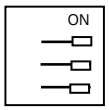
NEWALL NEWALL MEASUREMENT SYSTEMS LTD

SA100 & SA100-R Digital Readout Display

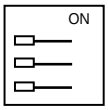
Contents

1.0 TECHNICAL SPECIFICATION

Construction:	1.5mmn sheet metal	
Dimensions:		
Height	72mm	(2.835")
Width	144mm	(5.878")
Depth	70mm	(2.756")
Weight	0.487Kg	(1.07lbs)
Operating Voltage:	12 - 27 VDC ±10%	
Supply Voltage Fluctuation:	Within operating voltage range	
Maximum Power Consumption:	6 watts	
Operating Temperature:	0 to 45°C	
Storage Temperature:	-20 to 60°C	
Inputs:	Single channel quadrature	
Input Configuration:	(See DIP switches on rear of DRO)	



Differential Encoder Input (A, /A, B, /B, RM, /RM)



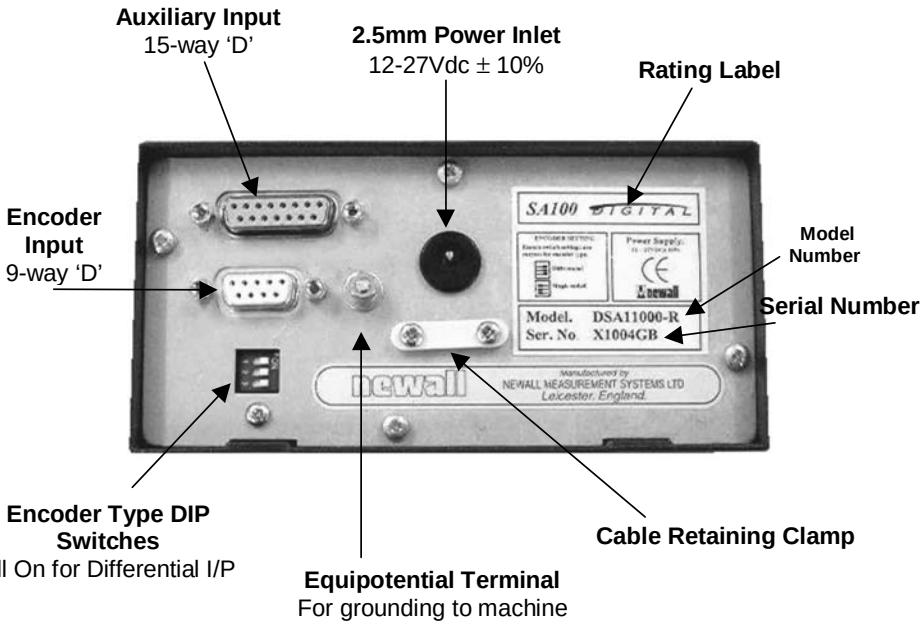
Single Ended Encoder Input (A, B, RM)

Environmental Conditions:	Indoor use, IP20 Pollution degree 2 in accordance with IEC664
Relative Humidity:	Maximum 80% for temperatures up to 31°C Decreasing linearly to 33% at 45°C
EMC Compliance:	BS EN 50081-2 Electromagnetic Compatibility Generic Emission Standard - Industrial Environment
	BS EN 50082-2 Electromagnetic Compatibility Generic Immunity Standard - Industrial Environment

Certificate No FM36096

NEWALL MEASUREMENT SYSTEMS LIMITED RESERVES THE RIGHT TO CHANGE THE SPECIFICATION WITHOUT NOTICE

2.0 CONNECTION



INPUTS

Encoder Input (9-way D)	
Pin No.	**Function**
1	N/C (or 0V)
2	Channel A
3	Channel /A
4	Channel B
5	Channel /B
6	0V
7	+5V
8	Channel RM
9	Channel /RM

Auxiliary Input (15-way D)	
Pin No.	**Function**
1	Reserved
2	0V
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	+5V DC
8	+5V DC
9	0V
10	Reserved
11	Reserved
12	Remote Index
13	Reserved
14	Reserved
15	0V

WARNING! DO NOT CONNECT THE UNIT DIRECTLY TO THE MAINS POWER SUPPLY.

NOTES

Note: *For implementation of the remote Index facility and Auxiliary options see Section 7.0*

Model number DSA11000 denotes the unit to be for linear measurement and display.

Model number DSA11000-R denotes the unit to be for Rotary measurement and display.

An optional, external, power supply unit is available. Please contact your distributor for details.

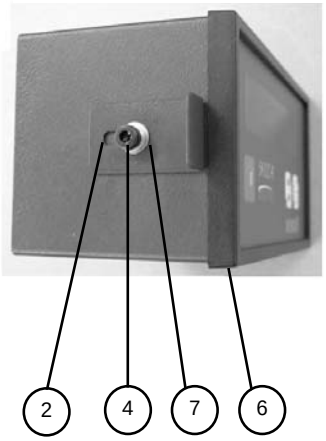
3.0 INSTALLATION

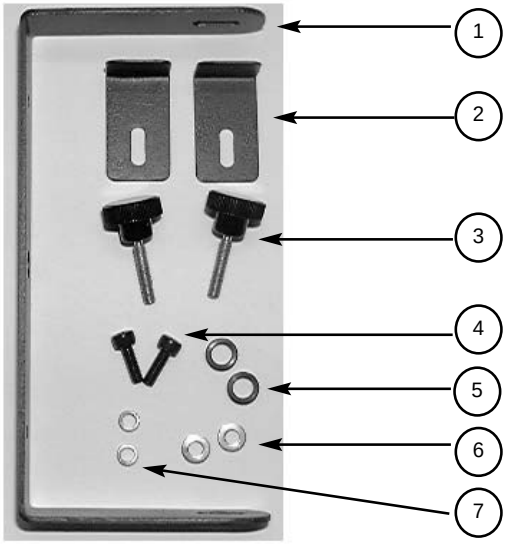
NOTES

An opional installation kit allowing for either desk, or panel mounting is available. (Part Number: DSAKIT)

