ADS420
Saccharimeter

User Guide

Bellingham + Stanley

ADS420 User Guide (Eng)

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Bellingham and Stanley Ltd. has been manufacturing high quality optical instruments in the UK since 1914 and is a leading manufacturer of refractometers, polarimeters, and saccharimeters. The current range of products includes optical and digital hand refractometers as well as a full range of laboratory refractometers and polarimeters available through a network of trained distributors throughout the world. Process refractometers are also available through specialist outlets.

Our main website gives full details about Bellingham and Stanley Ltd. and our products. Foreign language brochures in PDF format may be downloaded from this section of the site by clicking the *flag*. We apologise if the foreign language brochure of your choice is not available.

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Bellingham + Stanley
Longfield Road
Tunbridge Wells, Kent TN2 3EY
United Kingdom
Main: +44 (0) 1892 500400
Fax: +44 (0) 1892 543115
sales.bs.uk@xyleminc.com

Bellingham + Stanley
90 Horizon Drive
Suwanee, GA 30024
United States of America
Main: (678) 804 5730
Fax: (678) 804 5729
sales.bs.us@xyleminc.com

DECLARATION OF CONFORMITY

According to ISO/IEC 17050-1 & 2 : 2004

Manufacturer's Name	*Bellingham & Stanley Limited*
Manufacturer's Address	Longfield Road, Tunbridge Wells, Kent TN2 3EY United Kingdom

declares that the product

Product Name	ADS420 Saccharimeter
Model Number	All

Is designed to conform to the following Product Specifications:

Safety

BSEN60950-1:2002

EMC

Emissions

- EN55022:2006 Radiated Emissions Class A
- EN55022:2006 Conducted Emissions Class A

Immunity

- EN61000-3-2:2006 Harmonics
- EN61000-3-11:2001 Flicker
- EN61000-4-2:1995 ESD 8kV contact
- EN61000-4-3:2006 EMS 3V/m
- EN61000-4-5:1995 Surges 0.5kV (line to line) 1.0kV (line to earth)
- EN61000-4-11:2004 Power outages 1 cycle/100%

Supplementary

The product herewith is designed to comply with the requirements of the EMC Directive 89/336/EEC and the Low Voltage Directive 2006/95/EC.

CE

RoHS Compliant

This symbol is an internationally agreed indicator that the product bearing it should not be disposed of as general waste or garbage which might end up in landfill sites, but should instead be sent for special processing and/or recycling in those countries where appropriate legislation and facilities are in place.

contents

section 1

Installing the instrument

Unpacking the instrument

Carefully remove all of the packing material. It is recommended that the box and other packing materials are retained so that, should the need arise, the saccharimeter can be safely returned to the manufacturer.

Check that all parts listed below are present and that no transit damage has occurred. If any are damaged or missing, contact the supplier immediately.

Contents list

1 ADS420 Saccharimeter module, see table below for part number
1 Power supply, 55-105
1 Mains lead, see below for part number
1 Operating Instructions, 37-262
1 Instruction manual CD-ROM, 55-300
1 Polarimeter tube, 35-47 (37-20 package only)
1 Funnel type polarimeter tube, 36-57 (37-21 package only)
36-58 (37-22 package only)

Part numbers

ADS420 saccharimeter part numbers

Model	Description
37-420	Saccharimeter module only
37-20	Complete standard package saccharimeter including power supply & accessories
37-21	Complete 100mm flow package saccharimeter including power supply, accessories and compatible upper sample lid (4 slots)
37-22	Complete 200mm flow package saccharimeter including power supply, accessories and compatible upper sample lid (4 slots)

Mains lead part numbers (for use with Power supply 55-105)

Moulded plug type for	Voltage	Mains cord wire colours			Code no.
		Line (Phase)	*Neutral (Return)*	*Earth (Ground)*	
Switzerland	*230V*	-	-	-	61-181
Denmark	*230V*	-	-	-	61-182
India / South Africa	*230V*	-	-	-	61-188
Australia	*230V*	-	-	-	61-189
No plug – open lead	-	*Brown*	*Blue*	*Green / Yellow*	61-190
UK 13 Amp square pin to BS1363/A	*230V*	-	-	-	61-191
United States (3 pin)	*110V*	-	-	-	61-192
Europe (Schuko)	*230V*	-	-	-	61-193

Positioning the system

Place the instrument on a flat and stable bench that is:

- dry and indoors
- away from draughty or hot equipment like fans or heaters
- out of direct sunlight or strong ambient light
- away from potential sources of interference, such as RFI generating equipment
- within reach of a power point
- not using a power circuit that also has large motors or noise generating equipment connected to it

Mains connection

The power supply adapter is supplied with a moulded mains cord and plug, to suit one of several socket types. For UK lead, replace fuse only with the type indicated on the plug.

Power requirements

Voltage	110 to 230V ~ ± 10%, 50 to 60 Hz
Maximum load	less than 40 mA

Power supply adapter 55-105

RISK OF ELECTRIC SHOCK:

- For electrical safety information, read the label on the power supply.
- For indoor use only.
- Must be kept dry.
- Disconnect the equipment from the mains supply before unplugging the mains lead from the power supply unit.
- Do not open the power supply adapter. No user serviceable parts inside.

