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# **SY021 Portable Load/Force Meter User instructions**

**Relates to firmware version 5.2**

## INTRODUCTION

The SY021 is a portable load meter, which can indicate the load present on any attached cell. A dual channel version is available which indicates the load on 2 load cell inputs simultaneously. Calibration details of up to 50 load cells can be stored for each available input. RS232 and data logging options are also available.

### Connection Details

#### Loadcell

Load cells are connected using locking 4 pin DIN connectors. The connections are:

| Pin | Signal       |
|-----|--------------|
| 1   | Excitation + |
| 2   | Signal +     |
| 3   | Signal -     |
| 4   | Excitation - |

Depending on your requirements, load cells can be fitted with the DIN plugs, or you may find it useful to wire a plug to a 4 way terminal block for general-purpose use.

#### RS232

The RS232 socket, if fitted, is a 2.5mm stereo jack on the left-hand side. Connections are:

|        |   |     |
|--------|---|-----|
| Screen | = | GND |
| Tip    | = | TXD |
| Ch2    | = | RXD |

### Operation

When the instrument is switched on the opening screen will show:

```
'Synectic Design '  
' SY021 (c) 2009 '
```

After about 2 seconds the screen will then show:

```
'Chan1 = xx  Mode'  
'Chan2 = yy  Mode'
```

Where xx and yy are the last used channel numbers and mode is the current operating mode (Continuous or Peak hold) of each channel.

If the second channel option is not fitted, the second line will indicate 'Single channel'

To display the weight on each available input, press ENT on the keypad. If the RS232 option is fitted and use of Batch Reference has been selected, see 7.5, the screen will first show:

```
'ENT when correct'  
' Batch ABC12345'
```

This allows the current batch reference, ABC12345 in this example, to be changed. This is done using the sideways arrows (4&6) to select the character and the up/down arrows (2&8) to change each character. If the up or down arrow keys are held in the display will automatically cycle through the available characters. Press ENT when correct.

The screen will indicate the weight on each input using the calibration data and units set for each channel.

In continuous measurement mode Tare buttons marked T1 and T2 can be used to tare either input. This tare value is not stored; therefore if the unit is switched off and on it will revert to the stored tare value. The stored tare value can be saved with calibration data using the manual calibration mode (See 6.2)

In peak hold mode, Reset buttons R1 and R2 will reset either input, ready to find the next peak.

If the RS232 option is fitted and use of Batch Reference has been set, pressing 5 will send current measurement details to the RS232 port. Eg

```
Acme Trading Co  
Batch Ref ABC12345  
Peak1 = 50.25kg  
Peak2 = 25.12kg
```

Pressing any other key will return the display to indicate the selected channels.

## 2.0 Changing channels and operating modes

Press 1 to change input 1 or 2 to change input 2.

Pressing 1 will change the display to show:

```
'Configure input1'  
'Chan (00-49) xx '
```

Where xx is the currently selected setup channel. The unit can store details of up to 50 setup channels for input 1. The channels are numbered 00 to 49.

To change the setup channel number press ENT and then the channel number. If you enter the wrong number press ENT again and repeat the process until the required setup channel number is shown. Pressing CAL will then show the currently selected mode (Continuous or Peak Hold) Press ENT to switch between the modes. When correct press CAL.

The option of changing the filter setting is then presented. The initial value will be as set during calibration, (see 3.0) but it can be changed here without affecting any of the other calibration settings. When correct press CAL to return to the channel display screen.

The same operation can be carried out for input 2, if fitted, by pressing 2. The available channel numbers for input 2 are 50 to 99.

## Calibration

To calibrate an input press CAL. The display will show:

Calibration Mode  
Enter PIN ----

A pin number should now be entered to access the calibration options. The factory default is 1234.

Once the PIN has been correctly entered, the 2nd line will show:

Calibrate Cell

If a channel needs calibrating to match a cell press ENT and go to step 3.1, otherwise press CAL and you will move on to the next step, the unit will display the filter setting that is filter 0 - 3

### 1. Input selection

If 2 sensor inputs are fitted, the screen will show:

Calibration Mode  
Which Input? -

Press 1 or 2 to calibrate the required sensor input.