Desktop or support mounting arm

Panel Mounting





ITEM	DESCRIPTION	QTY
7	M4 S/C SPRING WASHER	2
6	M4 FLAT WASHER	2
5	SPACE WASHER	2
4	M4X12 CAP HD SCREW	2
3	KNOB	2
2	BRACKET	2
1	BRACKET	1

4.0 INTRODUCTION

NOTES

The **SA100** range of digital readouts, DRO, offers the very best in functional versatility backed by Newall's famous robustness and quality guarantee.

Two versions are available:

- The **SA100 Digital** for applications where a linear displacement is to be measured.
- The **SA100-R Digital**. This DRO offers a range of functions specifically targeted at rotary applications, be they measured by a shaft encoder or a radius tape.

Please ensure that you have the correct SA100 Digital model for your application.

This manual covers both versions of the **SA100**. Please refer to the relevant section for details of operation.

4.1 NORMAL OPERATION

NOTES

SA100

1. [abs inc] Pressing **[abs/inc]** key toggles between absolute and incremental mode. LED's on the **[abs/inc]** key indicate current operating mode.

2. [in mm] Pressing **[in/mm]** key toggles between inch and millimetre mode. LED's on the **[in/mm]** key indicate current operating mode.

3. [0] Pressing this key zeroes the current absolute or incremental position, as indicated by the LED's on the **[abs/inc]** key.

4. ***Reference*** To find a scale reference marker press the **[0]** key and, whilst held, press the **[abs/inc]** key.

[0] + [abs inc]

*The keypads on the **SA100** and **SA100-R** are specifically targeted at either Linear or Rotary applications.*

SA100-R

1. [abs inc] Pressing **[abs/inc]** key toggles between absolute and incremental mode. LED's on the **[abs/inc]** key indicate current operating mode.

2. [⇚] **A) Rollover (± 360°)**
Pressing the **[angle]** key toggles between positive and negative arcs. The LED's on the **[angle]** key indicates the current operating mode.

[⇚] = ***[angle]*** *key*

e.g. **Positive angle = (Negative angle + 360°)**

i.e. +270° ≡ -90°

See configuration of ANGLE *in Set-Up for detailed information on Rollover and continuous operating modes.*

B) Continuous count (±)
Pressing the **[angle]** key toggles between the continuous measured count and the radial, arc, position. i.e. the continuous measured position minus the number of whole 360° rotations. The LED's on the **[angle]** key indicates the current operating mode.

[⇚•] = *Continuous mode*

e.g. **Continuous measured angle = 973°**

i.e. **Radial angle = 973° - (2 x 360°) = 253°**

[⇚•] = *Radial mode*

3. [0°] Pressing this key zeroes the current absolute or incremental position, as indicated by the LED's on the **[abs/inc]** key..

4. ***Reference*** To find a scale reference marker depress the **[0°]** key and, whilst held, press the **[abs/inc]** key.

[0] + [abs inc]

See over page for detailed instructions on using the reference function.

4.2 REFERENCE OPERATION

Note: This function only works with encoders that provide an index marker output signal. However an externally generated reference (e.g. a limit switch) can also be used. Please refer to APPENDIX A for more details.

This feature allows for any given axes to be referenced to a datum position. The index marker pulse, from the encoder, is used to generate a signal that informs the DRO that the reader head has reached its datum position. Index pulses generally appear in one of two forms depending on the type of encoder connected. These can either be periodic, say 20mm, or single action. Generally, when a scale has a single action index marker this is located at the centre of travel.

1. Enter Reference mode using the **[0]** + **[abs/inc]** key combination.

2. The display will show '`REF  `'.
   The **SA100** will continue to show this until a reference marker is found **or** the referencing operation is aborted using the **[in/mm]** key.

A) For Periodic Index pulses

Position the encoder such that it lies between the datum index marker and the next index marker position. (Say, within +/-15mm for a 20mm index period).

3. Move the axis towards the datum index position. Once the index marker has been triggered the axis will start to count. The axis position is now referenced to that datum position. Both absolute and incremental axis values will be loaded with the value assigned to `REF LOAD` during Set-Up. This value may be positive, negative or zero.

B) For Single Shot Index marker

3. Move the axis towards the datum index position. Once the index pulse has been triggered the axis will start to count. The axis position is now referenced to that datum position. Both absolute and incremental axis values will be loaded with the value assigned to `REF LOAD` during Set-Up. This value may be positive, negative or zero.

Note 1: The axis will start to count from the value defined in Set-Up for '`REF LOAD`'.

Note 2: Refer to the encoder manual for specification information relating to its Index marker(s).

Note: 3 If the operation is aborted the axis position (absolute or incremental) will be zeroed. i.e. any previous position information will be lost.

NOTES

! Note.
The reference function works the same way on both the SA100 and SA100-R units.

*On the SA100-R the **[angle]** key replaces the **[in/mm]** key.*

Tip:
Mark the datum position on the machine bed to allow for this position to be located quickly.

Tip:
For best accuracy, always reference by approaching the index marker in the same direction.