WARNING:

- Do not cover, designed to operate with free air convection.
- No cleaning required.

Note: *A waterproof power supply adaptor, code no. 55-250, which can be used in damp environments, is available as an optional extra.*

section 2

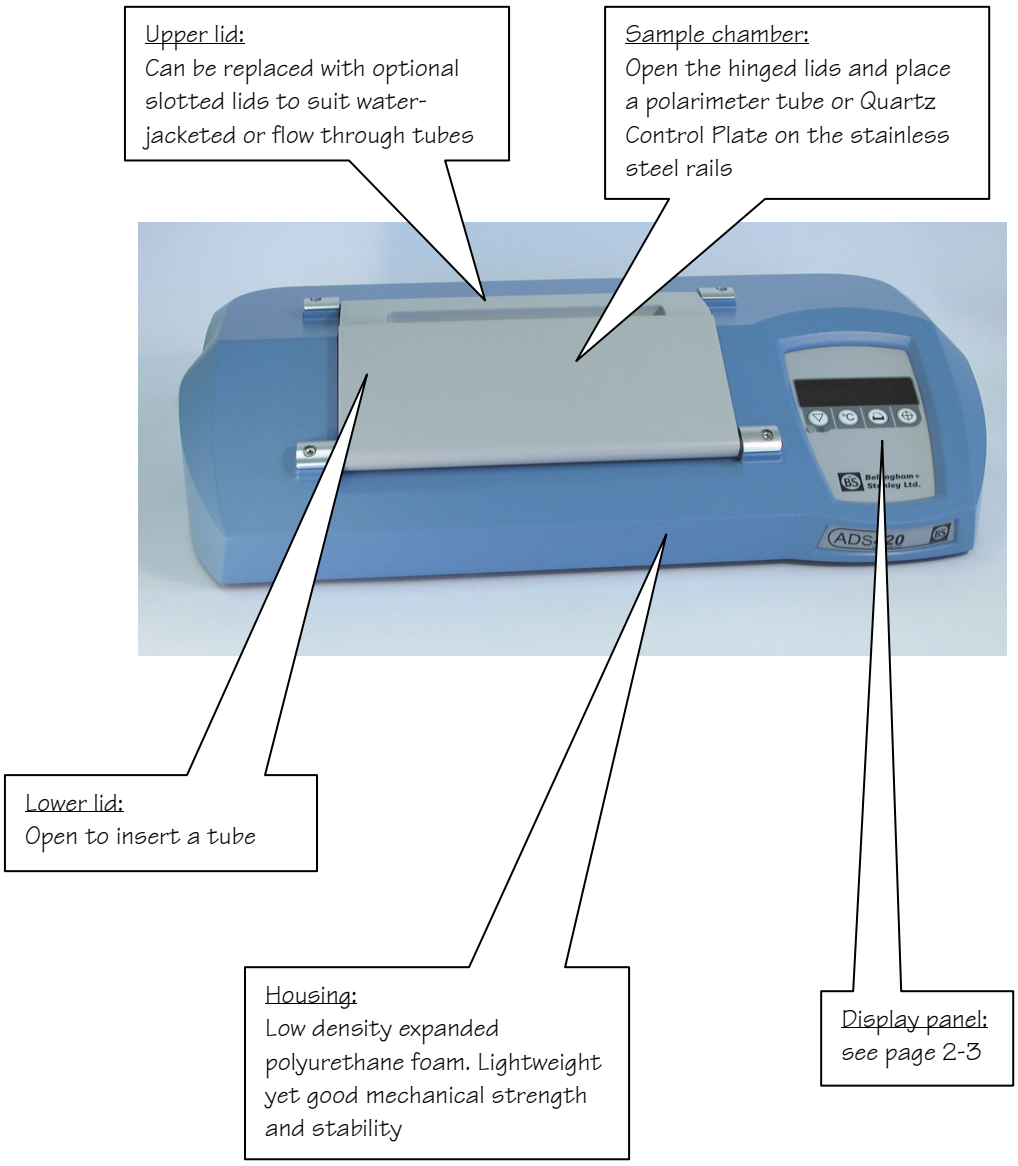
Instrument description

Instrument overview

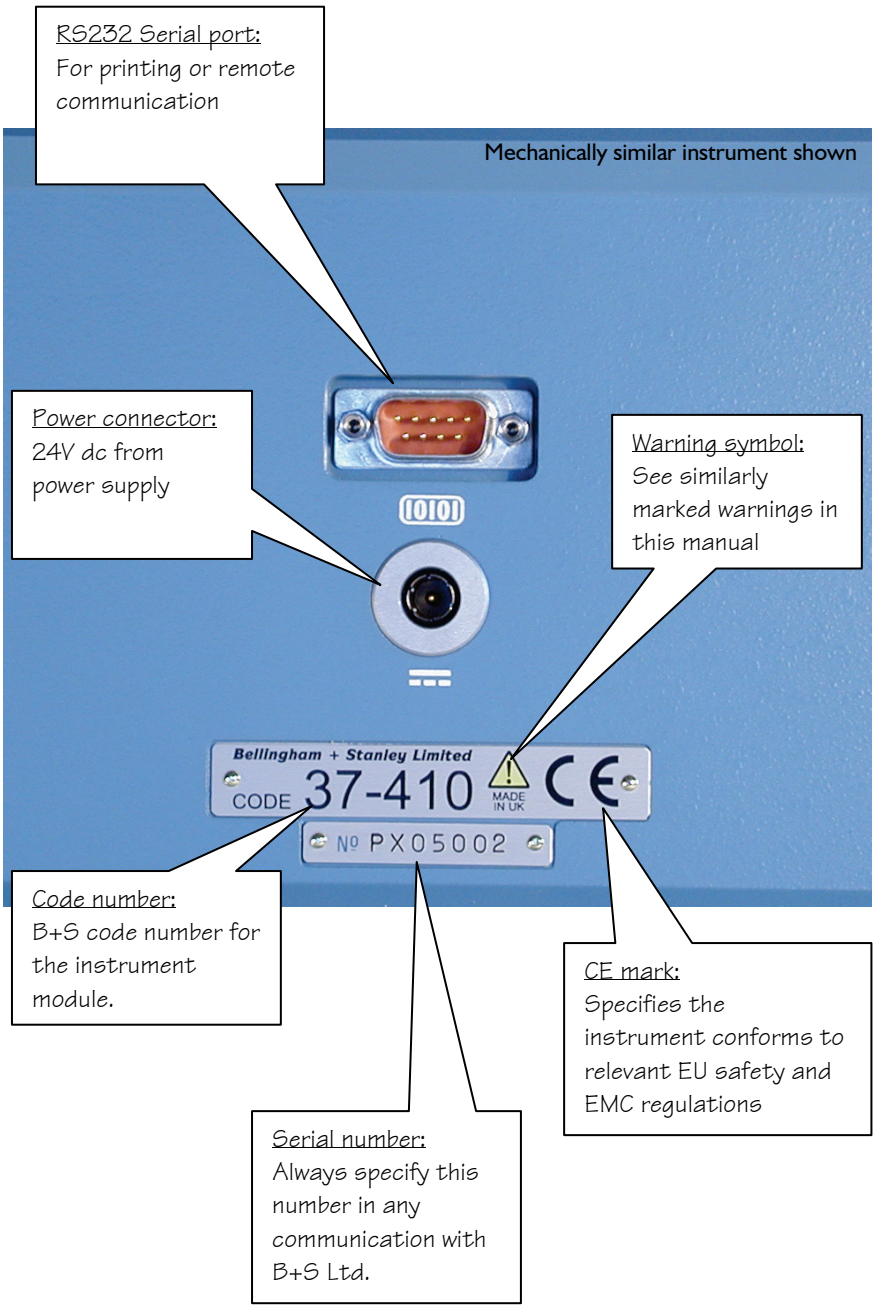
The saccharimeter

The ADS420 Saccharimeter is a self-contained, easy-to-use polarimeter suitable for measuring the rotation of optically active