

FREQUENCY TO ANALOGUE CONVERTER

Type B12-10b

User Guide

Continuous development may necessitate
changes in these details without notice

Document Ref: UDB12-10.vp Rev 2



PROCESS MEASUREMENT, CONTROL & DISPLAY INSTRUMENTATION

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WARNING!

It is important that this guide is read and fully understood before attempting installation or commissioning of the instrument. Instructions appearing in this document, and current safety legislation, must be observed to ensure personal safety and to prevent damage to the instrument or equipment connected to it.

The instrument should be installed, commissioned and operated *only* by suitably qualified and authorised personnel.

Safety and EMC information

Safety: EN61010 -1

Immunity: EN50082-1

Emissions: EN50081-1

CE certified



The specifications for the instrument must not be exceeded. If the instrument is used in a manner not specified, the protection provided by the instrument may be compromised.



The instrument must be installed in an enclosure that provides adequate protection against electric shock.



Ensure that power to the instrument is switched off and signal wiring isolated from hazardous voltages before carrying out installation or maintenance.



The instrument is designed for installation in a clean, dry environment (Pollution degree 1).



Stroud Instruments Ltd strongly recommends that repairs and re-calibration work are done on a return to factory basis in order that our quality standards, product specifications and safety precautions are not compromised.



The instrument is double insulated

Note: Clean with a moist cloth - USE NO SOLVENTS.

Installation



WARNING: Installation should be conducted by appropriately skilled and authorised personnel only.



WARNING: Ensure that power to the instrument is switched off and signal wiring isolated from hazardous voltages before carrying out installation.



WARNING: The instrument must be installed in an enclosure that provides adequate protection against electric shock.

Location

- The instrument is designed for installation in a clean, dry environment
- Do not install near to switch gear, motor controllers or other sources of strong magnetic fields.
- Avoid exposure to direct sunlight and ensure the ambient temperature inside the enclosure that the unit is mounted in will not exceed our specification.

Fixing

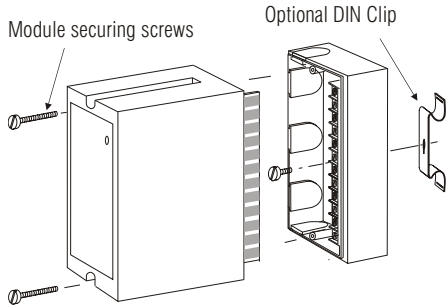
B12 Series Modules are designed to be fitted to a flat dry surface using two 4mm screws. Alternatively, by fitting an optional DIN clip, they may be clipped to a rail conforming to BS5584:1978, EN50 022, DIN46277-3.

Grommets are provided on three sides of the base section and there are two rear entry knock outs in the bottom.

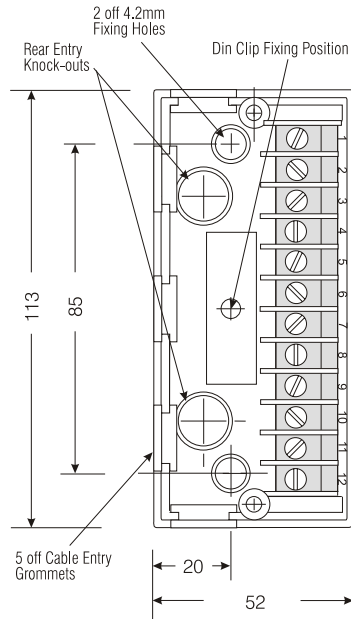
To gain access to fixing points:

- (i) Remove the plug-in module securing screws.
- (ii) Gently pull away the plug-in module from the base section.

- (iii) To refit the module, align the module edge connectors with the socket in the base and carefully press home. NB do not overtighten the module securing screws.



Dimensions and fixing positions



Depth of unit 106mm

Wiring and connections

- Segregate power supply and signal wiring.
- Use screened cable for all signal wiring with the screen earthed at instrument end only.
- All connections should be made using ferrules.