4.3 EDITING A FLOATING POINT VALUE

On entry into a parameter edit mode (by the **[abs/inc]** key) the existing parameter value is displayed. A cursor is shown either as a flashing **'_',** (underscore), if the digit position is blank or as a flashing version of the digit at the current position.

The three **SA100** keys are used to edit a value as follows:

SA100	SA100-R	Description
[0]	**[0°]**	Used as "ENTER" when the required value has been keyed in.
[abs/inc]	**[abs/inc]**	Used to scroll the digit at the current position through the values: -, 0, 1...9
[in/mm]	**[angle]**	Used to move the cursor through the numeric digits to be edited.

NOTES

! Note.
This facility is only used to enter numerical values during Set-Up.

*Only a digit position which is currently blank and proceeds a numeric digit can have a **'-'**, minus, sign inserted by use of the **[abs/inc]** key*

5.0 SA100 Digital LINEAR DIGITAL READOUT

5.1 SET-UP MODE SA100 (Linear)

Entry into Set-Up mode is achieved by holding down the **[abs/inc]** key during normal operation and then pressing the **[in/mm]** key momentarily.

Once in SET-UP mode the following menu items are accessible:

To move through the available Set-Up options press the **[in/mm]** key.

SET-UP	Press the **[0]** key to save changes and exit Set-Up
AR	Axis resolution Toggle through available options using the **[abs/inc]** key
DR	Display resolution (mm) Toggle through available options using **[abs/inc]** key
DIR	Direction (0 or 1) Toggle using **[abs/inc]** key to change sense of direction
FEN	Fail Enable (ON or OFF) Toggle using **[abs/inc]** key (OFF = Ignore, ON = Sensor fail detected)
REF LOAD	Axis Load value used during referencing operation. Pressing **[abs/inc]** key allows editing.
LIN ERR	Linear Error Comp (0.900000 to 1.100000). Pressing **[abs/inc]** key allows editing.
SF	Scale Factor (0.001 to 99999.999). Pressing **[abs/inc]** key allows editing.
SFT	Scale Factor Type (0 or 1) Toggle using **[abs/inc]** key (0 = Multiply, 1 = Divide)

When the parameters have been configured, return to the SET-UP menu item and press **[0]** to return to normal operation mode.

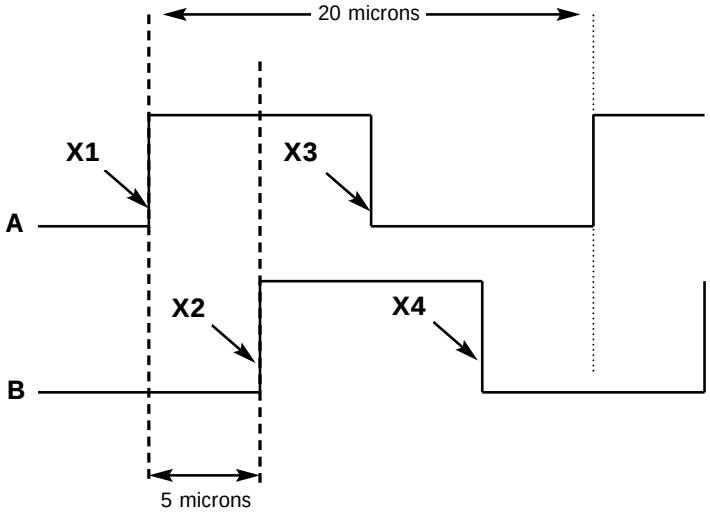
NOTES

*'**Tip**.*
*Check that the **[in/mm]** keys LED's are in the desired mode prior to entering Set-Up. The unit of measurement (inch or mm) used during Set-Up is defined by the current operating display mode.*

5.2 AR - AXIS RESOLUTION

Axis resolution is the distance moved between successive encoder output edges.

Example:
A 5-micron resolution would be derived from an encoder having a 20-micron period. i.e. a times four multiplier will be applied.



Procedure:

- From Set-Up select 'AR'.
- Use the **[abs/inc]** key to toggle through the available axis resolutions.

5.3 DR - DISPLAYED RESOLUTION

The displayed resolution does not have to coincide with the selected Axis Resolution. It can not however be selected to be of a higher resolution than that defined for Axis Resolution.

Procedure:

- From Set-Up select 'DR'.
- Use the **[abs/inc]** key to toggle through the available display resolutions.

Example:
If the Axis Resolution is set to 1 micron.

Using the **[abs/inc]** key to toggles through 0.001, 0.002, 0.005 and 0.01. Consequently, the displayed resolution can be selected to be 1, 2, 5 or 10 microns.

NOTES

Tip.
*The status of the **[in/mm]** key on entry in to Set-Up determines the mode of data entry, Inch or mm.*

5.4 DIR - DIRECTION

NOTES

Direction allows the operator to change the positive direction of travel of the reader head.

Procedure:

- From Set-Up select 'DIR'.
- Use the **[abs/inc]** key to toggle the setting value between 0 and 1.

Example:

If the current setting is **0** and the travel is positive from right to left then changing the setting to **1** will reverse the direction to measure positive from left to right.

5.5 FEN - HEAD FAIL DETECTION

! Note.
*Please check encoder specification for information on the synchronisation of the index marker pulse. If the encoder is capable of generating the illegal condition (A low, B low and RM high) then the automatic head failure detection should be **TURNED OFF**.*

The **SA100** has the facility to detect if the attached encoder has become disconnected, sustained severe cable damage or with some encoders, electronic failure.

Mode of Operation
The detection mechanism monitors the incoming signals from the encoder to look for an illegal combination of input levels.