samples, which has been specifically designed for the sugar industry. The readings are displayed in °Z (International Sugar Scale) on a bright 7-segment LED display. The instrument is housed in a rigid polyurethane foam moulded case which is light in weight whilst being extremely rugged and has a high resistance to chemical attack from the majority of commonly used samples.

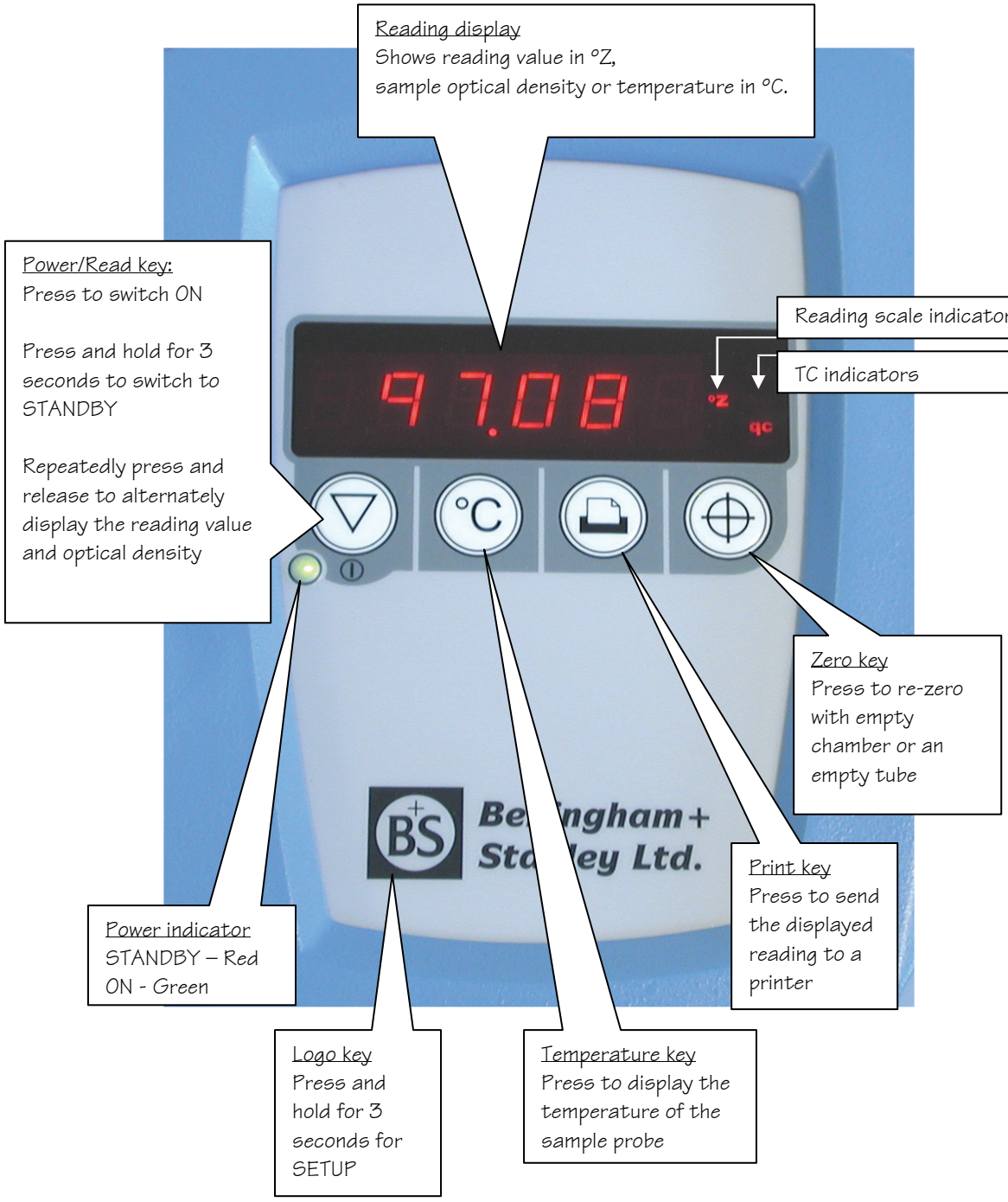
The instrument supplied within the 37-22 package has an upper slotted lid fitted as standard.



