ISOCON-6-LIN

24V AC or DC POWERED

ISOLATING SIGNAL CONVERTER

Industrial Interface

June 2007

CONTENTS

Industrial Interface Systems Ltd
sales@industrialinterface.co.uk
www.industrialinterface.co.uk

1. INTRODUCTION

1.1 Hardware Features

The ISOCON-6-LIN is a universal input Isolating Signal Converter. It can accept virtually every type of analogue input signal from millivolts to 40Vdc, mA, thermocouples, RTD's etc. It also produces 3 types of analogue output; voltage, mA source, or mA sink and the output can be configured to use up to 31 linearisation points, programmed using 2 push-buttons and an adjustable input source.

The unit can be powered by any DC voltage between 12 and 36Vdc or 12 and 32Vac. For mains AC voltage the ISOCON-3 is available which can be powered from any supply from 90Vac to 264Vac at 50 or 60Hz.

The instrument is packaged in a very compact 12.5mm wide enclosure which can be mounted on standard TS35 DIN-rail.

1.1.1 Isolation Details

The ISOCON-6-LIN has full 3 port isolation of 1000V between the Input Stage, Output Stage and Power Supply for functional reasons.

2. UNPACKING

The instrument should be carefully inspected for signs of damage which may have occurred in transit. In the unlikely case that damage has been sustained, DO NOT use the instrument, but please retain all packaging for our inspection and contact your supplier immediately.

The instrument comes with the following items as standard:

1 Isocon-6-Lin Isolating Signal Converter
1 Isocon-6-Lin User Guide

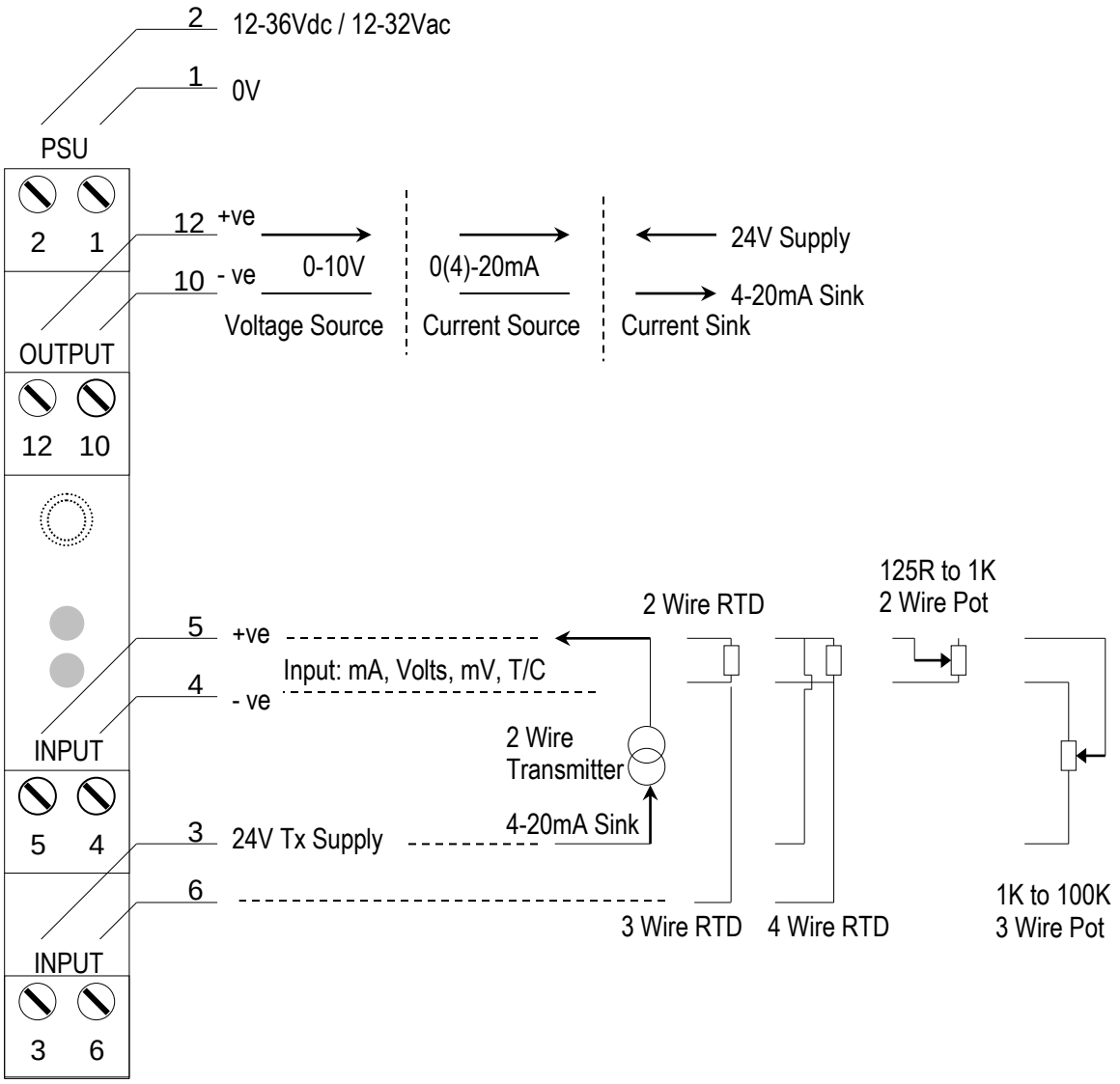
If the instrument has been factory configured the input and output details will be listed on the Serial number label on the side of the unit. If this label is blank then the unit will be set to its default configuration which is 4-20mA input and 4-20mA source output. Please check that the details on the side label are correct, especially the power supply voltage.

