SAPPHIRE
DRO COUNTER

INSTALLATION AND
OPERATING INSTRUCTIONS

Newall Measurement Systems Ltd

1. INSTALLATION

1.1 MOUNTING
The Sapphire is supplied with a pivot support bolt as standard. Figure 1.1.1 shows how you can use this arrangement to mount the Sapphire.
You will find supplied with the unit a fixing kit consisting of a M10 Nyloc nut and nylon washers. Be sure that the mounting arrangements are secure, as you will need to apply pressure to the front panel when you use the keypad.

A single or double arm mounting bracket can be supplied as a optional extra.

1.2 POWER SUPPLY
Before connecting the electrical supply to the Cabinet, check the supply voltage and frequency. The counter is supplied with a 115V or 230V selector to accept the appropriate supply with a voltage variation of + or - 15%.
A fuse is fitted as a precaution. If the fuse blows it is a possible indication of some significant problem with the power source. Check the power source and wiring carefully before replacing the fuse.

The fuse fitted is a 20x5mm glass type T500mA, which is a 500mA time delay (anti-surge) fuse.

It is important that both the Sapphire and the machine on which it is fitted are properly earthed (grounded). An inadequate earth will cause problems with the Sapphire and with the measurement transducers.

Fit the power lead into the socket at the back of the unit. The Counter is supplied with a right angle power lead.

1.3 CONNECTIONS
Figure 1.1.1 shows the connection sockets at the back of the Sapphire. These consist of either one or two 'Bleecon' sockets for the measurement transducers, depending on the number of axes you have ordered.

The Sapphire is designed for use with Spherosyn transducers. The transducers are connected to the Sapphire with Bleecon type connectors. These connectors have a sliding sleeve that locks the connectors to their sockets.

Switch off the Sapphire before connecting the transducers. To fit the connectors into the appropriate socket on the back of the Sapphire, first align the connector and then push firmly in place. You should hear a click confirming that the locking sleeve has engaged. To remove the connector , pull back on the connector sleeve to disengage the locking mechanism.

1.4 SWITCHING ON

Check first the electrical supply and select the appropriate operating voltage switch on the back of the unit.

The on/off switch for the Sapphire is also mounted on the back of the unit as shown Figure 1.1.1.

When you switch on the Sapphire. the unit will automatically go through a brief self test routine.

During this routine, the name Sapphire will be shown then the software version number will be displayed and all segments of the displays will be lit.

After this routine, the unit will display measurements and is ready for normal use.

The software version number is in the format 01.01.   The first two digits refer to the manual and should correspond to the version number of the manual printed at the top of each page of this manual. The last two digits, after the decimal, are used by the manufacturer.

Every time you switch on ,the Sapphire will automatically use the Digifind feature to compensate for any movement of the transducer up to 6mm(¼") in either direction since the unit was last used. This applies whether the Sapphire was switched off deliberately or unintentionally - such as a power failure.

The Keypad of the Sapphire is shown in figure 1.1.2 and explained in Section 3 below.

CONVENTIONS USED IN THIS MANUAL

The direction of travel of an axis refers to the travel of the tool relative to the workpiece.