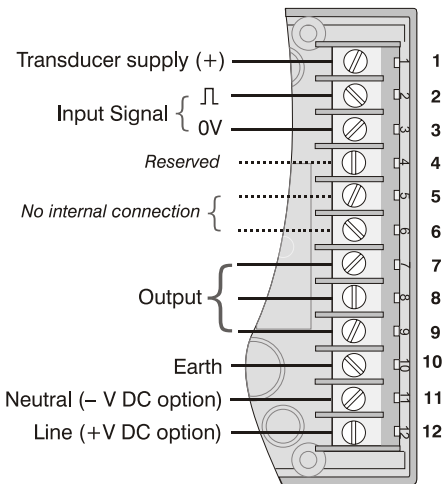
Screw terminals are provided - wire capacity $2 \times 1.5\text{mm}^2$ (approx. 16 AWG).

Access to terminals



WARNING: Ensure that power to the instrument is switched off and signal wiring isolated from hazardous voltages

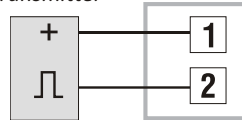
Loosen the two module securing screws. Gently pull away the top section of the module from its base to expose the fixing points and wiring terminals. To refit the module, align the module edge connectors with the socket in the base and carefully press home. **NB** do not over tighten the module securing screws.



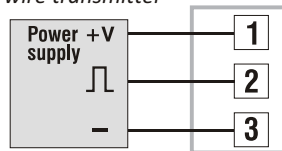
Input connections

The input is factory configured for one type of input only - see data label on enclosure for details of the type fitted. The input type is not user configurable and if changes are required, the unit must be returned to Stroud Instruments Ltd.

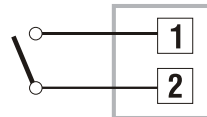
Two-wire transmitter



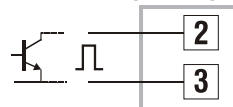
Three-wire transmitter



Volt-free contact



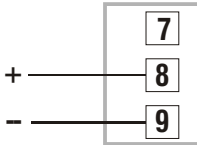
Open-collector and voltage change



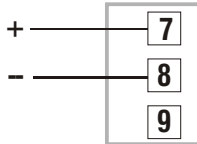
Output connections

Outputs are calibrated to order and are not user configurable - *see data label on enclosure for calibration details*. A change in the type of output will require a return to factory for re-configuration.

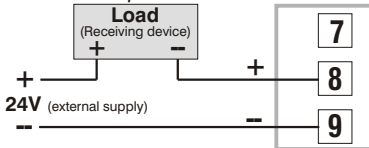
Voltage output



Current output



Current sink output



Power supply connections

This instrument is supplied in *one* of two power supply versions.

1. AC mains supply either: 110V, 220V or 230V \pm 50/60Hz, 5VA.
2. Low voltage supply: 11-32VDC 4W / 12-24VAC.



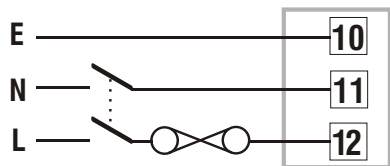
WARNING: Check that the supply voltage on the data label (on side of instrument) is suitable for the application.



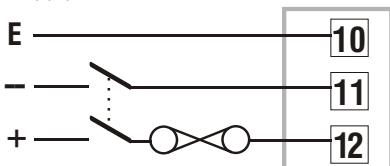
WARNING: Ferrules must be used for AC mains power wiring

Power supply wiring to the instrument should be protected by a suitable fuse and double pole switch - *see below*. The switch should be clearly marked as the isolating switch for the instrument.

AC supply



DC supply



Operation

The B12-10b provides an output current or voltage which is proportional to the frequency of an alternating voltage or pulse input signals. Digital and analogue filtering are provided to optimise performance to site conditions.