If re-configuration is required please refer to Section 4 of this manual.

3. CONNECTIONS

The ISOCON is housed in a compact DIN rail mounting enclosure, with 8 terminals, arranged in 4 rows of 2 terminals. Two rows are at the top of the front panel and 2 rows are at the bottom. All the sensor input terminals are on the bottom rows and the power supply and analogue outputs are on the top terminals.

The diagram below shows how to connect all the different input, output and power supply types.

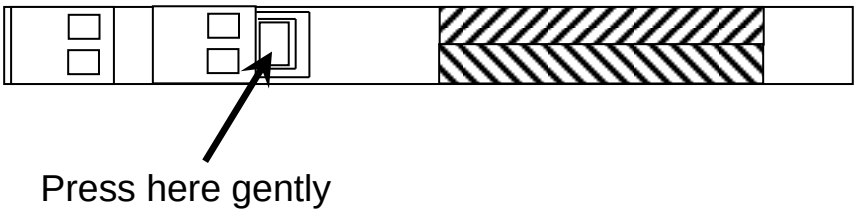


4. CONFIGURING THE ISOCON

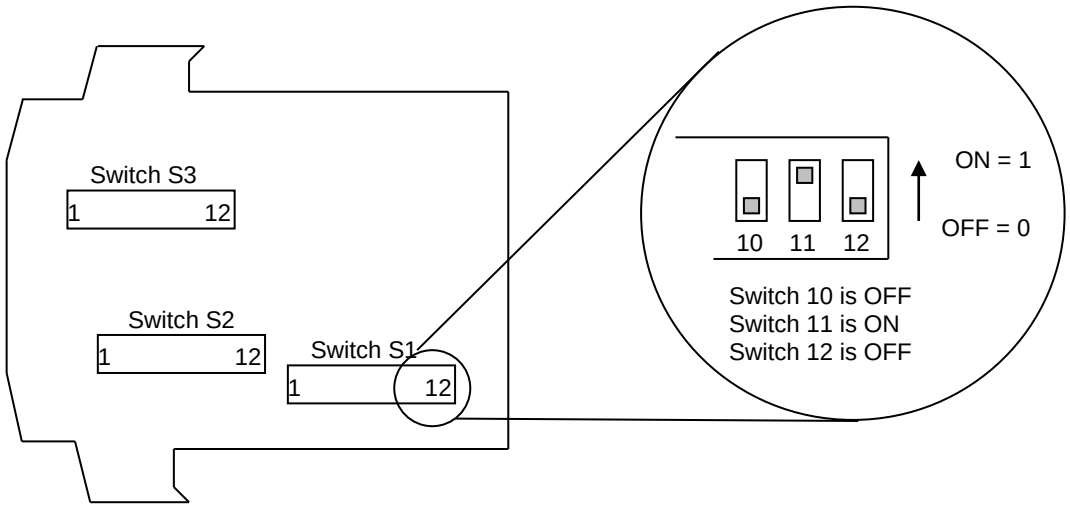
! WARNING !
DO NOT OPEN UNIT OR ADJUST SWITCHES WITH POWER SUPPLY, INPUT OR OUTPUT CONNECTED

The ISOCON is an extremely versatile device which can support many different types of input. The unit is configured by turning the power off, selecting the internal switch settings required and turning the power back on.

To open the Isocon, 2 catches just below the outer terminal blocks must be pushed in gently, one at a time. The front of the case can then be pulled and the unit will come out of the box.



There are 3 switch banks, S1, S2, and S3, located inside the ISOCON as shown below:



Switch S1 and S2 configure the input type and range, and switch S3 configures the output type, range and a few additional functions. The switch settings are explained in the next few pages. The diagrams refer to switch positions 0 and 1, with 0 being OFF and 1 being ON. This is illustrated in the picture above.

4.1.1 Voltage Input:

Select the range from the table below and set Switch S1 to the required values.