Keys on the keypad are signified in bold print, such as **<ent>** for the enter key.
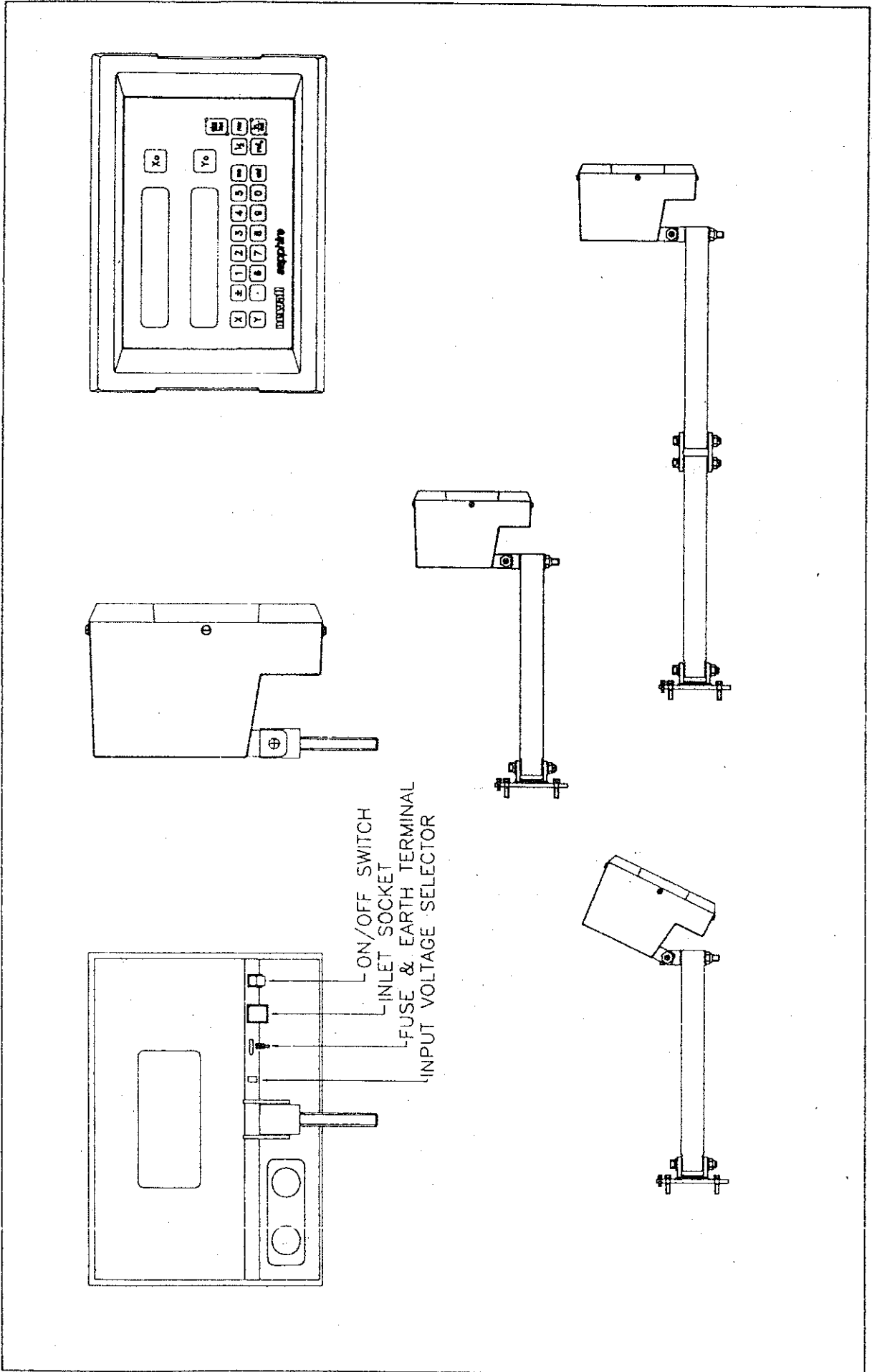
ON/OFF SWITCH
INLET SOCKET
FUSE & EARTH TERMINAL
INPUT VOLTAGE SELECTOR

Figure 1.1.1

2.0 SET UP

The set up procedure allows you to to change the main default settings for the Sapphire. For normal use, you will probably find that you only need to perform the set up procedure once, and it is possible that the factory defaults are suitable for your needs without change.

The set up procedure can only be activated just after power is switched on to the unit. On switching on the unit, press the concealed key under the "ne" of the newall logo on the keypad. (See Section 3 'Using the Keypad' if you have difficulty locating this key). You must press and release this key during the initial self test routine when all segments of the display are lit.

When you have selected set up, the letters "S U" appear in the top axis display.

The set up procedure makes use of a menu system. The main menu consists of a list of options that you can change. You simply press the < abs/inc > key to scroll through this list until you reach the option you wish to change. To change the option when selected, press the <Xo> or <Yo> key.

The main menu consists of the following list of options:

MENU ITEM	MEANING
SLP (SLEEP)	Enables or disables the datahold facility.
dir (DIRECTION)	Changes the direction of measurement for each axis.
rad or dia (RAD/DIA)	Changes the measurement from normal to diameter for any axis.
LC (LINEAR COMPENSATION)	Selects a linear error compensation factor.

The scrolling of these options will continue when pressing the <abs/inc>.

