point 50 pixels to the **right**
	Prev	Jump 50 pixels **up**
	Next	Jump 50 pixels **down**
	⬆ ⬅ ➡ ⬇	Fine adjust measurement point **centre position**

For Locating the Laser Centre Positions

KEYS	ACTIONS
To select the laser to move: **F3** Select CAM028L Top Laser, **OR** CAM026L Left Laser **F4** Select CAM028L Bottom Laser, **OR** CAM026L Right Laser	**Saves then Dims** the camera illumination level. **Switches ON** lasers
	◀◀ ▶▶ Adjust **laser brightness**
	Home Jump measurement point 50 pixels to the **left** (ONLY for Top/Left Laser)
	Home Jump measurement point 50 pixels to the **right** (ONLY for Top/Left Laser)
	Home Jump 50 pixels up
	Home Jump 50 pixels down
	Fine adjust laser **centre position**

For Closing the Measurement Facilities Screen

KEYS	ACTIONS
OK	Save the positions of the laser and measurement centres (to be recalled on next measurement observation). Save the defect length measurement value. **Switches OFF** lasers. Close the Measurement Facilities Screen. Restore camera illumination to previous brightness. *If **NOT** doing a Wincan or ProPIPE+ survey:* • Automatically write the defect length measurement into the on-screen survey text If you **ARE** doing a Wincan or ProPIPE+ survey: • Reshow the observation parameter entry box. • Automatically paste the defect measurement value into the selected parameter's value.
Esc	**Switches OFF** lasers. Close the Measurement Facilities Screen. Restore camera illumination to previous brightness *If you **ARE** doing a Wincan or ProPIPE+ survey:* • Reshow the observation parameter entry box.

Pipe Diameter Measurement

Overview of the Concept

SOLOPro+ Push-rod systems, and Proteus™ Crawler systems which are equipped with Minicam **Diameter Sensor** cameras CAM026L/CAM028L, allow the user to measure the diameter of a round pipe, and to automatically insert that measurement into your observations. The diameter measurements can be made within a *WinCan* or *ProPIPE+* survey, or outside of these surveys just using free-format survey text entry.

The basic principle is:
• Begin an observation of a defect that requires a diameter measurement.
• Perform the diameter measurement.
• Store the measurement into your observation.

1	Begin observation that requires a Diameter Measurement

When user is not performing a WinCan or ProPIPE+ survey

Locate a point in the pipe that requires diameter measurement.

To begin an observation of that defect:
If you desire, you can first type in some survey text to describe the measurement.
• For example, type in **Diameter**.
• Later on, after you've done the diameter measurement, the pipe diameter value will automatically be inserted after this text on-screen, to make for example: **Diameter: 150mm**.

	Press the **Camera Settings** key to display the Camera menu.
F6	Press the **F6** key to display more **Camera** functions, such as the **Measurement** features.
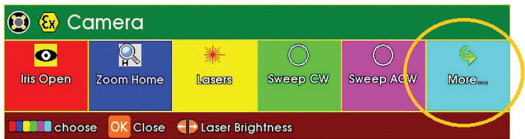
F2	Press the **F2** key to display the **Diameter Measurement** functions.
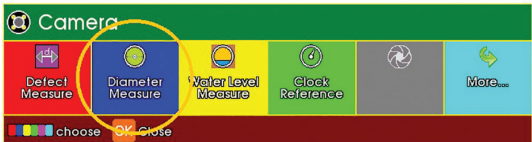
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You can now choose the diameter measurement type.
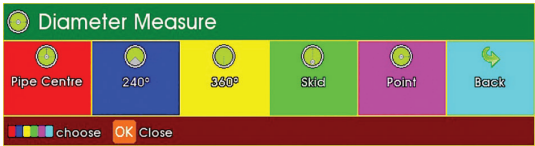
Now follow STEP 2 on page 28 *Perform the Diameter Measurement*.

When user is performing a WinCan or ProPIPE+ survey

Locate a point in the pipe that requires diameter measurement.

To begin an observation of that defect:
In the normal way, choose an observation **Defect Code** that requires the **Diameter Measuremen**t. The usual observation parameters entry box appears.