Voltage Range	Switch S1											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0-1V	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**0**
0-2V	0	0	0	1								0
0-4V	0	0	1	0								0
0-5V	**0**	**1**	**0**	**0**								**0**
0-7.5V	1	0	0	0								0
0-8V	0	0	1	1								0
0-10V	**0**	**1**	**0**	**1**								**0**
0-15V	1	0	0	1								0
0-20V	0	1	1	0								0
0-30V	1	0	1	0								0
0-40V	0	1	1	1								0
1-5V	**0**	**1**	**0**	**0**								**1**
-5 to +5V	1	1	0	0								**1**
-10 to +10V	1	1	0	1	0	1	0	0	1	1	0	0

Then select the required setting from the table below for switch S2

Voltage Range	Switch S2											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0-30V & 0-40V Ranges	0	0	1	1	0	0	1	1	0	0	0	0
All other Ranges Listed Above	0	0	1	0	1	0	1	0	0	0	0	0

! WARNING !
DO NOT OPEN UNIT OR ADJUST SWITCHES WITH POWER SUPPLY, INPUT OR OUTPUT CONNECTED

Please note that PC Software is available to provide information on switch settings for your input and output requirements.

4.1.2 Current Input

Select the range from the table below and set Switch S1 to the required values.

mA Range	Switch S1											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0-1mA	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**0**
0-2mA	0	0	0	1								0
0-4mA	0	0	1	0								0
0-5mA	0	1	0	0								0
0-8mA	0	0	1	1								0
0-10mA	0	1	0	1								0
0-15mA	1	0	0	1								0
0-20mA	**0**	**1**	**1**	**0**								**0**
0-30mA	1	0	1	0								0
4-20mA	**0**	**1**	**1**	**0**								**1**
4-40mA	0	1	1	1								1
4-30mA	1	0	1	0								1
-5 to +5mA	1	1	0	0								1
-10 to +10mA	1	1	0	1	0	0	0	0	1	1	1	0

Then select the required setting from the table below for switch S2

mA Range	Switch S2											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Using Internal 24V Tx Supply for 4 to 20mA	1	1	0	1	0	0	1	1	0	0	1	0
Unipolar Ranges (e.g. 0-20mA, 4-20mA)	1	1	0	0	0	0	1	1	0	0	0	0
Bipolar Ranges (e.g. -10 to +10mA)	1	1	0	0	1	0	1	0	0	0	0	0

! WARNING !
DO NOT OPEN UNIT OR ADJUST SWITCHES WITH POWER SUPPLY, INPUT OR OUTPUT CONNECTED

Please note that PC Software is available to provide information on switch settings for your input and output requirements.

4.1.3 Millivolt (mV) Input

Select the range from the table below and set Switch S1 to the required values.

mV Range	Switch S1											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
0-25mV	0	0	0	0	0	0	0	1	1	1	0	0
0-50mV	0	0	0	1								
0-100mV	**0**	**0**	**1**	**0**								
0-125mV	0	1	0	0								
0-150mV	1	0	0	0								
0-200mV	**0**	**0**	**1**	**1**								
0-250mV	0	1	0	1								
0-300mV	1	0	0	1								
0-500mV	**0**	**1**	**1**	**0**								
0-600mV	1	0	1	0								
0-1000mV	0	1	1	1								
0-1200mV	1	0	1	1								
-125 to +125mV	1	1	0	0								
-125 to +1000mV	1	1	1	1	0	0	0	1	1	1	0	0

And then select the required setting from the table below for switch S2

mV Range	Switch S2											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
All Unipolar Ranges (e.g. 0-500mV)	0	1	0	0	0	0	1	1	0	0	0	0
Bipolar Ranges (e.g. -125 to +125mV)	0	1	0	0	1	0	1	0	0	0	0	0

! WARNING !
DO NOT OPEN UNIT OR ADJUST SWITCHES WITH POWER SUPPLY, INPUT OR OUTPUT CONNECTED

Please note that PC Software is available to provide information on switch settings for your input and output requirements.

4.1.4 Potentiometer Input

Select the range from the table below and set Switch S1 to the required values.

Potentiometer Input	Switch S1											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2 Wire 0-125R	0	0	0	0	0	0	0	1	1	1	0	1
2 Wire 0-250R	0	0	0	1								
2 Wire 0-500R	**0**	**0**	**1**	**0**								
2 Wire 0-625R	0	1	0	0								
2 Wire 0-750R	1	0	0	0								
2 Wire 0-1K	**0**	**0**	**1**	**1**	0	0	0	1	1	1	0	1
3 Wire from 0-1K to 0-100K	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**1**	**1**	**1**	**0**

Then select the required setting from the table below for switch S2

Potentiometer Input	Switch S2											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
2 Wire Potentiometer	0	1	0	0	1	0	0	1	0	0	0	1
3 Wire Potentiometer	0	0	1	1	0	0	1	1	0	0	1	0

! WARNING !
DO NOT OPEN UNIT OR ADJUST SWITCHES WITH POWER SUPPLY, INPUT OR OUTPUT CONNECTED

Please note that PC Software is available to provide information on switch settings for your input and output requirements.

4.1.5 Thermocouple Input

Select the range from the table below and set Switch S1 to the required values.