#### 1.1 Setup Channel selection.

Each sensor input can store up to 50 different setups, these are numbered 0-49 for sensor input 1 and 50-99 for input 2. The unit will ask for a setup channel number. Enter the required number (0-49 or 50-99).

### 2. Filter setting

The display will then show the currently set filter value (0-3) of the selected channel. The filter value determines the number of readings, which are averaged for each sample as follows:

- 0 = 1 reading (fastest response)
- 1 = 2 readings
- 2 = 4 readings
- 3 = 16 readings (heaviest damping)

Each reading takes approximately 80 mSec.

When correct press CAL.

### 3. Selecting Units

The display will indicate the current units for the selected channel. 4 units are available, kg, t, lb and a 4th user programmable unit. Press ENT until the required units are displayed.

### 4. Decimal places

The display will then show the selected number of decimal places (0-3), this can be changed by pressing the required number.

When correct press CAL.

## 5. Input range

You will then be asked to select the input range to best match the sensor output. The range currently selected will be shown first. There are 2 ranges available:

A = 0 to 2.25mV/V

B = 0 to 4.5mV/V.

Selecting range B for a sensor with a maximum output of 1.5mV/V will still work, but the display stability will not be as good.

Press ENT until the required range is shown, then press CAL.

## 6. Calibration method

The calibration method (automatic or manual) will now be shown where with the automatic mode, calibration can be by either adding a known weight or by entering mV/V figures; and manual mode allows for fine adjustment of an input, which has already been calibrated. Press ENT to select the required mode, then CAL.

### 6.11 Automatic mode

The display will first show ' Use known load '. If this is the required method, press CAL and go to 6.12. If ENT is pressed the display will show ' Use mV/V value '. If this is the required method, press CAL and go to 6.13. Pressing ENT will toggle between the two methods.

### 6.12 Using known load

The instrument will request the value of a known test weight to be entered. When entered the 1st line of the display will show:

No Load then ENT

Without the test load present, the ENT key should be pressed.

The display will then change to show:

Add Load then ENT

At this point add the specified test load and press ENT.

The channel will now be calibrated.

### 6.13 Using mV/V value

The instrument will request the value of the full-scale range to be entered using the previously specified decimal places and units. E.g. if 2dp & kg had been selected, the display will show 'FS Range---.---kg'. Enter the value as a 5-digit value, including leading zero's if appropriate.

The display will then show 'Value - .----mV/V' Enter the value from the load cell calibration certificate.

The instrument then offers the opportunity to tare the input. With the load cell attached and no load present, or with the signal wires shorted, press the appropriate tare button. If tare is not required, e.g. if the mV/V value for a previously calibrated load cell is being adjusted, press any other key.

The display will move on to calibration step 7.

## 6.2 Manual mode

The instrument will indicate the current weight. This can be zeroed by pressing the tare button, T1 or T2. Pressing CAL introduces a 100k shunt resistor to simulate an applied load. Repeating CAL will remove the shunt. Pressing the up and down arrow keys will produce a fine adjustment of the displayed weight. When correctly adjusted, press CAL

## 7. RS232 option

If the RS232 option is not fitted move on to custom units calibration setting 9

### 7.1 Internal clock date setting

The display will now show:

```
' Internal Clock '  
' DATE  dd/mm/yy '
```

To change the date type in a new 6 digit value in the form ddmmyy or press CAL to move on.

### 7.2 Internal clock time setting

The display will now show:

```
' Internal Clock '  
' TIME  hh:mm:ss '
```

To change the time type in a new 6 digit value in the form hhmmss or press CAL to move on.

### 7.3 RS232 setting

If the RS232 option has been fitted the display will show

```
'CONFIGURE  RS232'  
'Baud Rate  -9600'
```

The data format is fixed as 8 data bits, 1 stop bit, no parity. Four baud rates are available, 2400, 9600,38400 & 115200. Pressing the up arrow (2) or the down arrow (8) will cycle between the values. When correct press CAL

### 7.4 Inter Character Gap

This feature is included to accommodate printers which only have a small buffer and may not be able to keep up with a full speed stream of data. It allows a gap between each transmitted character to be added. The length of the gap is programmable up to 255msec.