To leave the set up routine press the hidden key again, "ne" of newall.
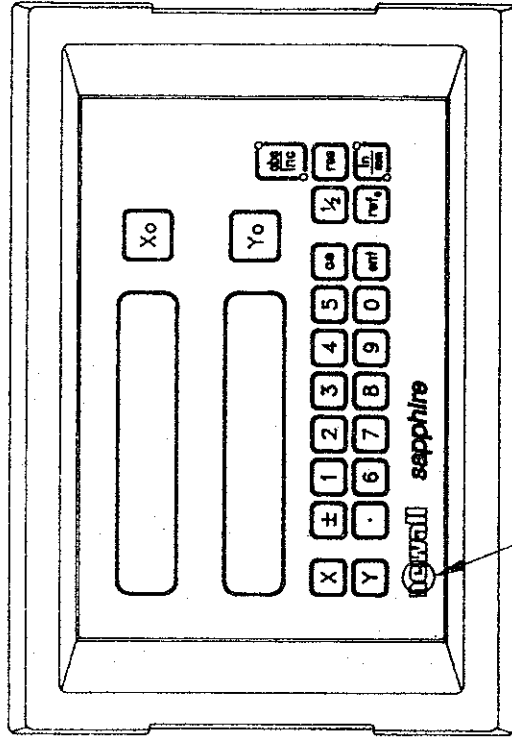
"ne" HIDDEN KEY
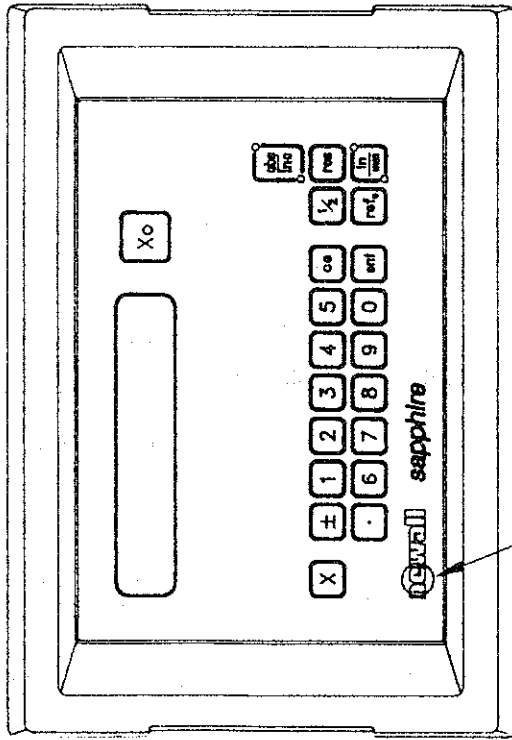
"ne" HIDDEN KEY

Figure 1.1.2

(a) Sleep/Datahold

In the main menu, press the **<abs/inc>** key until "SLP ON" is displayed. Press **<Xo>** and the choice of "SLP OFF" appears. You can scroll between "SLEEP ON" or "SLEEP OFF" by pressing the **<Xo>** Key. When selection is made press **<abs/inc>** to continue to the next option.

Select "SLEEP ON" if you want to be able to use the Datahold facility.(see Section 4.8 below for a description of Datahold). Otherwise select "SLEEP OFF".

(b) Direction

The direction option allows you to change the direction of travel of each axis. For example, if after installation the X axis is measuring positive from right to left, you can use this option to change the direction of the X axis so it measures positive from left to right.

In the main menu, press the **<abs/inc>** until "dir" (direction) is displayed.

Each axis display will show "0" or "1" depending on the direction set.

Pressing each axis key **<Xo>** or **<Yo>**, switches the direction.   When the unit is displaying the choices you wish to use, press **<abs/inc>** to continue to next option.

(c) Radius/Diameter

This option allows you to select any axis to display measurements at a two times (x2) factor. This is used on lathes and other turning applications to display diameter rather than radius. In the main menu, press the **<abs/inc>** key until "rad" or "dia" is displayed.

Pressing each axis key **<Xo>** or **<Yo>**, switches between radius (ie normal) display and diameter display for that axis. When the unit is displaying the choices you wish to use, press **<abs/inc>** to continue to the next option.

(d) Linear Error Compensation

This option allows you to apply a constant correction factor to all measurements displayed. This factor is expressed in parts per million (PPM).

In the main menu, press the **<abs/inc>** key until LC (Linear Compensation) is displayed.