Switch S1 for Thermocouple Input

Temperature Range in °C			Switch												
K J R S N E	B	T	1	2	3	4	5	6	7	8	9	10	11	12	
0 to 100	400 to 500	0 to 50	0	0	0	0		0	0		0				
0 to 200	400 to 600	0 to 100	0	0	0	1									T/C Type
0 to 400	400 to 800	0 to 200	0	0	1	0									
0 to 800	400 to 1200	0 to 400	0	0	1	1									
0 to 125	400 to 525	-50 to 50	0	1	0	0						0	0	0	K
0 to 250	400 to 650	-50 to 100	0	1	0	1						0	0	1	J
0 to 500	400 to 900	-50 to 200	0	1	1	0						0	1	0	R
0 to 1000	400 to 1400	-50 to 400	0	1	1	1						0	1	1	S
0 to 150	400 to 550	-100 to 50	1	0	0	0						1	0	0	N
0 to 300	400 to 700	-100 to 100	1	0	0	1						1	0	1	E
0 to 600	400 to 1000	-100 to 200	1	0	1	0						1	1	0	B
0 to 1200*	400 to 1600	-100 to 400	1	0	1	1						1	1	1	T
0 to 175	400 to 575	-200 to 50	1	1	0	0									
0 to 350	400 to 750	-200 to 100	1	1	0	1									
0 to 700	400 to 1100	-200 to 200	1	1	1	0									
0 to 1400**	400 to 1800	-200 to 400	1	1	1	1		0	0		0				

Linearisation ON 0
Linearisation off 1

CJC ON 0
CJC off 1

* n/a for types N and E
** n/a for types K, J, N and E

Then select the required setting from the table below for switch S2

Thermocouple	Switch S2											
	1	2	3	4	5	6	7	8	9	10	11	12
All Ranges	0	1	0	0	1	1	1	0	0	0	0	0

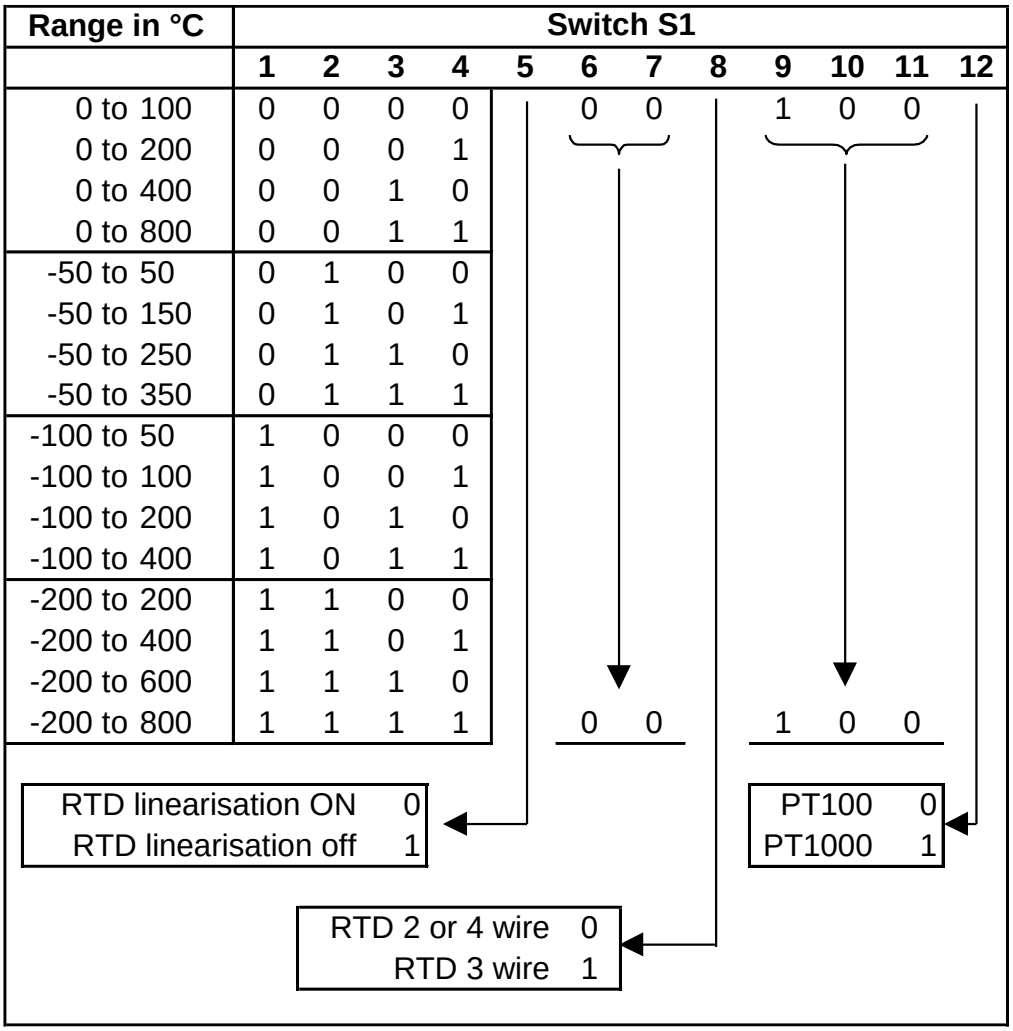
! WARNING !
DO NOT OPEN UNIT OR ADJUST SWITCHES WITH POWER SUPPLY, INPUT OR OUTPUT CONNECTED

Please note that PC Software is available to provide information on switch settings for your input and output requirements.