Optional computer software and infra red link enable ranging to be adjusted, e.g. to suit a turbine meter replacement, and other parameters tuned to filter the effects of input signal noise.

Input/Output configuration

The B12-10b is configured for a particular type of transducer and output signal during manufacture. For a change of either input type or output signal, the instrument should be returned to Stroud Instruments Ltd. Output signal span and zero are calibrated during manufacture and adjustment is not required.

Input signal level

The 'Level' control accessed through the front panel, sets the sensitivity or trigger threshold for the instrument. Turning the level control anticlockwise will decrease the trigger point making the instrument more sensitive to lower amplitude signals. To reduce sensitivity to noise, the level control should be turned clockwise (decreases sensitivity) until the output signal falls and then back off the control until reliable triggering off the input signal is achieved.

Setting up for programming

Programming the B12-10b requires the optional Software and Infra red link adaptor

kit. The minimum software/hardware requirements are: Windows™ 95/98/NT/ME/2000; PC with Pentium 133 Mhz, 32Mb RAM and vacant USB port. Communication is via an infra red link.

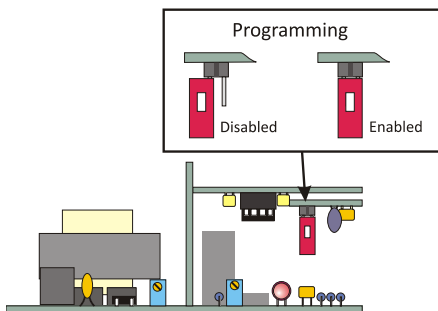
Important note !

To improve noise immunity in areas near to variable speed drives, switch gear or other sources of strong magnetic fields, the B12-10b is supplied with programming disabled by an internal link. To enable programming proceed as follows:

1. To gain access to the link, refer to 'Opening the module' on page 9
2. Locate the link on the sub-board, unplug the link and reinsert in the 'Enabled' position as shown below.
3. Refer to 'Re-assembly' on page 10 to reassemble the module - **IMPORTANT ! and noting the location of sub-board.**



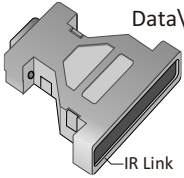
WARNING - Electric shock hazard
Do not attempt to programme the unit out of its enclosure.



Please note: to maximise noise immunity, the link should be replaced in the 'Disabled position' after programming.

Hardware installation

Before connecting to PC, install the USB Link IR driver from the SIL CD: run



Data\software\USB-Link\setup.exe'.

Further instructions for installing the USB Link IR will appear on screen at end of the driver installation.

Software installation

On the SIL CD, locate and run '`\Data\software\107-10\setup.exe`'-also on the SIL website www.sil.co.uk/software.htm

Positioning the IR Link transceiver

Infrared communications are effective at distances up to one metre. The IR Link Transceiver must be pointed at the apertures in the side of the B12-10b Frequency to Analogue unit. The IR Link Transceiver has a beam angle of approximately 15° so alignment is not critical however the line of sight must be unobstructed.

NB If there are other B12-10b (or 107-10B) units in the vicinity, ensure they are shielded from the infrared beam.

Setting up the IR link

Before communication with the B12-10b can be initiated, the software must be configured for the appropriate serial (COM) port. Open the B12-10b programmer application and select the appropriate COM port from the 'Communications Port' drop down list (*bottom left hand of the application window*).

Confirm communication with the B12-10b has been established by clicking the "Read current settings from unit" button. Refer to

'Troubleshooting' (page 5) if no reply is received from the B12-10b.

Programming

Settings are stored in non-volatile memory. To obtain the settings currently programmed into the B12-10b, click the "Read current settings from unit" button.

Digital filtering

Digital filtering enables effective attenuation of noise yet permits a rapid response to a change in the input signal.

Spurious input signals are attenuated by averaging a series of input measurements. The number of measurements used in the averaging process is specified by the '**Averaging Count**' parameter. When this is set to a count of '1', no digital filtering is performed. Increasing the Averaging Count will increase the amount of input signal filtering but will incur a proportionate increase in response time.