A	B	RM	Status
L	L	H	SIG FAIL
L	H	X	OK
H	L	X	OK
X	X	L	OK

X = don't care state i.e. can be either High (H) or Low (L).

! Note.
*The reference function can still be implemented even with the head fail detect capability turned **OFF***

If the signal fails or the encoder becomes disconnected, then the illegal input combination is generated internally within the **SA100**. The display will then show 'SIG FAIL'. If you are able to correct the fault then pressing the **[0]** key will reset the display. If the 'SIG FAIL' message continues to be displayed after pressing the **[0]** key then the fault has not been corrected.

Disabling the Head Failure Detection
Procedure:

- From Set-Up select 'FEN'.
- Use the **[abs/inc]** key to toggle the setting value between **OFF** (disable) and **ON** (enable).

5.6 REF LOAD - REFERENCE LOAD

NOTES

This function allows for a pre-programmed value to be loaded into the axis counter, as a start value, when the '**Reference**' function is implemented.

Procedure:

- From Set-Up select 'REF LOAD'.
- Use the **[abs/inc]** and **[in/mm]** keys to enter the desired Reference load value, as described earlier.

Example:

The **SA100** is configured with a 1m travel, linear scale with a single reference, index, marker located at its centre. The operator wishes to set the datum, zero point, to the leftmost end of the scale.

The 'DIR' value in Set-Up would also need to be set to give a +ve direction for left to right movement, in this example.

Scale length = 1000mm

Index marker located mid scale = 500mm

Hence, REF LOAD = 500

5.7 LIN ERR - LINEAR ERROR COMPENSATION

NOTES

Linear Error Compensation allows the operator to apply a constant correction factor to the axis measurement before it is displayed. Linear error may occur if the axis of the machine is not perfectly parallel to the scale (cosine error) or if the machine is moving in an arc (Abbè errors). The cause of this may be:

- Machine wear
- Deflection of the machine due to an uneven weight
- Misalignment of the scale due to poor installation

! Note.
The further away the scale is mounted from the centre line of the workpiece, the greater is the potential for linear errors to occur.

The Linear Error Compensation Factor is expressed as a multiplier, (0.900000 to 1.100000), that is applied to the measured distance prior being displayed. A factor of 1.000000 indicates that no compensation is being applied.

i.e. **Measured distance x 1.000000 = Measured distance**

In order to calculate the required Compensation Factor, from normal operation with no compensation applied:

Procedure:

- Move the machine to the zero position of the standard against which the axis is to be compared.
- Zero the display using the **[0]** key.
- Move the machine a known distance as defined by the standard and record the measured distance as displayed on the **SA100**.
- Calculate the Compensation Factor using:

$$\textbf{Compensation Factor} = \frac{\textbf{True or standard distance moved}}{\textbf{Measured Distance}}$$

! Note.
All measurements will be adjusted, multiplied, according to the Compensation Factor entered. To disable this facility enter a Linear Error Compensation Factor of 1.000000

- Enter Set-Up and select 'LIN ERR'
- Enter the calculated Compensation Factor as described previously

5.8 SF & SFT - SCALE FACTOR

NOTES

Ignoring all offsets and rounding to display resolution, the displayed value on the **SA100** (millimetre mode) is a result of the following calculation:

If SFT (Scale Factor Type) = 0

DISTANCE = EDGE_COUNT * AXIS_RESOLUTION * LINEAR_COMP * SCALE_FACTOR

If SFT (Scale Factor Type) = 1

DISTANCE = EDGE_COUNT * AXIS_RESOLUTION * LINEAR_COMP / SCALE_FACTOR

Where:

EDGE_COUNT = number of edges from encoder from zero position

AXIS_RESOLUTION = 0.0001, 0.0002, 0.0005, 0.001, 0.002, 0.005 or 0.01 mm

LINEAR_COMP = error compensation factor in range 0.900000 to 1.100000 (Default = 1.000000)

SCALE_FACTOR = 0.001 to 99999.999 (Default = 1.000)

! Note.
In inch mode DISTANCE is further divided by 25.4 as there are exactly 25.4mm to one Inch.

Example:

A linear encoder is connected to a RAM that is being used to pump measured amounts of a fluid. The diameter of the RAM is 10cm and the display is required to show how many litres of fluid are being displaced for a given stroke.

! Important
*For this example, the display is only valid if it remains in **mm** mode. If switched to Inch mode the value displayed will be meaningless!*

Working in mm mode:

Volume displaced (mm^3) = $\frac{\pi \times D^2 \times \text{Stroke}}{4}$

Where:
$\pi = 3.14159$
D is the RAM diameter in mm Stroke is in mm

Recalling that there are $1000cm^3$, ($\equiv 1{,}000{,}000mm^3$), in 1 litre (SI definition) gives:-

Scale Factor (to show Litres) = $\frac{\pi \times D^2 \times \text{Stroke}}{4 \times 1{,}000{,}000}$ $\frac{\pi \times 10{,}000}{4{,}000{,}000}$

Scale Factor (to show Litres) = **0.00785**

This is very small and close to the 3dp limit for an applied Scale Factor. Consequently, instead of multiplying by such a small factor we can divide by its inverse.

! Note:
*SF entry is limited to **3 decimal places** and as such any value must be rounded accordingly.*

Scale Factor (to show Litres) = $\frac{1}{0.00785}$ = **127.324**

The Scale Factor Type (SFT) is **1** as the value calculated is to act as a divisor.

i.e. The display will show **(S / 127.324)** (where S = measured distance/stroke in mm)

6.0 SA100- R Digital ROTARY DIGITAL READOUT

6.1 SET-UP MODE SA100-R (Rotary)

Entry into Set-Up mode is achieved by holding down the **[abs/inc]** key during normal operation and then pressing the **[angle]** key momentarily.