The services panel



The display panel



Basic operation

Switching on

Plug in the power supply and switch on the mains supply. The instrument will switch to standby mode with the power indicator showing red.

During the initialisation procedure, the instrument will automatically zero the reading so *it is essential that any polarimeter tubes and quartz control plates are removed from the chamber before switching on*.

To switch on, press and release the *Power/Read Key*

The *Power Indicator* will show green and the display will show a progress bar:

When the instrument has stabilised, it will set zero and display the reading:

Switching to standby

To switch to standby, press and hold down the *Power/Read Key* (for approximately 3 seconds) until the display blanks and the *Power Indicator* shows red.

Taking a reading

Fill the polarimeter tube with your sample. Gently rock the tube from end to end to ensure all air bubbles are released through the centre filling tube.

While the instrument is stabilising, the display will flash between

a progress bar and the reading value

After the instrument has stabilised, the reading value will be displayed continuously.
The display indicators will show:

°z Reading scale °z (International Sugar Z Scale)

The temperature compensation indicators will show:

nc No compensation
or sc Sugar compensation
or qc Quartz compensation

Flashing display

If the instrument has stabilised (no progress bar) but the reading continues to flash, then the sample is too optically dense to enable an accurate reading to be calculated, i.e. its optical density (OD) is greater than 3.

Blocked light path

If an article has been left in the chamber which totally blocks the light path, and the instrument is displaying either the reading or optical density (see below) the display will show:

Optical density

If the *Power/Read Key* is repeatedly pressed,

the display will alternately show the reading value

and the sample optical density (OD)

where:

$$OD = - Log_{10} (\% \text{ light transmission} / 100)$$

OD 0.0	=	100% light transmission,	no absorption in the sample
OD 1.0	=	10% light transmission,	90% absorption in the sample
OD 2.0	=	1% light transmission,	99% absorption in the sample
OD 3.0	=	0.1% light transmission,	99.9% absorption in the sample

If the optical density of the sample is greater than 3, the reading value will flash.

Measurement temperature

If the *Temperature Key* is pressed,

the display will show the temperature of the sample probe.

The display indicators will show:

°C Temperature °Celsius

If the probe is left in its cradle at the rear of the chamber, it will provide a measure of the general chamber temperature. Alternatively, it can be placed in the filling arm of a centre filling tube when it will measure the temperature of the sample itself.

Printing the reading

The data for the last reading taken can be sent via the RS232 Serial port to either a printer or computer terminal program in the following format:

```
ADS420 No.PX05000
Scale: 'z  TC: sc
  96.67 Ok 0.1od 25.8'C
  96.68 Ok 0.1od 25.8'C
  96.67 Ok 0.1od 25.8'C
  96.67 Ok 0.1od 25.7'C

ADS420 No.PX05000
Scale: 'z  TC: nc
  96.66 Ok 0.1od 25.7'C
  96.67 Ok 0.1od 25.7'C
  96.68 Ok 0.1od 25.7'C
```

e.g.:
`96.67 Ok 0.1od 25.8'C`

Reading =
`96.67`

Status =
`Ok` (reading stable)
`Un` (not yet stable)
`No` (light path blocked)

Optical Density =
`0.1od`

Temperature =
`25.7'C`

The printer or computer RS232 configuration should be set to:
9600 Baud, 8 bits, no parity

Typically, use interconnecting cable 54-07 to connect to a PC with a 9way D-type connector or 54-02 to connect to a serial printer with a 25way D-type connector. (These cables are available from Bellingham + Stanley. Some devices may require alternatives.)