4.1.6 RTD Input

Select the range from the table below and set Switch S1 to the required values.

Range in °C	Switch S1											
	1	2	3	4	5	6	7	8	9	10	11	12
0 to 100	0	0	0	0		0	0		1	0	0	
0 to 200	0	0	0	1								
0 to 400	0	0	1	0								
0 to 800	0	0	1	1								
-50 to 50	0	1	0	0								
-50 to 150	0	1	0	1								
-50 to 250	0	1	1	0								
-50 to 350	0	1	1	1								
-100 to 50	1	0	0	0								
-100 to 100	1	0	0	1								
-100 to 200	1	0	1	0								
-100 to 400	1	0	1	1								
-200 to 200	1	1	0	0								
-200 to 400	1	1	0	1								
-200 to 600	1	1	1	0								
-200 to 800	1	1	1	1		0	0		1	0	0	



And then select the required setting from the table below for switch S2

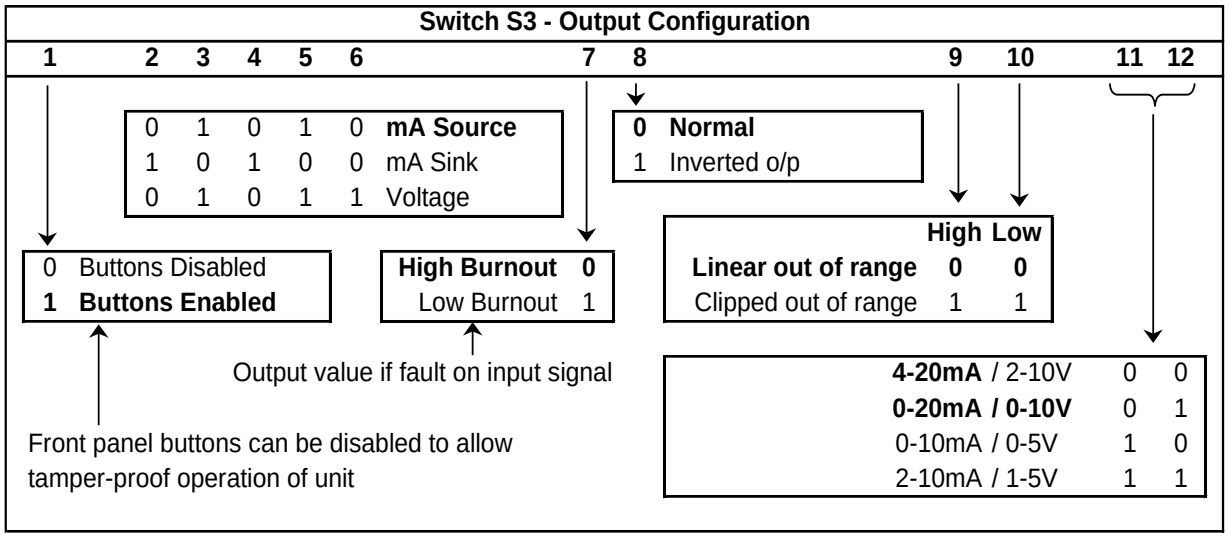
RTD	Switch S2											
	1	2	3	4	5	6	7	8	9	10	11	12
2 Wire RTD	0	1	0	0	1	0	0	1	0	0	0	1
3 Wire RTD	0	1	0	0	0	0	0	0	1	0	0	1
4 Wire RTD	0	1	0	0	0	0	0	1	0	1	0	0

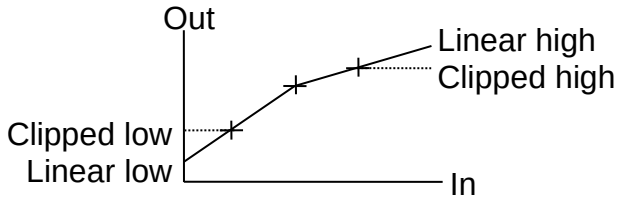
! WARNING !
DO NOT OPEN UNIT OR ADJUST SWITCHES WITH POWER SUPPLY, INPUT OR OUTPUT CONNECTED

Please note that PC Software is available to provide information on switch settings for your input and output requirements.

4.1.7 Output Configuration

Select the range from the table below and set Switch S3 to the required values.





e.g. 3 real points have been programmed, and a linear interpolation of them is used to calculate the output value. Beyond the range of these points, switches 9 and 10 control if output is linear or clipped.