The display will show:

```
'CONFIGURE  RS232'  
'Char Gap  xxxmsec'
```

xxx is the gap in msec. To change it press ENT and enter a new 3 digit value in the range 0-255.

When correct press CAL.

### 7.5 Batch Reference

If the RS232 option has been fitted, it is possible to print test results together with an 8 character batch reference. The display will show

'CONFIGURE RS232'                    'CONFIGURE RS232'  
'Use Batch Ref Y'                    **OR** 'Use Batch Ref N'

To select the required option press ENT to toggle between "Y" and "N"  
Press CAL to continue if data logger is fitted then display will go to 8 otherwise display will go to Custom Units

## 8. Data logger.

If the data logger is fitted the display will show

' Logger status '  
' ENT to check '

The logger has the capacity to store 3999 sets of readings for each channel. To check the logger status press ENT. As an example, the display will then show

' 191/3999 used '  
'Press 0 to clear'

In this case indicating that 191 of the logger memory locations are used. Pressing 0 will clear the memory, any other key will move on.

### 8.1 Data logger mode

Two modes of data logging are available, single shot or continuous. Single shot mode records a single set of readings each time the green '7' key is pressed while measuring. Continuous mode takes repeated readings when the green '7' key is pressed until the red '0' key is pressed, or until the memory is full. The logger will store up to 3999 sets of measurements. The rate at which the measurements are taken is dependent on the filter settings of each channel.

The data is stored in comma separated variable spreadsheet format.  
Fields are Day,Hour,Min,Sec,Chan1,Chan2.

Single shot readings store data in every field. Continuous readings leave the Day field empty but record the Seconds field with a resolution of 0.1sec.

Data is added to the spreadsheet until the logger is full. If this happens the display will show:

'DATA LOGGER MODE'                    'DATA LOGGER MODE'  
' Continuous '                    **OR** ' Single shot '

Pressing any key will turn off the logger and return to displaying the measurements.

Press ENT to select the required mode and CAL to move on.

## 8.2 Trigger Interval

If continuous mode the interval between saved readings depends on the filter setting:

| <u>Filter</u> | <u>Sample interval</u> |
|---------------|------------------------|
| 0             | 10 msec                |
| 1             | 20 msec                |
| 2             | 40 msec                |
| 3             | 160 msec               |

## 9. Custom units

The display will show ' Custom units ??' Where ?? Can be any pair of characters. To change the first character, press ENT. Use the up arrow (2) or down arrow (8) to scroll the available symbols. If either of the keys is held in the symbols will continuously scroll. When the first character is correct, press the right arrow (6) and repeat the process for the second character. Press ENT when finished.

## 10. Changing the PIN number

The 2nd line of the display will then show:

New PIN?

To change the PIN press ENT and enter the new value. Otherwise press CAL to return to the original channel display screen.

## 1. Accessing data

The data can be downloaded via the RS232 port. Any simple terminal software, such as Hyperlink, can be used. It should be configured to match the baud rate and bit pattern of the SY021. Set the terminal to capture text. Set the filename to have the extension .csv to indicate to the spreadsheet that the data is in comma separated variable format. Type \*D to download the data. The logger memory can then be cleared by typing \*C. After about 10sec the unit will respond with Y.

## Power supply

The unit is powered by 4 AA batteries. Any 1.5 volt types are suitable but NiCad are not as they only produce 1.2V. If rechargeable batteries are required rechargeable alkaline can be used. An external DC adapter can also be used. This should be 6V DC and fitted with a 3.5mm jack plug. It should be wired with the tip positive. Inserting the plug disconnects the internal batteries.