Press the *Print Key*.

If a printer or computer is connected and the data is sent out successfully, the display will briefly show:

Then revert to the normal reading display.

If a device is not connected to the serial port or if it is not set to receive data (e.g. printer offline), then the display will show:

for 6 seconds then revert to the normal reading display.

The instrument has multiple print formats. The instrument will be supplied with the 24 column (shown above) selected. To change the format see page 2-10.

Zeroing the reading

The instrument should be zeroed often to ensure accurate readings. It is a quick and simple procedure so can easily be carried out before every measurement. There must be no sample present and so it can be done with an empty chamber or, if preferred, with the polarimeter tube that will be used to measure the sample. However, if a tube is used, it must be empty, perfectly clean and dry.

Ensure the chamber is empty or insert an empty tube in the chamber. Wait for the reading to stabilise.

Press the *Zero key*.

The display will show a zero reading:

Selecting the temperature compensation

The optical rotation of any sample will vary with change in its temperature. For sugar samples and quartz control plates, the reading can be automatically corrected by selecting temperature compensation. For further details, see '*Sampling techniques*' below.

Press the *Logo key* for approximately 3 seconds

until the display shows:

Repeatedly pressing the *Temperature key*:

will step the temperature compensation through nc, sc, qc

The temperature compensation indicators will show:

	nc	No compensation
or	sc	Sugar compensation
or	qc	Quartz compensation

Press the *Logo key* to return to the normal reading display.

Changing the printer format

The instrument is initially set up to print to a 24-column printer. Alternatively the instrument can be configured to print in the following formats.

Format	Description
	A standard 24 column printer
	A 24-column printer that automatically prints the date. This format is designed for use with printer B+S Code 55-17.
	The CSV format should be used if the instrument is to be connected to a LIMS.

To adjust the printer format press the *Logo key* for approximately 3 seconds

until the display shows: 

then repeatedly pressing the *Print Key*…

⇩

will change the print format.

When displaying the desired print format, wait 3 seconds to accept and return back to the setup menu.

Press the *Logo key* to return to the normal reading display.

CSV Format:

reading, status, scale, temperature compensation, OD, temperature[CR][LF]

Example:

```
0.00,Ok,'z,sc,0.0,28.1[CR][LF]
0.00,Ok,'z,sc,0.0,28.1[CR][LF]
97.49,Un,'z,sc,0.0,28.1[CR][LF]
97.49,Ok,'z,sc,0.0,28.1[CR][LF]
```

Setting the calibration

The ADS420 instrument has two calibration adjustments. As described above, Zero corrects the calibration for short-term minor variations. This should be carried out simply with an empty chamber or with an empty tube and so can be performed at regular intervals; even before every new sample measurement.

The instrument also has a calibration span facility which can be used to check and, if necessary, correct the high end of the reading range using a Quartz Control Plate, an accurately prepared sugar solution or other sample of known value.

Before checking or resetting the span calibration, ensure that the instrument readings are stable and that Zero has been correctly set. Select the appropriate temperature compensation for the span sample, e.g. qc for a quartz control plate (see '*Sampling techniques*' below for information).

Press the *Logo key* for approximately 3 seconds

until the display shows:

To cancel from any point in the following sequence and return to the Setup display, press the *Power/Read key*

To Span the instrument, press the *Zero key*:

The display will show

Press the *Zero key* to continue

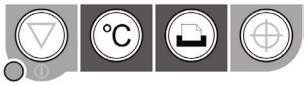
The last span value used will be displayed

If this value is correct, press the *Zero key* to accept it

The reading will be rescaled to the correct span value

Press the *Logo key* to return to the normal reading display.

If the value is not correct, press either
the *Temperature key* or the *Print* key to change it



The value will be displayed to the nearest 5°

Pressing the keys will have the following effect

▽	Cancel & return to Setup
°C	Decrease the value by 5
	Increase the value by 5
⊕	Select the displayed value to increase the resolution so that the value can be accurately trimmed

The selected value will be displayed to 0.01°

Pressing the keys will have the following effect

▽	Cancel & return to Setup
°C	Decrease the value by 0.01
	Increase the value by 0.01
⊕	Select the displayed value which will be used to calibrate the span reading

The reading will be rescaled to the selected span value

Press the *Logo key* to return to the normal reading display.

Remote operation

Operation of the ADS420 can be controlled remotely from a computer via the RS232 Serial port. The 54-07 interconnecting cable optionally available from Bellingham+Stanley will connect to the COM port of a typical PC. Use a proprietary terminal program or custom software to send commands and receive data.