To enable a rapid response to a change in the input signal, the most recent input measurement is continuously compared with the current average. If the change is greater than that specified by the '**Change Threshold**' parameter (this is specified as a percentage of FSD), the current averaging cycle is abandoned and a new one started.

The characteristics of the digital filter can therefore be modified by the Change Threshold and Averaging Count parameters. Changes in input due to noise or spurious signals that do not exceed the Change Threshold will be filtered therefore increasing the Change Threshold increases the maximum change in input that can be filtered. Increasing the Averaging Count will

increase the attenuation of these spurious signals.

The response time for the output of the B12-10b to settle will depend on the number of readings specified by the Averaging Count; consequently a large value of Change Threshold will result in slow response times for all but large changes in input. The Change Threshold should therefore be set to the lowest setting that gives adequate noise rejection whilst providing satisfactory response times for the application.

With the Change Threshold set low, the value of the Averaging Count will not affect the response time for a step input change but if the input is changing very slowly, a large value of Averaging Count will cause the output signal to lag behind the input. The Averaging Count should therefore be set to the lowest value that gives sufficient filtering.

Programmable parameters

Averaging count

Spurious input signals are attenuated by averaging the number of input measurements specified by the Averaging Count. The Averaging Count is the number of measurements used for calculating the running average.

Minimum: 1 (no digital filtering)
Maximum: 20
Default: 5

Change Threshold (%)

To enable a rapid response to a change in the input signal, the most recent input measurement is continuously compared with the running average. If the change in input is greater than that specified by the

Change Threshold parameter, the current averaging cycle is abandoned and a new one started.

Minimum: 0 (no averaging)
Maximum: 100
Default: 10

Output scaling

The output signal may be scaled to any portion of the input signal frequency range with the following parameters.

1- Zero Scale Frequency (Hz)

The input signal frequency giving zero output signal.

Minimum: 0
Maximum: 10000
Default: 10000

2- Full Scale Frequency (Hz)

The input signal frequency giving full scale output signal. *(NB to function correctly three places of decimal only may be entered)*

Minimum: 0.1
Maximum: 10000
Default: 10000

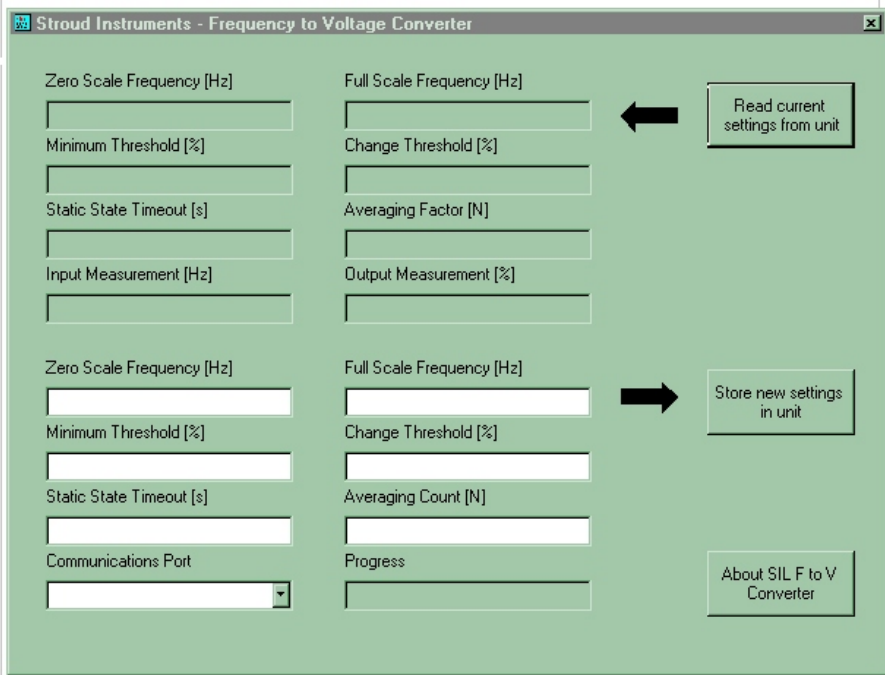
Static state timeout (seconds)