## RS232 Interface commands.

When the RS232 interface is fitted the following commands are available

| Command | Description    | Response  |
|---------|----------------|---|
| *@      | Read Unit ID   | Model number, Firmware version and serial number.<br>Eg. SY021,V5.2, 1234cr   |
| *C      | Clear Log      | If Logger is fitted; 'Y' if successful, 'N' if unread data if no logger fitted; '?'   |
| *D      | Dump logger    | If logger fitted; Transfer logger data in CSV spreadsheet format.<br>If no logger fitted '?'  |
| *M      | Logger memory  | Reports size of data logger memory<br>eg. 032 indicates 32k logger<br>000 indicates no logger   |
| *H      | Define Header  | Allows a header of up to 50 characters to be programmed.<br>After *H type the heading, ending with cr. Batch tickets and data downloads will contain the header at the top. |
| *R1     | Read Channel 1 | Sign symbol followed by a 5 digit value decimal point as appropriate eg; +12.345cr  |
| *R2     | Read Channel 2 | As R1 but for channel 2.  |
| *T1     | Tare Channel 1 | Zero the reading on Channel 1<br>When done replies with cr,   |
| *T2     | Tare Channel 2 | As T1 but for Channel 2   |

## Instrument calibration

For automatic calibration using mV/V and full scale values, the instrument uses a set of calibration values stored in its non-volatile memory. There are 4 values, 1 for each for the 2.25mV/V and 4.5mV/V ranges for each channel. Each value is a 3 digit number which is nominally 500 and which can be adjusted up or down, each step equating to a 0.01% change. To access these values press CAL but then instead of entering the PIN, press CAL, 2, ENT, 1.

The display will then show

```
'Calibration Mode'  
'Ch1 Rng2mV/V ----'
```

Pressing ENT will display the current value. Pressing ENT again will allow a new value to be entered or pressing CAL will move on the next value.

### Example.

A calibrated loadcell is available with an output of 2.012mV/V at 100kg.

The loadcell is connected to channel 1 of the SY021 and automatic calibration mode is

selected. The given values of 2.012mV/V and 100kg are entered using the 2.25mV/V range and selecting 2 decimal places. When tested the displayed weight is found to be 0.03% high. The current value of Ch1 Rng2mV/V is found to be 512, press ENT and change this to 515. The re-enter the calibration figures of 2.012mV/V, 100kg. The weight should now be correct.

### **Instrument Details**

To check the serial number and firmware version of the instrument, hold in the CAL button as power is switched on.

### **Power requirements.**

The instrument is powered by 4xAA batteries. Typical current consumption when connected to a 350 ohm loadcell is 40mA, giving an operating life with standard alkaline cells of approximately 40 hours. With no loadcell connected the consumption drops to 20mA.

If rechargeable batteries are required we recommend rechargeable alkaline cells.

When the instrument is switched off, consumption is less than 0.1uA, therefore it is not necessary to remove the batteries when not in use for a few days. (Some competitors instruments consume around 100uA when turned off)

### **Instrument identification**

The serial number and firmware version can be found by holding in both the PROG and TARE keys as the instrument is turned on. The serial number will first be shown. Pressing any key will then show the firmware version. Pressing a key again will show the currently set baud rate for the RS232option. Pressing any key again will set the unit for normal operation.

### **RS232 option**

RS232 communication, if fitted, is via a 2.5mm jack socket fitted to the left hand side of the instrument. Connection to a computer can be made using the supplied lead by plugging the 9 way D-type socket into the 9 way plug on the computer. If the computer RS232 port uses a 25 way plug, a 9-25 way adapter will be required. If the computer isn't fitted with an RS232 port, but has a USB port, a USB to serial converter can be used. The computer RS232 baud rate will need to be set to match the instrument. To find out the current setting see 'Instrument identification' above. The following commands are available.