Examples:

Switch S3 Examples												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
4-20mA Source	1	0	1	0	1	0	0	0	0	0	0	0
0-20mA Source	1	0	1	0	1	0	0	0	0	0	0	1
0-10V	1	0	1	0	1	1	0	0	0	0	0	1
4-20mA Sink	1	1	0	1	0	0	0	0	0	0	0	0

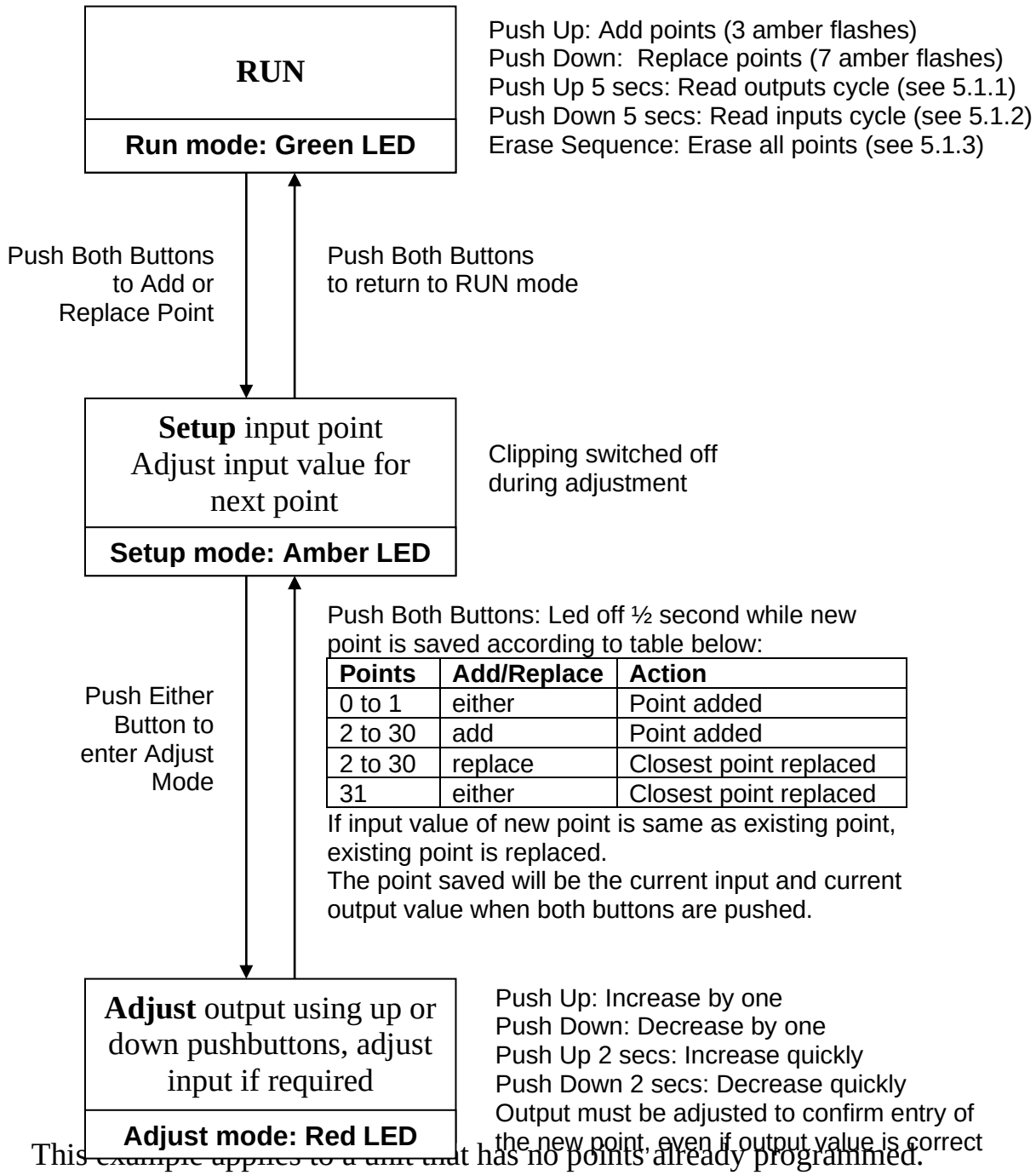
! WARNING !
DO NOT OPEN UNIT OR ADJUST SWITCHES WITH POWER SUPPLY, INPUT OR OUTPUT CONNECTED

Please note that PC Software is available to provide information on switch settings for your input and output requirements.

5. CALIBRATING THE ISOCON-LIN

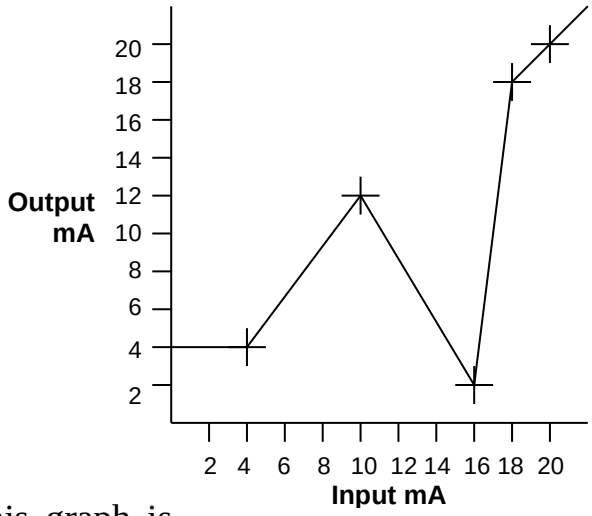
When the unit is shipped the ISOCON-LIN will be calibrated with linearisation points for the input and output types and ranges on the side label. If this label is blank then the unit will be setup for 4-20mA input and 4-20mA source output, but it will have no linearisation points programmed and therefore will not have been "calibrated". It will initially rely on two default points generated from reading switches 8,11 and 12.