The display will show "LC 0" or the last correction factor.

To insert or change a correction factor, select the axis and enter the factor you wish to use.

For example, to apply a factor of 200PPM to the X axis, press the following keys:
<X><2><0><0><ent> .

If the unit is displaying measurements less than the actual measurement, enter a positve factor to compensate. A factor of 200PPM means displays are measurement x 1.000200.

When each axis is displaying the correction factor you wish to use, press **<abs/inc>** to return to the first option.

To leave the set up routine press the hidden key, "ne" of newall.

To establish a correction factor, check the measurements displayed by the Sapphire against a known distance. For example, you might use a known(actual) distance of 500mm, against which the Sapphire displays 499.8mm. The correction factor you would then apply is:

$$(0.2mm/500mm) \times 1,000,000 = 400PPM$$

If the Sapphire displays 500.2mm over the same distance, the correction factor would be:

$$(-0.2mm/500mm) \times 1,000,000 = -400PPM$$

WARNING. Once you have entered a correction factor for an axis, all measurements will be adjusted accordingly. If you wish to disable this adjustment, you will have to enter a correction factor of zero.

3. USING THE KEYPAD

Figure 1.1.2 shows the layout of the keypad. The keys are used as follows:

Key	Purpose
<Xo><Yo>	Set the current position for the axis to zero.
<X><Y>	Select axis to enter dimension.
<abs/inc>	Switches between absolute and incremental. (light indicates choice of mode)
<ce>	Clear entry values in preset mode.
<½>	Centrefind function.
<res>	Change between 0.005mm (0.0002") and 0.01mm (0.0005") Resolution count.
<ent>	Enter key to confirm a dimension you have keyed with the numeric keypad.
<ref$_o$>	Select the Digifind function. (datum setting)
<in/mm>	Switches between inch and metric display. (light indicates choice of mode)
<±><1><2><3><4><5> <·><6><7><8><9><0>	Numeric keypad for entering dimensions and other numbers.

In addition, there is a concealed key under the "ne" of "newall" logo. **This key is not embossed.** The concealed key is used to enter the set up procedure and for Datahold (sleep) feature.

4. STANDARD FUNCTIONS

4.1 USING INCREMENTAL

(a) Purpose and Use

When the Sapphire is set to incremental use, it can be used to display each new position relative to the last position. This is also known as point-to-point use.

The Sapphire is set to incremental use for all axes together.   On setting to incremental (<abs/inc> key indicates mode of choice by indicator light), you can zero each axis by pressing <Xo> or <Yo>. This sets a temporary datum and movement will then be displayed relative to this datum.

As an alternative to zeroing the axes, you can enter the coordinates of a position relative to the datum you wish to use.

Each time you switch to incremental mode, the Sapphire will display your current position relative to the last datum you set in incremental mode - the Sapphire keeps your last datum in memory.

(b) Keystrokes

Operator Steps	Keystrokes	Axes Display
Set all axes for incremental use	<abs/inc>	
Set a temporary datum	<Xo> <Yo>	X 0.00 Y 0.00
Enter the coordinates of a position, eg X100, Y50	<X><1><0><0><ent> <Y><5><0><ent>	X 100.00 Y 50.00

4.2 USING ABSOLUTE

(a) Purpose

When the Sapphire is set to absolute use, it can be used to display the position to the established <ref$_o$> datum position. (See 4.3 'Finding the last Datum')

(b) Keystrokes

Operator steps	Keystrokes	Axes Display
Set all axes for absolute use	<abs/inc>	

(c) Establishing the Datum

When you zero the display in absolute mode, you are setting the current position of your machine as your datum position. All other positions will be measured relative to this datum.

To set the datum, you must position the machine precisely at the point you intend to use as the datum and then zero any or all axes, in the 'absolute mode' <abs/inc>.

Operator steps	Keystrokes	Axes Display
Set all axes for absolute	<abs/inc>	
Move machine to precise position		
Set that position as the datum	<Xo> <Yo>	X 0.00 Y 0.00

4.3 FINDING THE LAST DATUM

If the datum has been lost, eg due to movement with the Sapphire switched off, then move the axis to within 6mm (1/4") of where the axis was last zeroed and press the <ref_o>. The datum is correctly restored.

Warning: This is to both axes on a two axes unit.