The computer RS232 configuration should be set to:
9600 Baud, 8 bits, no parity

Action	Key	ASCII code	Typical output data format Each output data string is terminated by CR+LF (ASCII 13+10)
Request the current reading	'Return'	13	96.75 Ok 'z nc 0.1od 25.6'C
Request the current reading in CSV format	R	82	96.75,Ok,'z,nc,0.1,25.6
Request software type & version, instrument model and serial number	'Crtl'+R 2	18 50	37-604-01 ADS420 No.PX05000
Set TC to none	T 1	84 49	TC(1..3)=? TC: nc
Set TC to sugar	T 2	84 50	TC(1..3)=? TC: sc
Set TC to quartz	T 3	84 51	TC(1..3)=? TC: qc
Set Zero calibration	C Z	67 90	Calibrate(Z/S)=? Zeroed
Set Span calibration	C S <span value> <cr>	67 83	Calibrate(Z/S)=? Span Aim=? Spanned
Start a drift run	D <no of secs> <cr>	68	Driftrun, interval (secs)=? Reading, Status, Scale, TC, OD, Temp 97.06,Ok,'a,qc,0.1,25.3 97.06,Ok,'a,qc,0.1,25.3 97.06,Ok,'a,qc,0.1,25.3 97.06,Ok,'a,qc,0.1,25.3 97.06,Ok,'a,qc,0.1,25.3 97.06,Ok,'a,qc,0.1,25.3
End the drift run	Any key		Finished
Help	H	72	Serial Command Help . . . .

When the instrument receives a serial command, the display will show:

When the action has been completed and the data sent, the instrument will revert to the normal reading display.

RS232 serial port

The RS232 serial port can be via the 9 pin "D type" connector on the rear of the instrument. The interconnecting cable socket can be secured with the 2 screws but these must be finger-tightened only – *DO NOT OVER-TIGHTEN.*.

9 Pin "D type" plug connections

Pin No.	Function	Data direction
2	Received data	in
3	Transmitted data	out
4	DTR	In
5	Signal Ground	
6	DSR	Out

Sampling techniques

In order to achieve the maximum performance from the ADS420 Series Saccharimeter, it is essential that extreme care is taken with cleanliness of the instrument and the polarimeter tubes. Allow the instrument to stabilise for at least 30 minutes after switching on before taking accurate readings

Cleaning

Always empty and clean the polarimeter tube immediately after taking readings. Remove the cover glasses and thoroughly wash and dry both the tube and the glasses using an appropriate solvent (normally water with water based samples).

It is essential that the tube and glasses are scrupulously clean and there are no finger prints or marks on the glasses.

Wiping the tube and glasses occasionally with ethyl alcohol will remove any residue of oils left from the samples. *NEVER* use acetone, white spirit, or other aggressive solvents or any abrasive fluids on any painted surface or, particularly, the membrane keypad panel.

Filling the tube

The cover glasses must be directly in contact with the ends of the tube without any gasket material between them. The rubber washer must be placed between the end cap and the cover glass. The end caps should be lightly finger-tightened just enough to prevent leaking. Over tightening will stress the glass which will cause optical rotation and measurement errors. *DO NOT OVER-TIGHTEN.*

Centre bulb tube

Fit a cover glass to one end of the tube. Hold the tube vertically and completely fill the tube to its end. Slide the second glass onto the tube end and secure with the end cap. Hold the tube horizontally and rock to allow any bubble to enter the bulb so that it is not in the light path.

Centre filling tube and Centre filling tube with cup-shaped filler

Fit both cover glasses and, holding the tube horizontally, slowly fill the tube through the centre filler. Gently rock the tube to allow any bubbles to escape via the centre filler.

Funnel tube and Flow-through tube

These tubes are suitable when measuring a large number of similar samples. The current sample is flushed through and replaced by the new sample. The amount of sample required for this will depend on the type of sample and its viscosity and can be determined by experimentation. If there is to be an extended period before the next sample, the tube should be emptied, cleaned and dried.

Cover glass stress

As stated above, excessive tightening of an end cap can cause stresses in the cover glass which will cause optical rotation in the glass itself and so give a measurement error. The reading displayed will be a combination of the rotation of the sample and the rotation in the glass. Careful assembly of the tube should not cause a problem, however, any resultant rotation can be eliminated by first setting Zero on the assembled, empty tube. This can be done on all tube variants except for the 'Centre bulb' type.

The tube components must be thoroughly cleaned, dried and assembled. Place the tube on the rails in the sample chamber and wait for stabilisation. Press the *Zero key*. Fill the tube as described above without touching the end caps. The displayed rotation will then be strictly related to the sample itself.

Temperature compensation

The optical rotation of any sample will vary with change in its temperature. The amount of this change for a certain temperature variation will depend on the sample type and nominal rotation. Typically:

- a sugar solution with a rotation of 100°Z at 20°C will *decrease* to approximately 99.5°Z at 30°C
- a quartz control plate with a rotation of 100°Z at 20°C will *increase* to approximately 100.14°Z at 30°C

Therefore, it is necessary to maintain the sample at a constant temperature (usually 20°C) by using a water-jacketed tube or monitor the temperature of the sample and correct for the change.

Temperature compensation can be selected to suit either sugar solutions (sc) or quartz control plates (qc) which will correct the reading from the temperature of the temperature probe to 20°C. That is, it allows the saccharimeter to run at ambient temperature but produces readings as if the system was running at 20°C.