Once in SET-UP mode the following menu items are accessible:

To move through the available Set-Up options press the **[angle]** key.

SET UP-R	Press the **[0°]** key to save changes and exit Set-Up.
TYP	Alter using **[abs/inc]** key to select between **AUTO, TAPE or ROTY**
CONFIG	Used self calibrate system and automatically set some system parameters. Only appears for type **AUTO**
AR	Axis resolution (mm). Only appears for type **TAPE** Toggle through options (0.0001 through 0.01) using **[abs/inc]** key.
CPR	Counts per revolution. Only appears for type **ROTY** Pressing **[abs/inc]** key allows editing.
DR	Display resolution in decimal places. Toggle through options (0.0001 through 0.01)) using **[abs/inc]** key.
DIR	Direction (0 or 1). Toggle using **[abs/inc]** key to change sense of direction.
FEN	Fail Enable (**ON** or **OFF**). Toggle using **[abs/inc]** key (**OFF** = Ignore, **ON** = Sensor fail detected).
REF LOAD	Axis Load value used during REF operation. Pressing **[abs/inc]** key allows editing.
ANGLE	Set mode of display (**CT** or **RL**) Toggle using **[abs/inc]** key (**CT** - Continuous, **RL** = ±360° Rollover)
DISP	Set unit mode of display (-.-.- or DEC). Toggle using **[abs/inc]** key (DEC = Decimal Degrees, -.-.-DMS).
RADIUS	Load value (mm) used in calculation of angle when in angle mode. Pressing **[abs/inc]** key allows editing. Only appears for type tape
ANG ERR	Angular Error Comp (0.900000 to 1.100000). Pressing **[abs/inc]** key allows editing. Only appears for type tape
G RATIO	Gear Ratio (0.001 to 99999.999). Only appears for type **ROTY** Pressing **[abs/inc]** key allows editing

NOTES

! Note.
All displacement measurements are in metric (mm).

Tip.
If the output rate of the encoder is unknown or has complex gearing select AUTO *. This will enable the automated calibration software routines.*

Menu structure shown in Figure 1, over page.

! Note.
When the parameters have been configured, return to the SET-UP-R *menu item and press **[0°]** to return to normal operation mode.*