If the period in which the input signal remains unchanged exceeds this value, the current measurement is abandoned and the output signal cut to zero. In the event of a transducer or signal line failure, this facility ensures the output is not erroneously held at the last reading. The maximum allows for valid measurements to be taken with a single pulse every 4000 seconds i.e. $f=0.00025\text{Hz}$.

NB *This parameter overrides 'Minimum Threshold.'*

Minimum: 2
Maximum: 4000
Default: 2

Continued on Page 9 >



Notes:

- (i) Programmed settings are stored in non-volatile memory.
- (ii) Storing or reading parameters will cause the current measurement of the input signal to be abandoned. The software will generate a warning if a new measurement has not taken place since the last computer reading taken.
- (iii) Parameter settings are restricted by the software to valid limits. Notification is given by the software in the event of range errors.
- (iv) Fractional precision outside valid limits will be truncated on downloading to the instrument.
- (v) A warning will be given by the software if the minimum threshold setting corresponds to a time greater than the combined static state timeout for high and low states. NB Static State Timeout always takes precedence.
- (vi) Measurements outside of defined input range are clipped to limits with the exception of a 2.3% over-range which allows measurements and outputs of up to 102.3% of full scale. NB *This does not include any measurements over 10kHz.*

Minimum threshold (% of FSD)

The percentage of full scale below which the output signal is cut-off to zero (i.e. low level cut-off). This is applicable only to successful measurements within the period defined by the Static State Timeout. This parameter is more suitable for measurements that are typically well above 1Hz. As the sampling period is a minimum of one second, it will take at least this time for the output to clip to zero if such a measurement suddenly stops.

Minimum:	0
Maximum:	100
Default:	1

Note: **Default values:** These are the values programmed during manufacture if alternative values are not specified at the time of ordering.

Troubleshooting

If no response is received from the B12-10b, check the following:

- The correct COM port has been chosen.
- IR Link connections are secure.
- The B12-10b is powered up.
- The IR Link Transceiver is positioned correctly.

There are no other infrared sources which may temporarily disrupt communications.

Fuse replacement and power supply adjustments



WARNING: Switch off all supplies and isolate signal and other wiring from dangerous voltages before proceeding.

Please note: the operating supply voltage on DC and 24V AC powered versions cannot be changed by the user.

Opening the module

- (i) Remove plug-in module as described in Access to Terminals in the Installation section.
- (ii) The plate with the terminal connections label can now be removed by easing apart the longer sides of the module to release the interlocking tongue and groove.
- (iii) Note the location of the printed circuit board which must be replaced in the same position. Slide out the board.

Fuse replacement

The fuse holder is located at the edge of the circuit board adjacent to the mains transformer or low voltage power unit.

Fuse size: 20mm x 5mm dia.

Fuse ratings:

AC supply - 100mA Quick Blow

DC supply - 250mA Anti-surge

Changing AC supply voltage

Mains powered units can be adapted for operation on 110V, 220V or 230V supplies.

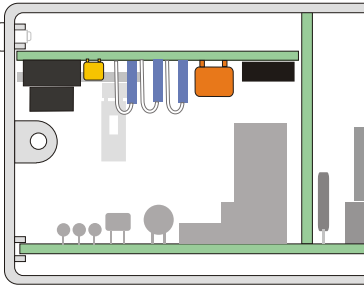


WARNING: Links for 110VAC and 220VAC must be insulated with silicon rubber sleeving.

The required link settings, shown opposite, are effected by soldered tinned copper wire links.