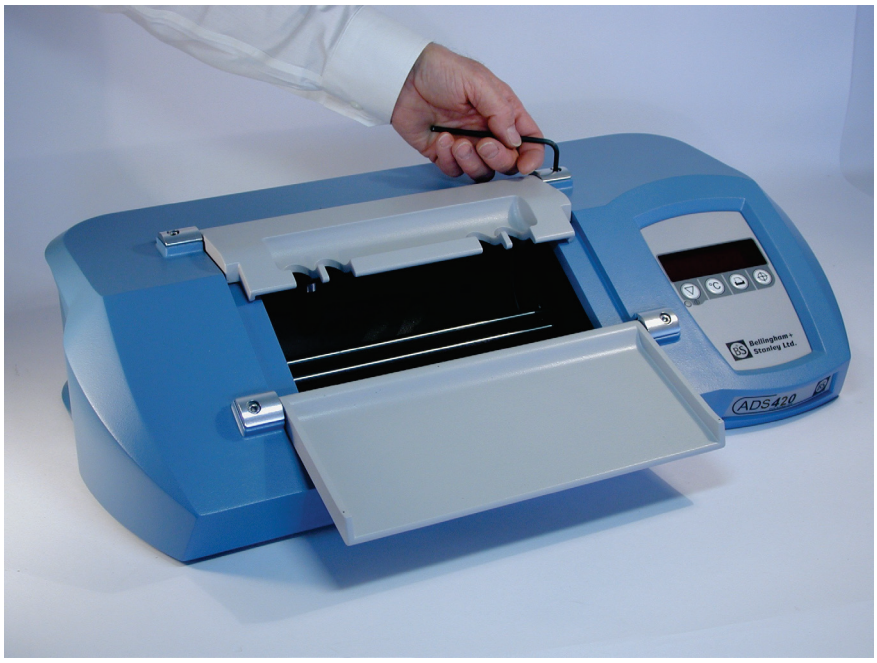
Temperature compensation will only be valid if the detected sample temperature is stable and the probe is at the same temperature as the sample and so sufficient time should be allowed for the sample to stabilise within the chamber. This will be simplified when using a centre filling tube by removing the temperature probe from its holder in the chamber and placing it in the tube centre arm so that it contacts the sample.

When using a B+S Quartz Control Plate, the temperature probe can be placed in a Thermal Block Assembly (code 34-241) which is then clipped to the body of the QCP.

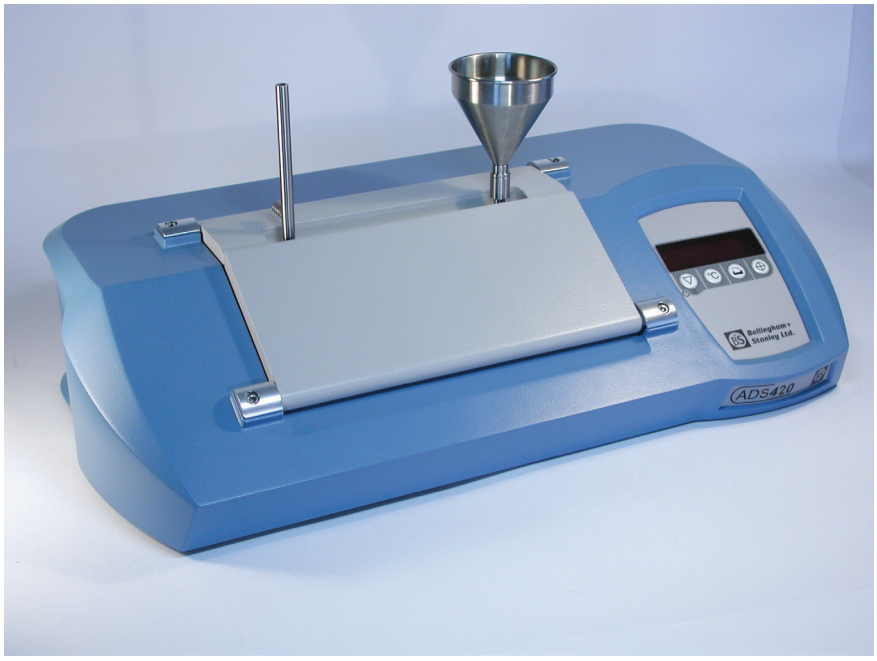
Flow-through and water-jacketed tubes

When using optional water-jacketed polarimeter tubes, the standard upper lid should be replaced with a slotted type, see '*Section 5, Accessories*'.

The instrument supplied within the 37-22 package has an upper slotted lid fitted as standard.



The upper lid can be easily removed by unscrewing the hinge block retaining screws using a standard 4mm Allen key.



The slots will allow the circulation hoses to exit the chamber and also ensure that funnel tubes are held in an upright position. It is important that any hoses connected to the tube must be sufficiently flexible not to pull the tube off of the rails. *It is essential that both tube support sleeves are firmly in contact with the rails whilst a measurement is taken*.

section 3

Information and error displays

Information displays

Progress bar showing the reading is stabilising (after initial stabilisation, will flash alternately with reading)

Normal reading display
Will flash if optical density is greater than 3

Light path blocked

Calibrate Span?
Press calibrate key to continue

Calibrating

Reading data being sent to serial port

Instrument being controlled remotely

Error displays

Error conditions are displayed with an error code as shown

Error code	Fault condition	Action
1	Printer not connected or off-line	Check printer is operational and connections correct
2	Non-volatile memory read error	Contact B+S Service department
4	Non-volatile memory save error	Contact B+S Service department

When contacting B+S Service Department, please have the following information ready:-

a. ADS420 serial number (on label at the rear of the instrument housing).
b. Software version (see below).
c. Error code.