6.2 SET-UP MENU STRUCTURE SA100-R

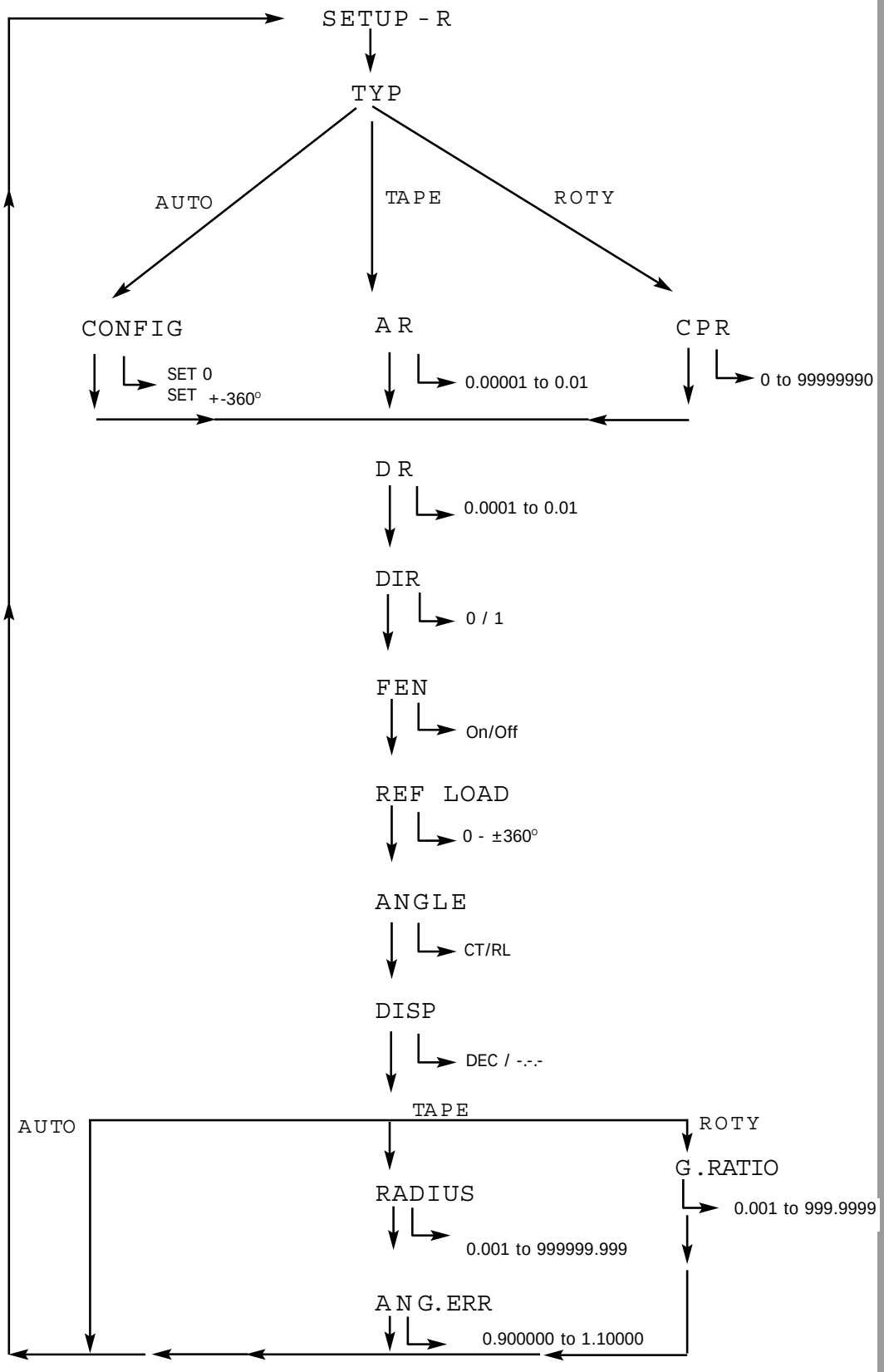


Figure 1. Set-Up Menu Structure

NOTES

! Note.
Depending on the selections for `TYPE` *the structure of the menu varies*

These menu items are common to all 3 types ***AUTO,TAPE & ROTY***

6.3 CONFIG - AUTOMATIC CALIBRATION

NOTES

This feature allows systems to be configured even when fundamental elements of the system are unknown.

CONFIG will automatically allow for systems where:

- Axis resolution
- Rotary of angular movement
- Counts per revolution
- Gearing
- Table radius

...are unknown, to be accurately configured.

This procedure effectively calculates a multiplier to be applied to the counts, measured during the movement through the standard angle, such that the displayed angle is exactly that of the standard.

Procedure:

- From 'TYPE ' select 'AUTO'
- Display will show ' CONFIG'
- Press the **[abs/inc]** key to enter automated calibration
- Display will show ' SET 0'.
- Move the rotary table to a datum, position.
- Press any key
- The display will change to 'ANGLE
- Press any key to edit the default value of 90 degrees, [0] to enter)
- Move the rotary table a known, standard, angle (e.g. 90°)
- This display will show (e.g.) **'SET 90'**
- Press any key
- The display will show either **'CAL PASS'** or **'CAL FAIL'**
- Press any key
- This display will return to '**CONFIG'**
- If calibration was succesful move onto the next item **'DR'** using the **[angle]** key to repeat the **'CONFIG'** process using **[abs/inc]** key.

! Note.
This function works for both angular and rotary encoder types and recommended where complex gearing may be involved.

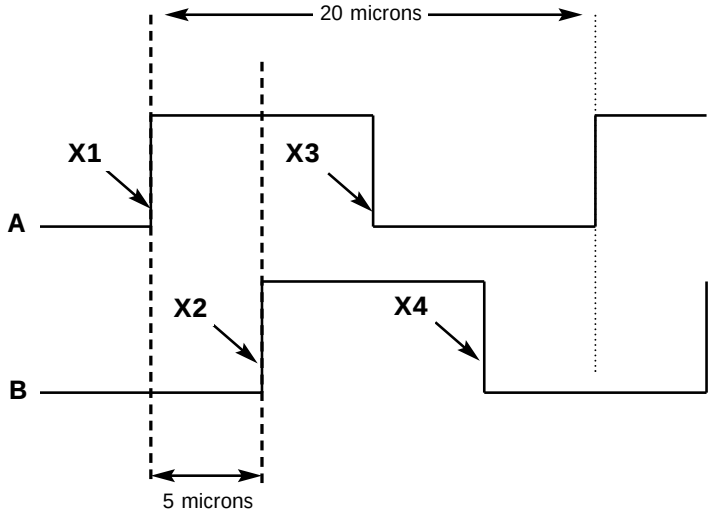
The automatic calibration procedure is now complete. Set the remaining user parameters as defined in the menu structure.

6.4 AR - AXIS RESOLUTION

NOTES

Axis resolution is the distance moved between successive encoder output edges.

Example:
A 5-micron resolution would be derived from an encoder having a 20-micron period. i.e. a 4 times four multiplier will be applied.



! Note.
AR is only required during manual configuration of a non-rotary encoder.

! Note.
All Newall Digital DRO cabinets apply a x4 multiplier by default.

Procedure:

- From Set-Up select 'AR'.
- Use the **[abs/inc]** key to toggle through the available axis resolutions.

6.5 DR - DISPLAYED RESOLUTION

The setting defines the decimal places to which an angular position is displayed.

Procedure:

- From Set-Up select 'DR'.
- Use the **[abs/inc]** key to toggle through the options (0.0001 through to 0.01)

When in DMS display mode (see DISP) a decimal point is used to separate the Degrees from the Minutes from the seconds.

Example 1: Decimal Degrees
The DR setting defines the decimal places and rounding to which the angular position will be displayed if decimal degrees are being displayed

e.g. DR =0.002 True angle = 247.3477

Displayed value = 247.348

Note: If **DEGREES . MINUTES . SECONDS** are being displayed then no rounding occurs.

6.6 DIR - DIRECTION

NOTES

Direction allows the operator to change the positive direction of travel of the reader head.

Procedure:

- From Set-Up select 'DIR'.
- Use the **[abs/inc]** key to toggle the setting value between 0 and 1.

Example:

If the current setting is 0 and the travel is clockwise from right to left then changing the setting to 1 will reverse the direction to measure clockwise from left to right.

6.7 FEN - HEAD FAIL DETECTION

*Please check encoder specification for information on the synchronisation of the index marker pulse. If the encoder is capable of generating the illegal condition (A low, B low and RM high) then the automatic head failure detection should be **TURNED OFF**.*

The **SA100-R** has the facility to detect if the attached encoder has become disconnected, sustained severe cable damage or with some encoders, electronic failure.