Continued from previous page

	Press the **Up Arrow** / **Down Arrow** keys to select the observation parameter that requires a **Diameter Measurement** value.
F6	Press the **F6**, the coloured keys will change and ask for what is to be measured.
F2	Press the **F2** key to display the **Diameter Measurement** type options.
	• Press one of the coloured keys to measure using that type of measurement (STEP 2 on page 28 *Perform the Diameter Measurement*). • The observation parameters entry box is removed from screen so you can see the camera picture.
	Now follow STEP 2 on page 28 *Perform the Diameter Measurement*.
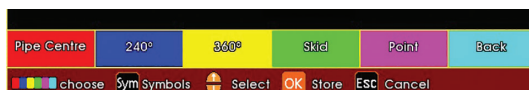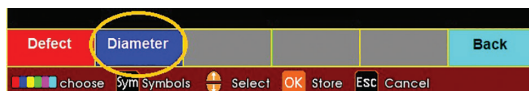
2 | Perform the Diameter Measurement

• Decide which type of Diameter Measurement you wish to perform.
• Press the appropriate coloured **Function** key for your choice of **Diameter Measurement** type.
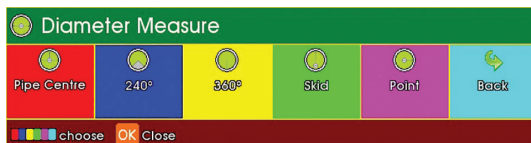
Pipe Centre	Takes a single measurement vertically (upwards) to determine the vertical positioning of the camera in the pipe.
240°	Takes many measurements around the pipe to calculate the diameter, but the bottom 120° of the pipe is not measured – use this type if there is water in the pipe.
360°	Takes a complete set of measurements all around the pipe to calculate the diameter – use this type if there is no water in the pipe.
Skid	Takes a single measurement vertically (upwards) to determine the vertical positioning of the camera in the pipe – use this for a CAM026L push camera with a 100mm skid.
Point	Takes a point distance measurement to the pipe wall from wherever the distance sensor is currently pointing.
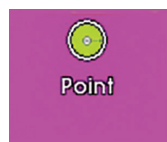
Continued on next page

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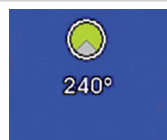|	
	Press the appropriate coloured **Function** key to begin the **Measure** using your chosen type of measurement. • The screen shows the measurement in progress. • When the measurement is complete, the measured value is shown.
Esc	• Press the **Esc** key if you want to stop and cancel the measurement, or if you don't want to store and use the measured value.
OK	• To store and use the measured value, press **OK**.
	• Press one of the coloured keys to measure using that type of measurement (STEP 2 on page 28 *Perform the Diameter Measurement*). • The observation parameters entry box is removed from screen so you can see the camera picture.
	Diameter Measure 150mm OK Store Esc Close

3 | Store the Measurement into your Observation

When user is not performing a WinCan or ProPIPE+ survey

OK

When the measurement has been performed, press the **OK** key if you want to store and use the measured value automatically.

• The measured value is automatically inserted into your text
on-screen, to say for example. **Diameter: 150mm**

When user is performing a WinCan or ProPIPE+ survey

OK When the measurement has been performed, press the **OK** key if you want to store and use the measured value automatically.

• The measured value is automatically inserted into the highlighted observation parameter.

• You can change this automatically inserted value if you want.

Water Level Measurement

(Based on user-adjustable OSD graphics)

Overview of the Concept

Many observations require the user to enter a **Water Level** value, usually as a percentage of the total pipe diameter. (Norway for example has many cases where Water Level is important).
Here is described a method for measuring the Water Level.

At present users estimate Water Level by facing the camera forwards, and use their skill to **visually judge** how far up the pipe the water comes.

A user might judge this picture as **5%**.

This concept proposal is to have user adjustable on-screen graphics so that the CCU can perform a calculation of the Water Level value.

1 | Perform a Water Level Measurement

Locate a point in the pipe that requires water level measurement.

To begin an water level measurement:
If you desire, you can first type in some survey text to describe the measurement.
• For example, type in **Water Level**.
• Later on, after you've done the diameter measurement, the pipe diameter value will automatically be inserted after this text on-screen, to make for example: **Water Level: 8%**

Use the **Left Arrow** / **Right Arrow** keys to adjust the position of the **YELLOW** line to touch the pipe joint.

Use the **Up Arrow** / **Down Arrow** keys to adjust the position of the **BLUE** to sit on the water. Use the **Left Arrow** / **Right Arrow** keys to adjust each end of the **BLUE** line to touch both sides of pipe.

