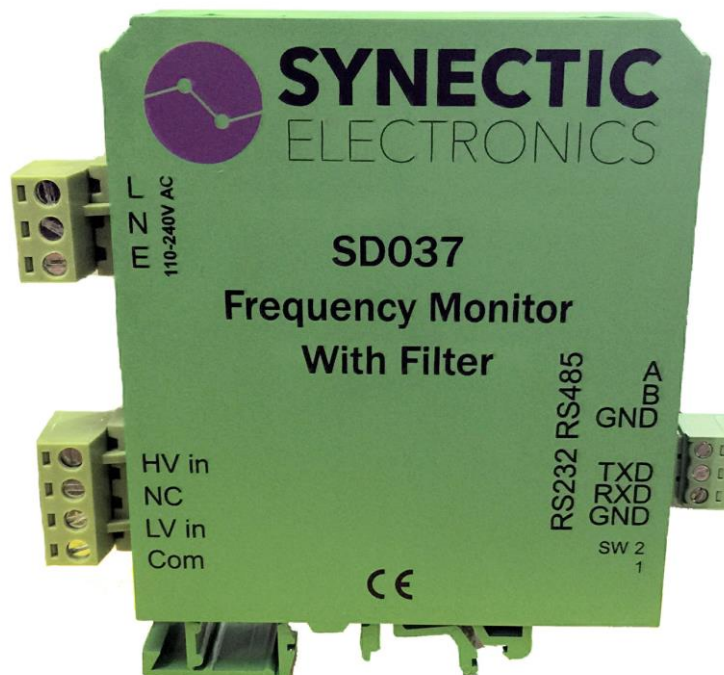


## SD037 Mains Frequency Monitor



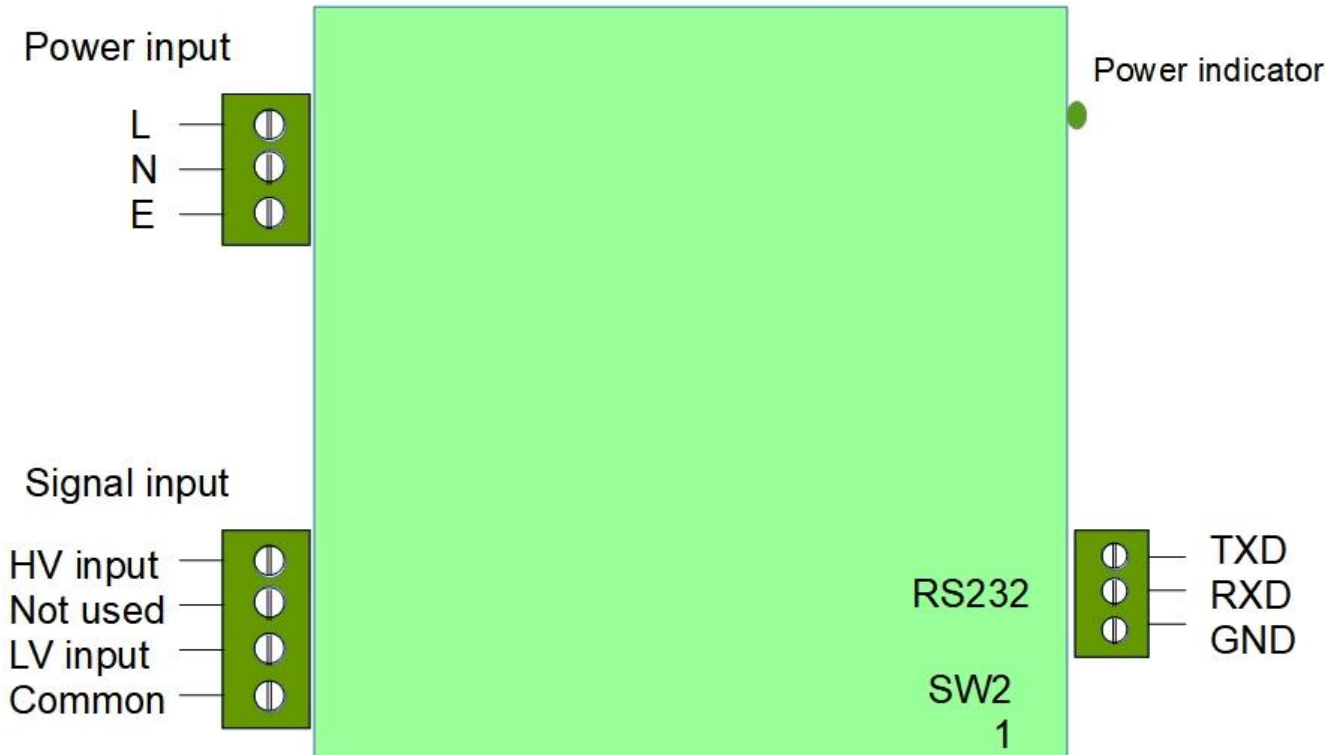
## User Instructions

SD037/-S-A-M  
RS232 ASCII & Modbus

## Description

The SD037 is designed to monitor the frequency of a mains voltage signal and report the value, on demand, via an RS232 serial interface. This version has selectable ASCII or Modbus RTU protocols. It features a 3 pole low pass Bessel filter with a -3dB frequency of 75Hz. This removes unwanted harmonics from the input signal. It is housed in a DIN rail mount case and powered from a universal input mains supply.