Mode of Operation
The detection mechanism monitors the incoming signals from the encoder to look for an illegal combination of input levels.

A	B	RM	STATUS
L	L	H	SIG FAIL
L	H	X	OK
H	L	X	OK
X	X	L	OK

X = don't care state i.e. can be either High (H) or Low (L).

! Note.
The reference function can still be implemented even with the head fail detect capability turned OFF.

If the signal fails or the encoder becomes disconnected, then the illegal input combination is generated internally within the **SA100**. The display will then show 'SIG FAIL'. If you are able to correct the fault then pressing the **[0]** key will reset the display. If the 'SIG FAIL' message continues to be displayed after pressing the **[0]** key then the fault has not been corrected.

Disabling the Head Failure Detection

Procedure:

- From Set-Up select 'FEN'.
- Use the **[abs/inc]** key to toggle the setting value between OFF (disable) and ON (enable).

6.8 REF LOAD - REFERENCE LOAD

NOTES

This function allows for a pre-programmed value to be loaded into the axis counter, as a start value, when the '**Reference**' function is implemented.

Procedure:

- From Set-Up select '`REF LOAD`'
- Use the **[abs/inc]** and **[angle]** keys to enter the desired Reference load value, as described earlier.

Example:

The **SA100-R** is configured with an encoder on a rotary indexing table capable of describing a 180° arc and has an index marker at 90°. The operator wishes to set the display to read 90°, not zero, when referencing the system.

Hence,

`REF LOAD` = 90.0000 (in decimal degrees)

6.9 ANG ERR - ANGULAR ERROR COMPENSATION

Angular Error Compensation allows the operator to apply a constant correction factor to the axis measurement before it is displayed. The function is applied when it is not possible to accurately measure the radius of the rotary table when configuring the system manually.

The Angular Error Compensation Factor is expressed as a multiplier, (0.900000 to 1.100000), that is applied to the measured distance prior to being displayed. A factor of 1.000000 indicates that no compensation is being applied.

i.e. **Measured Angle x 1.000000 = Measured Angle**

In order to calculate the required compensation factor, from normal operation with no compensation applied:

Procedure:

- Move the machine to the zero position of the standard against which the axis is to be compared (90° square for example).
- Zero the display using the **[0°]** key.
- Move the machine through a known arc, as defined by the standard, and record the measured angle as displayed on the **SA100-R**.
- Calculate the Compensation Factor using:

$$\text{Compensation Factor} = \frac{\text{True or standard arc moved}}{\text{Measured arc}}$$

- Enter Set-Up and select 'ANG ERR'
- Enter the calculated Compensation Factor as described previously

NOTES

! Note.
Although this feature is provided to give set-up flexibility, where the radius of the rotary system is not accurately known it is advised that the Auto calibration option be implemented to configure the system.

! Note.
All measurements will be adjusted, multiplied, according to the Compensation Factor entered. To disable this facility enter a Linear Error Compensation Factor of 1.000000.

6.10 G. RATIO - GEAR RATIO COMPENSATION

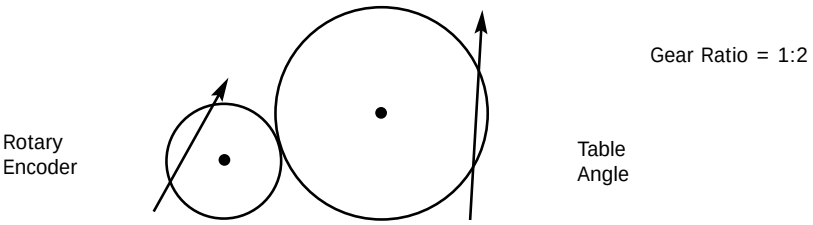
Gear Ratio Compensation allows for systems where gearing occurs after the point at which the angular position can be measured.

A factor of 1.000 indicates that no gearing compensation is being applied.

i.e. **Measured Angle x 1.000 = Measured Angle**

Example :

A system consists of a rotary shaft encoder coupled to a rotary table providing gearing of 1 to 2. In order to display the table angle the G.RATIO must be similarly defined.



i.e. Table angle = ½ that measure at the encoder.

Hence:

G.RATIO = **0.500**

6.11 ANGLE - ANGLE DISPLAY MODE

Angle allows the operator to define if the display is to rollover at 360° back to zero or to give a continuous measurement.

Procedure:

- From Set-Up select 'ANGLE'
- Use the **[abs/inc]** key to toggle the setting value between CT (continuous) and RL (360° rollover)

Example:

	ANGLE MODE	
True angle	**CT**	**RL**
650°	650°	290°
-720°	-720°	0°

NOTES

! Note.
Although this feature is provided to give set-up flexibility, where the radius of the rotary system is not accurately known it is advised that the Auto calibration option be implemented to configure the system.

! Note.
All measurements will be adjusted, multiplied, according to the Gear ratio factor entered. To disable this facility a G.RATIO of 1.000 must be entered.

6.12 DISP - DISPLAY MODE

NOTES

This option allows the operator to select what mode of angular position the **SA100-R** is to display. The two options are Decimal Degrees (DD) and Degrees-Minutes-Seconds (DMS).

! Note.
When in DMS mode degrees minutes and seconds are delimited by a decimal point.