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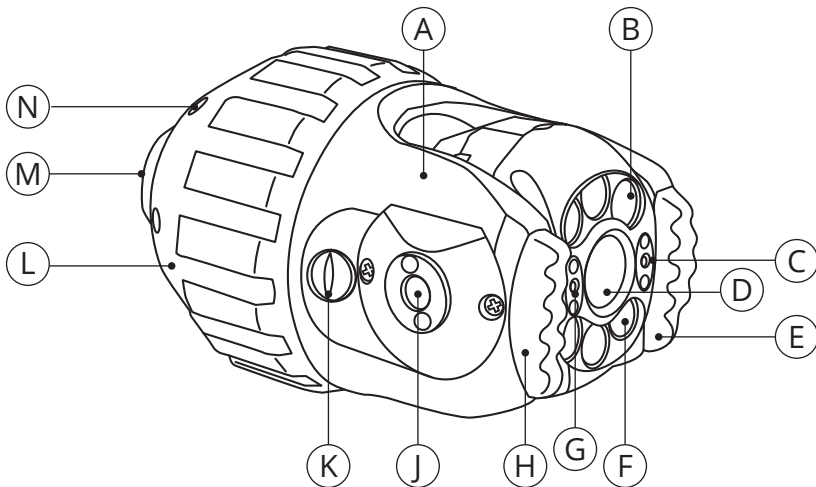|	The **Water Level** is shown on-screen.
OK	Press **OK** to either paste the water level value into a *Wincan* or *ProPIPE+* observation parameter, or to write it to the screen survey text.

CAM026L Pan, Rotate & Laser Camera

Description and Parts

The camera module CAM026L provides a high resolution colour, pan, rotate and laser camera for the Proteus™ platform. It has the following features:

- High resolution colour CCD image sensor
- Powerful LED lighting with narrow beam width lenses
- Dual Lasers
- Endless rotation range
- Panning range of +/- 135°
- Motorised focus control
- Internal pressure monitoring
- Impact resistant with user replaceable rubber protectors

A Serial number location	**H** Rubber protector
B LED illumination	**J** Distance sensor
C Laser	**K** Purge point
D Camera lens	**L** Camera protection skid
E Rubber protector	**M** Camera connector
F LED illumination	**N** Camera protection skid screws
G Laser	(6)

Technical Specifications

CAM026L - Pan, Rotate & Laser Camera	
Product Code	CAM026L
Pipe Diameter Measurement Range	90-600mm
Aligned Laser Spacing	25mm
Camera Resolution	470 HTVL
Sensitivity	<1.0 lux
Aperture/Field of View	F2.5 / 75°
Dimensions	120 x 74 x 74mm
Maximum Illumination Intensity	12.5k lux at 150mm
Pressure Depth Rating	1 bar (14.50psi)

CAM028L Pan, Rotate, Laser & Zoom Camera

Description and Parts

The camera module CAM028L provides a high resolution colour, pan, rotate, zoom and laser camera for the Proteus™ platform. It has the following features:

- High resolution colour CCD image sensor
- Powerful LED lighting with narrow beam width lenses
- Dual Lasers
- Endless rotation range
- Panning range of +/- 135°
- 10x optical 12x digital zoom
- Motorised focus control
- Internal pressure monitoring
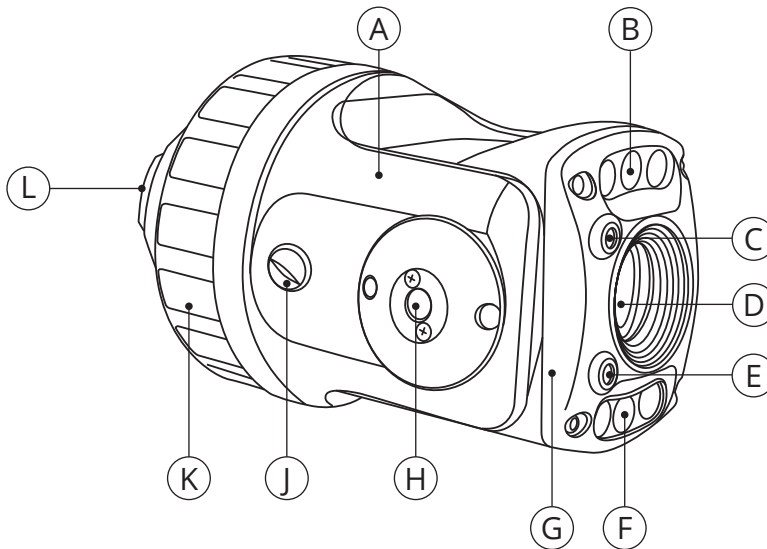
A Serial number location
B LED illumination
C Laser
D Camera lens
E Laser
F LED illumination

G Front housing
H Distance sensor
J Purge point
K Camera protection skid
L Camera connector

Technical Specifications

CAM028L - Pan, Rotate, Zoom & Laser Camera	
Product Code	CAM028L
Pipe Diameter Measurement Range	90-600mm
Aligned Laser Spacing	30mm
Camera Resolution	530 HTVL
Sensitivity	<1.0 lux
Aperture/Field of View	F1.8-F2.9 / 46° - 4.6°
Dimensions	143 x 80 x 80mm
Maximum Illumination Intensity	12.5k lux at 150mm
Pressure Depth Rating	1 bar (14.50psi)

minicam

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DESIGN 1220