The flowchart below shows how to program points.



This example applies to a unit that has no points already programmed.

IN (mA)	OUT (mA)
up to 4	4
4	4
10	12
16	2
18	18
20	20



The closest output range for this graph is 4-20mA, so S3: 6,11,12 are off. The output is clipped at the low end and linear at the high end so 10 is on and 9 is off. S3 should therefore be 1,3,5,10 on. Setup the input switches for 4-20mA : S1 is 2,3,9,10,11,12 on, S2 is 1,2,7,8 on. Connect up inputs and switch on. Green led indicates it is in run mode. After power up it is configured to add points by default.

1) Press and release both buttons. Led will go amber.
2) Apply 4mA to the input. Press and release the up button. Led will go red.
3) Adjust the output to be 4mA using the up and down buttons.
4) Press and release both buttons. Led will go off for ½ a second then go amber.
5) Apply 20mA to the input. Press and release the up button. Led will go red.
6) Adjust the output to be 20mA using the up and down buttons.
7) Press and release both buttons. Led will go off for ½ a second then go amber.
8) Apply 16mA to the input. Press and release the up button. Led will go red.
9) Adjust the output to be 2mA using the up and down buttons.
10) Press and release both buttons. Led will go off for ½ a second then go amber.
11) Repeat steps 8 to 10 for the other 2 points.
12) Led is amber. Press and release both buttons. Led will go green again.
13) Values can be verified using the read outputs and read inputs cycle.

If a value needs to be tweaked (e.g. you now wanted 16mA in: 5mA out), push the down button when the led is green to make it replace points (7 amber flashes). Push and release both buttons. Led will go amber. Follow steps 8 to 10 again, this time adjusting the output to 5mA. When led is amber, press and release both buttons. Led will go green again and values can be verified if required.

To add another point, push the up button when the led is green to make it add points (3 amber flashes). Enter the new point as before (steps 1,8,9,10,12 and 13).

5.1.1 Read outputs cycle

The output values of all points can be seen in run mode. Push and hold the up button until the led goes off and release it to view the output value of the first point. Push and release the up button to cycle through the other points until the led goes green again. (If there are no points programmed the led will go green again when the button is first released).

5.1.2 Read inputs cycle

An interpretation of the input values of all points can be seen in run mode. Push and hold the down button until the led goes off and release it to view the value of the first point. Push and release the down button to cycle through the other points until the led goes green again. The values seen are scaled from the output values of the lowest and highest point, in proportion to the input values used. The real input values can be calculated from the following process.

- Write down output values in a column labelled OUT. The first value is P_FOUT, the last value is P_LOUT.
- Write down input values in a column labelled IN.
- Read or measure the real input value for the first point (P_FIN) and last point (P_LIN). (You could measure these values by putting in different input values in run mode until you got the corresponding OUT value).
- Start a new column labelled IN(real) and put P_FIN as the first value and P_LIN as the last value.
- Calculate (P_LIN - P_FIN) / (P_LOUT – P_FOUT), make a note of this value, call it C.
- Take each value from the column IN, subtract P_FOUT, multiply by C, add P_FIN. This is the value for IN(real).

$$IN(real) = (IN - P_FOUT) * \frac{(P_LIN - P_FIN)}{(P_LOUT - P_FOUT)} + P_FIN$$

5.1.3 Erase points

The points can be erased in run mode using the push buttons by following this sequence:	push both release up push up release down push down
The led will flash red, amber, green five times to confirm this action.	release down push down release up release down

The points can also be erased using the switches: Switch power off, disconnect the output terminals, make a change to switch S3-11 or S3-12, and switch power on again. You must now power off, change switch S3-11 or S3-12 back again, insert the output terminals and power on.

5.1.4 Recommendations

By default the unit is configured to add new points after a power up. We recommend that the first two points programmed are at either end of the input scale. This is because in setup mode when one point has been programmed it uses that and the default point furthest away to determine what output value to use. If the first point was somewhere in the middle, the linear line between the output values of that and the default point may not cover enough of the output range to allow the output value of the next point to be setup easily.