	DISP	
Display type	**DMS -.-.-**	**DD DEC**
Resolution(max)	**1 second**	**As set byDR**
Example	**45.32.12**	**72.3421**

6.13 RADIUS - TABLE RADIUS DEFINITION

This function allows for the entry of the radius of the rotary table to be entered, when angular positions are to be measured and displayed. (For Tape mode only).

Tip.
If after entering this value the displayed angle is not 100% correct use the Angular Error Compensation facility to adjust the value accordingly.

Procedure:

- From Set-Up select 'RADIUS'.
- Use the **[abs/inc]** and **[angle]** keys to enter the table radius, as described earlier.

The angle displayed is calculated from the distance moved along the ARC (circumference) and the radius as follows:

$$\text{Angle}^{o} = \frac{\text{Distance} \times 360^{o}}{2 \times \pi \times \text{Radius}}$$

6.14 CPR - COUNTS PER REVOLUTION (ROTARY ENCODERS)

! Note.
*The option is only available when **TYPE** is **ROTY***

This function allows for the implementation of Rotary shaft encoders. This type of encoder is generally in the form of a rotating disc.

Tip
*If the **CPR** is unknown then select **AUTO** for automated calibration and Set-Up.*

The **CPR** refers to the number of counts, or edges, that the encoder will give for a single revolution. Care should be taken in the same way as with the setting of Axis resolution as the **SA100-R** automatically applies a x4 multiplier to the quadrature-input signals.

The information on the counts per revolution can be found in the encoder manufactures specification and is also generally marked on the encoder itself.

Procedure:

- From Set-Up select 'CPR'.
- Use the **[abs/inc]** and **[angle]** keys to enter the CPR, as described earlier.

7.0 USE OF AUXILLARY REFERENCE INPUT

Sometimes it may be desirable to use an auxillary reference marker i.e. one not integrated within an encoder. This could be a precision microswitch at one extreme of travel. With the **SA100 (or SA100-R)** it is possible to use such a remote switch contact to provide a reference pulse. The wiring arrangement required for this is shown below in Figure 1.

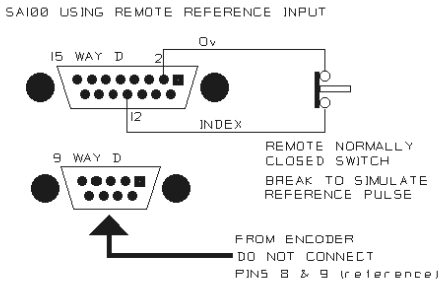


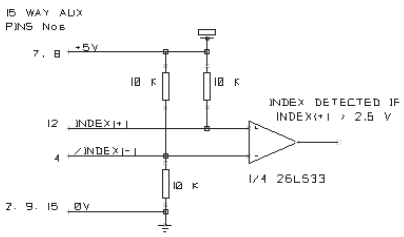
Figure 1.

It is important that any reference signals (if any) generated by the encoder are not connected to the 9 way encoder input. Instead a remote normally closed switch is wired between pins 2 and 12 of the 15 way auxillary connector.

5 volt DC power is also available on the 15 way auxillary connector :

· Pins 2,9 & 15 on the 15 way are 0V
· Pins 7,8 on the 15 way are +5V DC (max 100mA)

This 5 volt power can be used to power some solid state limit/proximity switches. However, any device added must replicate the action of a normally closed contact. For this reason simple mechanical switches are recommended. The following schematic shows the index input circuit to aid the selection of a proximity switch, should solid state interfacing be required. The Index(+) input should be normally be held below 2.5 volts. When it rises above this an the index signal is detected. Note maximum input voltages are as per RS422 specifications.



Using the arrangement outlined above does not provide any synchronisation between the encoder **A/B** signals and the auxillary reference input. One consequence of this is that the sensor fail detection of the **SA100** must be disabled (**FEN = OFF**) since the **A/B/INDEX** fail condition could exist whenever an asynchronous reference pulse occurs.

8.0 TROUBLESHOOTING

SYMPTOM	SOLUTIONS
Nothing happens when the unit is switched	Check unit is correctly connected to a working power source. Check the power lead is not damaged.
The unit is working but shows erratic readings.	This suggests a poor earth (ground) connection. Ensure the earth (ground) connection is installed. Ensure that the DIP switch settings at the rear of the unit are correctly set for the encoder type, single-ended or differential. See Section 1.0.
The **'SIG FAIL'** message is displayed.	There are two possible explanations for this message. 1. Check that the encoder connection is good and that the encoder cable has not been damaged. 2. The encoder reference marker (index) signal is not synchronised to the AB true (high) signal levels. See Sections 5.5 and 6.7 (depending on model).
The displayed measurement is not correct.	There are four possible explanations for this effect. 1. An incorrect encoder Axis Resolution **(AR)** has been selected. See Section 5.2 or 6.4 (depending on model). 2. An incorrect Linear Error **(LIN ERR)** has been entered (SA100 Linear only). See Section 5.7. 3. An incorrect Angular Error **(ANG ERR)** has been entered (SA100-R only). See Section 6.9. 4. An incorrect Scaling Factor **(SF)** has been selected. See Section 5.8 (SA100 Linear only).
The unit appears to count in the wrong **'DIR'**	Check the Direction configuration setting direction in Set-Up. See Section 5.4 or 6.6 (depending on model).

NOTES

See Section 1.0 for power source specification

Tip!
When configuring a SA100-R, where possible use the automatic calibration option.

8.0 CLEANING

Disconnect the unit from the power supply before cleaning.

It is recommended that the unit be wiped over with a lint free cloth with a non corrosive/abrasive cleaning fluid.

Do not use compressed air.

NOTES

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023-80120-UK · June 2004