## Connection details



## Power

Power input is from an AC supply of between 85 and 264V, frequency 47 – 63Hz. Connect live to L, Neutral to N and Earth to E terminals.

## Signal input

For mains frequency monitoring connect Live to HV input and Earth to common. For low voltage test inputs connect between LV input and Common.

## RS232 connections

TXD = signal output, connect to RXD of communicating instrument. Pin 2 of 9 way D-type on a standard PC connector.

RXD = signal input, connect to TXD of communicating instrument. Pin 3 of 9 way D-type.

GND = signal ground. Pin 5 of 9 way D-type.

Note: RS232 signals are isolated from the rest of the instrument and each other.

## Communications protocol

Communication is by RS232 serial interface. Data format is 8 data bits, 2 stop bits, no parity.

SW2 selects which protocol is used, OFF = ASCII, ON = Modbus RTU

Baud rate is determined by the setting of SW1, located next to the RS232 connector.

With SW1 off, (UP position), the baud rate is 115k2, with the switch on (DOWN) the baud rate is 19K2.

## ASCII Protocol

The commands available use standard ASCII characters, all starting with \* (\$2A)

In the following table, <sp> indicates space (\$20), <cr> indicates carriage return (\$D) If a command is received that isn't recognised the response will be ?<cr>. A Longitudinal Redundancy Check (LRC) can be added to the frequency reading if required.

Command	Response
*ID?<cr>	Instruments identification. Eg <sp>SD037, v1.81, 1234<cr> SD037 is the model, v1.81 is the firmware version, and 1234 is the serial number
*F?<cr>	Reports the current frequency. Eg <sp>49.9708<cr>
*C16000000<cr>	Frequency calibration function. This allows the instrument to be calibrated. The internal reference oscillator is 16MHz. The actual frequency can be measured on TP1 using a calibrated frequency counter. Get a measurement to 8 digits then enter the value. The unit will echo back the received value. Eg assuming the measured value is 16000045Hz, transmit *C16000045, response is <sp>16000045<cr> Note: A shift of 200 counts results in a shift in reading of 1 mHz.
*C?<cr>	Read the current calibration value. Eg transmit *C?<cr>, response is <sp>16000045<cr>
*A02<cr>	Modbus slave address function. *A followed by a 2 digit hexadecimal number defines a new address. Valid addresses range from 01 to F7 (1 – 247). If a value outside this range is entered the response will be "Range 01 to F7" and no change will be made.
*A?<cr>	Read the current slave address. Eg transmit *A?<cr>, response is <sp>02<cr>
*L?<cr>	Report status of LRC option. Response is "LRC Enabled"<cr> or "LRC Disabled"<cr>
*L1<cr>	Enable LRC option.
*L0<cr>	Disable LRC option

## LRC implementation

To calculate the LRC, add all bytes transmitted by the \*F? Command, AND result with \$FF, then XOR with \$FF, add 1 and AND with \$FF.

eg. for the \*F? example above:

ASCII <sp> 4 9 . 9 7 0 8 <cr>

hex 20+34+39+2E+39+37+30+38+0D = 1A0

1A0 AND FF = A0, A0 XOR FF = 5F, 5F+1 = 60 = LRC

## Frequency measurement accuracy

The frequency is initially calibrated to an accuracy of +/- 0.0001Hz. According to the crystal oscillator manufacturer's data, drift in the 1<sup>st</sup> year is +/- 5ppm = +/- 0.0003Hz max.

Over the following 10 year period, drift is +/-10ppm = +/-0.0005Hz

## Modbus RTU Protocol

To read the measured frequency to 4 decimal places, Modbus function code 03 is used to read two 16 bit holding registers. Stored in the registers is a 24bit hexadecimal value relating to the frequency x 10000. The Communication Log below shows an example of a frequency measurement.

The transmitted sequence is

Slave address 02

Function code

03

Starting Address

0000

No. of registers

0002

CRC check

C438

Response

Slave address 02

Function code 03

Byte count 04

Frequency

077F66

CRC check C438


The frequency in hex is

077F66 = decimal 491366 /10000 = 49.1366Hz

### Communication Log

```
>11:56:54: Connected using RTU to COM9
>11:57:09: TX: 02 03 00 00 00 02 c4 38
>11:57:09: RX: 02 03 04 00 07 7f 66 d8 e8
>11:57:09: Read succeeded: Function code:3.
```

## Specifications

Parameter	Min	Typ	Max
Power supply voltage	85Vrms		264Vrms
Power supply frequency	47Hz		63Hz
HV input signal	20Vrms		250Vrms
LV input signal	2Vrms		25Vrms
Frequency measurement range	10Hz		90Hz
Low pass filter cutoff (-3dB)		75Hz	
RS232 isolation	2500Vrms for 1min as per UL1577		
Frequency stability	+/-30ppm over temperature range -20C to 70C		
Enclosure	DIN rail 22.5x82x90mm. Green flame retardant PA 66 UL 94-V0		
	The CE mark confirms the compliance with European Directives, notably the Low Voltage Directive and the EMC Directive		