5.1.5 Default and real points

In run mode and setup mode points are used to generate the output from this table:

Points	**Points used**
0	2 default (based on S3: 8,11,12)
1	Real point plus default point furthest from real point
2 to 31	2 closest real points

5.1.6 Programming trick

When you push both buttons to go from adjust mode (red led) to setup mode (amber led), it saves the current input and output value as the new point. This means that in setup mode you could apply the wrong input value to get an output value close to the output value required for the new point. Once in adjust mode remember to apply the correct input value for the new point.
In adjust mode, averaging is applied to the input value to improve the overall accuracy of the point saved.

5.1.7 Calibrating a thermocouple input

When the unit is used to convert a thermocouple input it is important when calibrating to ensure that the thermocouple simulator employed is switched to automatic cold junction compensation and is at the same ambient temperature as the ISOCON. Note that this is not always easy to achieve, especially if the ISOCON is mounted in a warm cabinet. An alternative method is to use an ice-point reference and a mV source.

6. INSTALLATION

The ISOCON's input and output circuits are classed as Separated Extra Low Voltage (SELV). This means that they must not be externally connected to voltages exceeding 30V ac or 60V dc, nor do they generate voltages above these limits internally. Where a higher voltage input is required a specially designed DIVIDER unit can be used to condition the input signal prior to connection to the process input terminals.

The ISOCON unit clips directly onto 'Top Hat' (TS35) symmetrical DIN rail. Ideally, mounting orientation should be vertical, with the power supply situated on the top face to minimise temperature rise. Good airflow around the unit will maximise reliability of the instrument.

The use of bootlace ferrules is recommended on wiring terminations.

Do not exceed terminal torque rating of 0.4 Nm – use an appropriate screwdriver. The unit can be removed from the DIN rail by sliding a small screwdriver into the slot at the rear of the enclosure on the lower face and gently levering the metal clip, whilst lifting the unit from the rail.

7. TROUBLESHOOTING

The ISOCON-LIN has some built in self diagnostic functions. If the LED on the front panel is flashing then the fault can be found by counting the number of flashes between gaps and using the table below to locate the problem.

No of Flashes	Nature of Fault	Corrective Action
0 (Green On)	Unit Working – no suspected fault	Check Wiring and switch settings
2,3,8,9, 10,11,12 Green	Hardware Error, extreme noise, poor supply	Switch off unit, check switch settings, and wiring, and retry. If still faulty please contact supplier
6 Green	Corrupt linearisation points in eeprom	Push and release both buttons. This will cause the corrupt data in the eeprom to be overwritten, default points loaded according to the switch settings. The points will then need to be re-entered.
7 Green	RTD / Thermocouple burnout	Repair RTD, T/C or wiring
No LED	Power Failure	Check supply lines and voltage

7.1 Incorrect Reading

- Check that Unit is configured for the correct Sensor
- Check that Input Scaling is as required.
- Check that Linearisation has not been set incorrectly.
- Check that Thermocouples have correct compensation cables, and polarity.
- Check that RTD is set for correct option 2, 3 or 4 Wire.
- Check that RTD leads are connected to appropriate terminal pins.

7.2 Sensor Failure

- Check that sensor wiring is correct.
- Check Thermocouple polarity.
- Check that all RTD leads are connected to correct terminals.
- Check that the ISOCON is configured for correct sensor.
- Check that applied voltage is not out of range.
- Check that applied current is not out of range.
- Check that applied millivoltage is not out of range.

8. SPECIFICATIONS (@ 25°C)

Operating Temperature	0 to 55 °C
Operating Altitude	Sea Level to 2000m
Humidity	0-90% RH
Power Requirements	
DC Supply	12 to 36Vdc
AC Supply	12 to 32Vac
Current Consumption	55mA @ 24Vdc (20mA in & out)
	85mA @ 24Vdc (maximum load, tx supply)
	200mA @ 12Vdc (maximum load, tx supply)
	260mA for 50ms on 24Vdc power up
Transmitter Power Supply	22V to 29V @ up to 24mA
	Dependant on supply voltage and load
Calibration accuracy	±0.05% full scale
Linearity	±0.05% full scale
Temperature Stability	50ppm / °C
Input Impedance:	
Current Input	15 ohms
Voltage Input	1 Mohm
Millivolt Input	Greater Than 10 Mohm
Thermocouple Burn Out Current:	500nA Nominal
Cold junction compensation accuracy	±0.5°C over operating range
Maximum Voltage Output	11.5 V into a minimum of 7Kohm
Maximum Current Output	23.0 mA into a maximum of 1Kohm
Time Response (90% of step change):	50ms ± 10ms

Unit has full 3 port Isolation to 1kV between Power Supply, Input and Output.
The unit can also withstand transients of 2.5kV for 50 µsecs.

Dimensions	114.5 mm x 99mm x 12.5mm (H x D x W)
Mounting	DIN Rail TS35
Connections	Screw Clamp with pressure plate
Conductor Size	0.5 to 4.0 mm
Insulation Stripping	12 mm
Maximum Terminal Torque	0.4 Nm
Weight	Approx. 95g
EMC	BS EN61326
LVD Standards	EN61010-1
Installation Category (IEC 664)	II
Pollution Degree (EN61010-1)	2
Equipment Class (IEC 536)	II