Replacing module cover

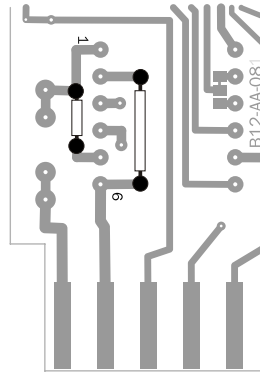
- (i) **IMPORTANT!** To ensure that the infrared transceiver aligns with the holes in the module cover, the sub-board must be located as shown below.



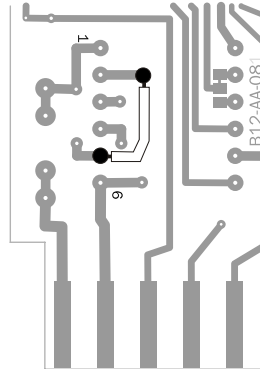
- (ii) Replace the printed circuit board ensuring correct location in the module cover slots.
- (iii) Replace the plastic plate by locating the side with the two tongues around the protruding printed circuit board and engaging into the mating grooves.
- (iv) Press the plate home to engage the single tongue.

AC mains supply links

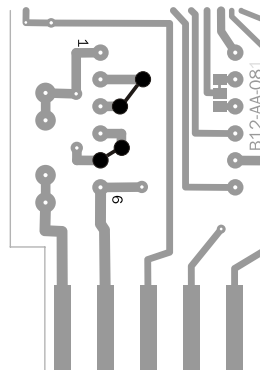
110 VAC



220 VAC



230 VAC



Specifications

Notes:

1. Input ranges are factory calibrated for one type of signal and not user configurable.

Input Type - *factory set*

Sine, square or triangular waveforms from volt-free switches, proximity switches, turbine meters, open collector (npn), current pulse, etc.

Input amplitude: 10 mV p.t.p. to 250 V R.M.S.

Current inputs: sense change in current drawn by proximity switches. Typical inputs include 1–3 mA.

Input Range: *See programmable options*

Transducer Power Supply

12VDC @ 10mA max.

Other voltages from 5V to 15V available to order.

Outputs (user selectable *except for high output drive options*)

0-10mA (2000R), 0-20 mA (1000R), 4-20 mA (1000R)

High impedance output drive options: 0-10mA (5000R), 0-20 mA (2500R), 4-20 mA (2500R)

Maximum output impedances in ohms shown in brackets.

0-5v, 1-5V, 0-10V, 2-10V (500R minimum)

Current sink 4-20mA @ 50 volts max.

Response Time

Typically 1sec without digital filtering (averaging count =1).

Isolation

The input and output are isolated from each other and from the power supply. Maximum voltage 250V RMS or 400V DC. Resistance 50×10^6 ohms measured at 1000V DC.

Calibrated Accuracy

$\pm 0.2\%$ FSD at 100% when factory calibrated.
NB Error introduced by User output range changes, typically 1% but may be corrected by span control.

Linearity Error

$\pm 0.1\%$ FSD (from 1 to 100% FSD)

Output Ripple

0.1% (peak to peak) of FSD

Load Resistance Effect

0.001% of span / 100 ohm change

Stability

Over 24 hours $\pm 0.1\%$ FSD,

Over 1 year $\pm 0.25\%$ FSD

Temperature Coefficients

Zero: $\pm 0.02\%$ span / °C, Span: $\pm 0.02\%$ span / °C

Environmental

Temperature: operating -10 to +60°C,
storage -20 to +70°C

Humidity: 0 – 95% RH non-condensing

Power Supply

AC Supply: 110, 220 or 230V $\pm 10\%$ 50/60Hz 5VA

Low voltage: 11-32VDC 4 W / 12-24VAC

Supply Voltage Rejection

Span change: $< 0.02\%$ span / % supply change.

Mechanical

Weight: approx. 0.5kg, Dimensions (mm): 106D x 52W x 113H

Enclosure: Fire retardant materials -
PPO base, ABS cover

Screw terminal wire capacity: $2 \times 1.5\text{mm}^2$