## Software commands

| Command | Description   | Response   |   |           |   |   |   |   |   |   |   |  |
|---------|---|--|---|-----------|---|---|---|---|---|---|---|--|
| @       | Read unit ID  | The model number, software version and serial number. Eg: SY021,v5.2,1234cr  |   |           |   |   |   |   |   |   |   |  |
| Bn      | Set baud rate   | Sets the baud rate for RS232 communications. Format is always 8 data bits, 1 stop bit, no parity.<br><br><table><thead><tr><th>n</th><th>Baud rate</th></tr></thead><tbody><tr><td>0</td><td>2400</td></tr><tr><td>1</td><td>9600</td></tr><tr><td>2</td><td>38400</td></tr><tr><td>3</td><td>115200</td></tr></tbody></table> <b>NOTE:</b> The new baud rate only takes effect when the instrument is switched off and back on.   | n | Baud rate | 0 | 2400  | 1 | 9600  | 2 | 38400   | 3 | 115200   |
| n       | Baud rate   |  |   |           |   |   |   |   |   |   |   |  |
| 0       | 2400  |  |   |           |   |   |   |   |   |   |   |  |
| 1       | 9600  |  |   |           |   |   |   |   |   |   |   |  |
| 2       | 38400   |  |   |           |   |   |   |   |   |   |   |  |
| 3       | 115200  |  |   |           |   |   |   |   |   |   |   |  |
| S       | Set streamed  | The displayed weight is continuously copied to the RS232 output. When the unit is switched off and powered up again display will resume to previously set condition which in this case is continuously coping weight to the output<br>The format of the output depends on the Z command. If the instrument was showing 'Ch n' it switches to the weight display.   |   |           |   |   |   |   |   |   |   |  |
| W       | Read weight   | Copies the next weight reading to the RS232 output   |   |           |   |   |   |   |   |   |   |  |
| Zn      | Format weight   | Determines whether a + sign is transmitted in front of positive values and readout whether leading zeros are suppressed.<br>Valid values for n are 0 - 3 giving the following results:<br><br><table><thead><tr><th>n</th><th>result</th></tr></thead><tbody><tr><td>0</td><td>no zero suppression, no + sign<br/>e.g. 0012.3 , -0012.3</td></tr><tr><td>1</td><td>zero suppression, no + sign<br/>e.g. 12.3 , - 12.3</td></tr><tr><td>2</td><td>no zero suppression, + sign<br/>e.g. +0012.3 , -0012.3</td></tr><tr><td>3</td><td>zero suppression, + sign<br/>e.g. + 12.3 , - 12.3</td></tr></tbody></table> | n | result    | 0 | no zero suppression, no + sign<br>e.g. 0012.3 , -0012.3 | 1 | zero suppression, no + sign<br>e.g. 12.3 , - 12.3 | 2 | no zero suppression, + sign<br>e.g. +0012.3 , -0012.3 | 3 | zero suppression, + sign<br>e.g. + 12.3 , - 12.3 |
| n       | result  |  |   |           |   |   |   |   |   |   |   |  |
| 0       | no zero suppression, no + sign<br>e.g. 0012.3 , -0012.3 |  |   |           |   |   |   |   |   |   |   |  |
| 1       | zero suppression, no + sign<br>e.g. 12.3 , - 12.3       |  |   |           |   |   |   |   |   |   |   |  |
| 2       | no zero suppression, + sign<br>e.g. +0012.3 , -0012.3   |  |   |           |   |   |   |   |   |   |   |  |
| 3       | zero suppression, + sign<br>e.g. + 12.3 , - 12.3        |  |   |           |   |   |   |   |   |   |   |  |

## Specifications

| <b>Parameter</b>           | <b>Min</b>   | <b>Typ</b> | <b>Max</b> |
|----------------------------|--|------------|------------|
| Supply voltage (DC)        | 5.6  | 6 (4xAA)   | 12         |
| Input sensitivity (mV/V)   | 0.5  |            | 4.5        |
| Excitation voltage (V dc)  | 4.95   | 5          | 5.05       |
| Conversion Rate per second | 1.6  |            | 100        |
| Peak Hold (msec)           | 10   |            | 640        |
| Current consumption(mA)    | 20; no loadcell connected  | 40         | 60         |
| Inputs                     | 1  |            | 2          |
| Calibration                | Known weight, mV/V value, or fine nudging. 50 loadcell set-ups can be stored |            |            |
| Display                    | 2 x 16 Character LCD   |            |            |
| Temperature drift (ppm/C)  |  | 50         |            |
| Shunt calibration          | 100kΩ internal resistor  |            |            |
| Communication options      | USB, RS232, baud rate changeable   |            |            |
| Operating temp.(C)         | -20  |            | 80         |
| Storage temperature (C)    | -65  |            | 150        |
| Case                       | ABS black IP65 case W=101.6mm, L=190.5mm, H=35mm                             |            |            |
| Connections                | 4 pin locking DIN connectors as standard. Others available                   |            |            |



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