4.4 CENTRE FIND

Centre find halves the dimension displayed for any or all axes selected. **You can use centre find in either absolute or incremental mode.** The keystrokes are the same in either case.

In the following example, centre find is being used on the X axis to find the centre point of a workpiece that happens to be 100mm wide.

Operator steps	Keystrokes	Axes Display
Locate to your first position-one edge of your workpiece-and zero the axis	<Xo>	X 0.00
Locate to the second position-the other edge of the workpiece		X 100.00
Use centre find to locate the centre point	<X><½> or <½><X>	X 50.00

In either absolute mode or incremental mode, once you have used centre find you can locate to the centre point by moving until the display is at zero.

If you are in absolute mode, remember that using centre find will set the datum to the centre point.

4.5 RESOLUTION

The <res> key allows you to select the resolution you wish measurements to be displayed. In millimetre display, the choice is between 0.005mm and 0.01mm. In inch display, the choice is between 0.0002" and 0.0005". For example, if you chose 0.01mm resolution, all measurements will be displayed rounded to the nearest 0.01mm.

4.6 ENTER or REMOVE DIMENSION

To load a dimension into the display and confirm <ent> or to remove <ce> the following steps are required.

Dimensions can be entered in either absolute or incremental modes.

(a) Keystrokes

Operator steps	Keystrokes	Axes Display
To enter a minus dimension for X axis.	<X> <±> <1><9><.><6><ent>	X -19.600
To remove one character	<ce>	

4.7 INCH/METRIC

To change between display in millimetres and in inches, press <in/mm>. The displays will be converted instantly. A light beside the key reminds you which measurement you are using

Selecting inch or millimetre display applies to all dimensions. For example, if you are in millimetre display, whenever you enter dimensions you should also use millimetres.

When you switch on the Sapphire , it will display the same unit of measurement that you set when you last used the unit.

4.8 DATAHOLD (SLEEP)

Datahold allows you to disable the Sapphire but retaining power to the measurement Transducers and memory circuits. You can use datahold to prevent unauthorised or accidental use of the Sapphire whilst unattended.

To select datahold, press the concealed key under the "ne" of the "newall" logo.

To return to normal use, press the same key again.

While the the Sapphire has been set to datahold, the keypad will not function and the displays will be blank. If the machine axis is moved, " !d" (displaced) will appear in the display to warn you of that movement. However, if any movement does occur, the Sapphire will keep track of it and the positioned displayed after datahold is cancelled will be the true position. If a key is pressed, "!F" (fingured) will appear in the display to warn you that someone has attempted to use the keypad, although the keypress will have had no effect.

5. OPTIONS

The Sapphire is available in either a single or two axes display.

No additional features are available.

Optional Accessory is an External Summing Unit.

6. TROUBLESHOOTING

<u>Symptom</u>	<u>Solutions</u>
1 Nothing happens when the unit is switched on. Not even the abs/inc or in/mm light works	Check that the unit is correctly connected to a working power source. Check the power lead is not damaged. Check the selector switch on the Sapphire is set to accept the correct power supply voltage. Check the fuse. Note that if the fuse has blown, this suggests a fault with the power source which must be corrected before the fuse is replaced. (See Section 1.2)
2 When the unit is switched on, the in/mm light works, but the displays are blank.	This suggests that voltage of the power is to low. Check that the power source is within the limits accepted by the unit. (See Section 1.2)
3 The displays work, but reset from time to time without the keys being pressed.	This suggests either that the voltage of the power source is too low, or that the power source has an intermittent fault. Check the power source as above and check that all connections are sound.
4 The displays work, but give erratic readings, the last digit jitters or the measurements jump to new figures unexpectedly.	This suggests that the there is a poor earth (ground) connection. Both the Sapphire unit itself, and the machine on which it is installed, must have proper earth (ground) connections.
5 "SPH FAIL" appears in the display.	This means that the unit is not receiving a proper signal from the measurement transducer. Check that the transducer connection is good. Check that there is no damage to the connectors or to the transducer lead. If only one axis is displaying this message, connect the transducer from a working axis into the faulty axis. If the same message appears, the fault is likely to be in the Sapphire unit and you should contact your local dealer. N.B. The unit must be switched off then on again to remove the "SPH FAIL" message.
6 The unit works properly, but measurements are inaccurate.	Check that the linear error compensation factor is set to zero or try a different factor. (See Section 2) If the unit is still not giving the required accuracy, check your machine. Remember that the measurement transducers are usually installed at some distance from your workpiece. Any play in slideways will have a crabbing effect - a rotational movement - that will cause a difference in movement between the workpiece and the transducer. This appears like a backlash effect. Make sure you are always taking measurements when moving to positions from the same direction. If you are still not achieving the results you need, contact your local supplier.