Displaying the software version

To display the software version number, first switch the instrument off by removing the power connector from the rear of the instrument.

Press and whilst holding down the *Power/Read Key*, plug in the power connector.

The display will show typically:

Press any key and the display will show typically:

Press any key to switch to the standby mode.

37-601	would be the software code
01	would be the software version

Defaulting the instrument

To default the instrument settings to the factory set values , first switch the instrument off by removing the power connector from the rear of the instrument.

Press and whilst holding down the *Logo Key*, plug in the power connector.

The display will show:

Press the *Zero Key* to default (or any other key to cancel):

The display will show:

section 4

Specification

Specification

Performance

Scale	°z - ISS
Range	-225 to +225
Resolution	0.01
Accuracy (Sucrose solution @ 20°C) (±)	0.03
Maximum OD for accuracy	3

Polarimeter tube

Maximum tube length	220 mm
End cap collar diameter	30 mm

Temperature

Ambient operating range	5 to 40 °C
Storage	-5 to 60 °C

Temperature compensation

None	-
Sugar	5 to 40 °C
Quartz	5 to 40 °C

Light source

Light emitting diode with interference filter	589 nm
Beam diameter, maximum	4 mm

RS232 configuration

Baud rate	9600
Word length	8 bits
Parity	None

Physical

Length (saccharimeter module only)	615 mm
Width (saccharimeter module only)	340 mm
Height (saccharimeter module only)	150 mm
Weight (including power supply)	9 Kg

Power requirements

Voltage	110 to 230 V~ ±10%
Frequency	50 to 60 Hz
Maximum current	40 mA

section 5

Spares and accessories

Spares and accessories

Printers		Code
Dot matrix impact printer serial: Euro version 230V		55-14
Dot matrix impact printer serial: US version 110V		55-15
Dot matrix impact printer serial: UK version 230V		55-16
See Spares below for printer spare parts		

Interconnecting cables		Code
Printer, BS1012 (25way D type)		54-02
Computer (9way D type)		54-07

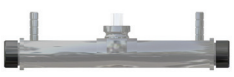
Quartz Control Plates		Code
Quartz Control Plate nominal 100°Z (34.6°Angular)		34-20
Quartz Control Plate nominal 15°Z (5.2°Angular)		34-21
QCP UKAS certificate of calibration traceable to PTB		90-803
Thermal Block Assembly		34-241

Instruction manuals		Code
English		37-262
French		37-263
Spanish		37-264
German		37-265
Brazilian		37-266

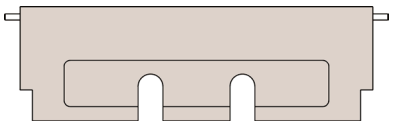
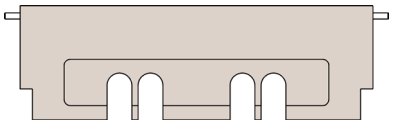
Spares		Code
Paper for dot matrix impact printers	Quantity: 20	55-91
Printer ribbon for dot matrix impact printers		55-93
Low strain cover glasses 15.5mm diameter.	Quantity: 12	35-60
Rubber washers for use between cover glass and end cap.	Quantity: 12	36-64
End caps, plastic.	Quantity: 2	35-68
Low volume tube spares *(tubes 35-71 to 35-78 only)*		
Temperature sensor clip for low volume tubes		35-79
Low volume tube cover glasses	Quantity: 6	35-80
Low volume tube sealing washers for use between cover glass and end cap.	Quantity: 10	35-81

Power supplies	Code
Power supply (unsealed) 110-230V	55-105
Mains lead for 55-105 with plug suitable for:	
United Kingdom	61-191
Euro (Schuko)	61-193
United States	61-192
Switzerland	61-181
Denmark	61-182
India / South Africa	61-188
Australia	61-189
No plug – open lead	61-190
Power supply (waterproof): 110-230V without mains plug	55-250

Polarimeter tubes

Type	* Code no. shown	Length	Slotted upper lid	Code no.
Standard glass sample tube with bulb to clear bubble from field of view		100 200	Not required	35-29 * 35-30
Centre filling glass tube with straight central arm for filling from funnel or flexible tube		100 200	Not required	35-46 35-47 *
Centre filling glass tube with cup-shaped centre filler to reduce risk of spillage		100 200	Not required	35-57 35-58 *
Low volume continuous flow-through tube		5 10 25 50	37-010	35-74 35-73 35-72 35-71 *
Low volume continuous flow-through tube with water jacket for temperature control		25 50	37-012	35-75 35-76 *
Low volume continuous flow-through tube for highly acidic samples		25 50	37-010	35-77 35-78 *
Funnel flow-through tube with water jacket for temperature control		100 200	37-012 37-011	36-57 36-58 *
Large Funnel flow-through tube with water jacket for temperature control		200	37-011	36-59 *
Continuous flow-through tube with water jacket for temperature control		100 200	37-012 37-011	36-67 36-68 *
Centre-Fill tube with water jacket for temperature control		100 200	37-010 37-009	36-77 36-78 *

Upper lids

Type		Code no.
No slots (as supplied)		37-008
2 slots		37-009
2 slots		37-010
4 slots		37-011
4 slots		37-012