Symptom	Solutions
7 One display is not working properly.	Swap transducers between axes to see whether the problem is associated with the transducer or with the Sapphire unit.
8 The unit will not respond to keys.	Switch the unit off and back on. Note that providing the machine has not been moved more than 6mm/¼" in any direction, you will not lose your current position by switching off and on.
9 When the unit is switched on, it displays the message "SU LOSt".	This means that the unit has been left with no power for more than 30 days, and the battery back-up is exhausted. All the set up options will have been set to the factory defaults. Check the settings in Set Up. (See Section 2)
10 None of the procedures above corrects the fault.	You should contact your Newall dealer. The Sapphire is designed as a sealed unit, and the electronic components inside are not suitable for repair by the user. Opening the case will invalidate the warranty.

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Digital Readout Systems ● Linear Encoders

Troubleshooting Guide for Newall Digital Readout Systems
For Display Models: Sapphire, DP7, DPG, Topaz, DP8, DPG2000, E70

This Troubleshooting Guide is intended for use in conjunction with the applicable user manuals. Please follow the troubleshooting steps below and call our Tech Support Department at 1-800-229-4376 with the results.

Nothing happens when the power switch is turned on (Axis windows are blank)

1. Ensure that the input voltage switch is set to the proper setting (115 / 230). This does not apply to DP7.
2. Check the fuse.
3. Test the input voltage to the display unit with a voltmeter.
4. Turn display off using the power switch.
5. Disconnect all reader head cables. A defective reader head could prevent the display from powering up.
6. Turn display on.

Inaccuracy in one axis

1. Get into "Setup mode" and check the following settings:
   a) ***Linear Compensation*** - Set to 0 on all axes.
   b) ***Scale Type / Input Type*** - Set to read the correct scale type (Spherosyn, Microsyn 5, Microsyn 10).
   c) ***Radius / Diameter*** - Diameter will display a 2:1 ratio. Radius will display a 1:1 ratio.

2. Put a dial indicator on the edge of the *reader head*. Move the axis. Compare the dial indicator reading to the display reading. If there is a discrepancy that exceeds our accuracy specifications, proceed to the next step.

3. Take the reader head cable from the malfunctioning axis and plug it into the other axis of the display (You may need to get into setup mode and ensure that this axis is set up to read the correct type of scale).

4. If the malfunction was corrected when the cable was moved to the other axis, the source of the fault is the display. The display will need repaired.

5. If the malfunction followed the cable to the other axis, the source of the fault is the reader head and scale assembly. If this is the case, proceed to the next step.

6. Check for any physical damage to the reader head and cable.

7. Check the reader head for proper alignment. It must be aligned within .002" on each side. Refer to the installation manual for instructions on reader head alignment.

8. Check the scale to make sure there is no binding on the scale. If the scale brackets are slightly loosened, you should be able to slide the scale back and forth through the brackets with minimal resistance.

9. If you have a Spherosyn scale, ensure that the scale is not bent. Remove the scale and roll it on a flat surface. If the scale is bent at all, it will cause inaccuracies. Replace scale if bent.

10. If there is no binding on the scale, the reader head is aligned, and the scale is not bent, the malfunction must be coming from the reader head. Replace the reader head.

Display shows "Signal Fail" or "No Signal" in one axis

1. Turn off display.
2. Take the reader head cable from the malfunctioning axis and plug it into the other axis of the display.
3. Turn display on.
4. If the scale works properly when connected to the other axis of the display, the source of the fault is the display. The display will need repaired. Note: You may need to get into setup mode and adjust the scale type, radius / diameter, and linear compensation (set to 0) parameters to get <u>accurate</u> readings. The main goal in this step is to identify the source of the signal fail / no signal error.
5. If the malfunction followed the scale cable to the other axis of the display, the source of the fault is the reader head. Replace the reader head.
   Note: Signal Fail or No Signal errors can NOT be caused by incorrect parameter settings.