

FC 2420

Linearised Frequency - Current Converter

User Instructions

ELECTRICAL SAFETY PRECAUTIONS

This equipment is protected in accordance with IEC Safety Class 1. It has been designed and tested according to EN60950 (Safety of information technology equipment), and has been supplied in a safe condition. The following precautions must be observed by the user to ensure safe operation.

Defects and abnormal stresses

Whenever it is likely that protection has been impaired, for example as a result of damage caused by abuse, severe conditions of transport or storage the equipment shall be made inoperative and secured against unintended operation.

Removal of covers

Removal of the covers is likely to expose live parts although reasonable precautions have been taken in the design of the equipment to shield such parts. The equipment shall be disconnected from the supply before carrying out any adjustments, replacement or maintenance and repair during which the equipment shall be opened. If any adjustment, maintenance or repair under voltage is inevitable it shall only be carried out by a skilled person who is aware of the hazard involved.

Mains plug

When the equipment is supplied with a mains plug it must be used with a socket that has an earth connection. The absence of an earth connection could make the equipment dangerous.

Fuses

Note there is a supply fuse in the live power supply connection. Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of mended fuses and the short-circuiting of fuse holders shall be avoided.

To provide protection against breakdown of the supply lead, its connectors and filter when fitted, an external supply fuse should be used in the live lead. The fuse should have a continuous rating not exceeding 3A.

Introduction

FC 2420 Features

The FC 2420 converts the output frequency from Webster turbine flow meters into a 4-20 mA signal for accurate transmission to a remote analogue readout, data acquisition system or other device. The FC 2420 has two independent microprocessor controlled channels. Each channel can be separately linearised to give an accuracy of better than 1% of the indicated reading.

- Dual channel, K factor linearisation, frequency-current converter
- Option of fast or slow sampling
- Very low ripple (in comparison with a charge pump)
- Good temperature stability - low drift characteristics
- True current source, option of 4-20 mA and 0-16 mA.
- Ability to sum outputs
- Calibration using dipswitches

Your device

Unpack the device.

You will have the following components: -

1. One FC 2420 frequency - current converter
2. One instruction manual
3. One 25-way 1m screened cable (optional)
4. One orange DIN rail interface connector (optional)

Your device has been set-up as follows

Serial no.

Channel 1 (controlled by J2 - see back page) has been configured for use with a

Channel 2 (controlled by J1 - see back page) has been configured for use with a

Power supply set for use with

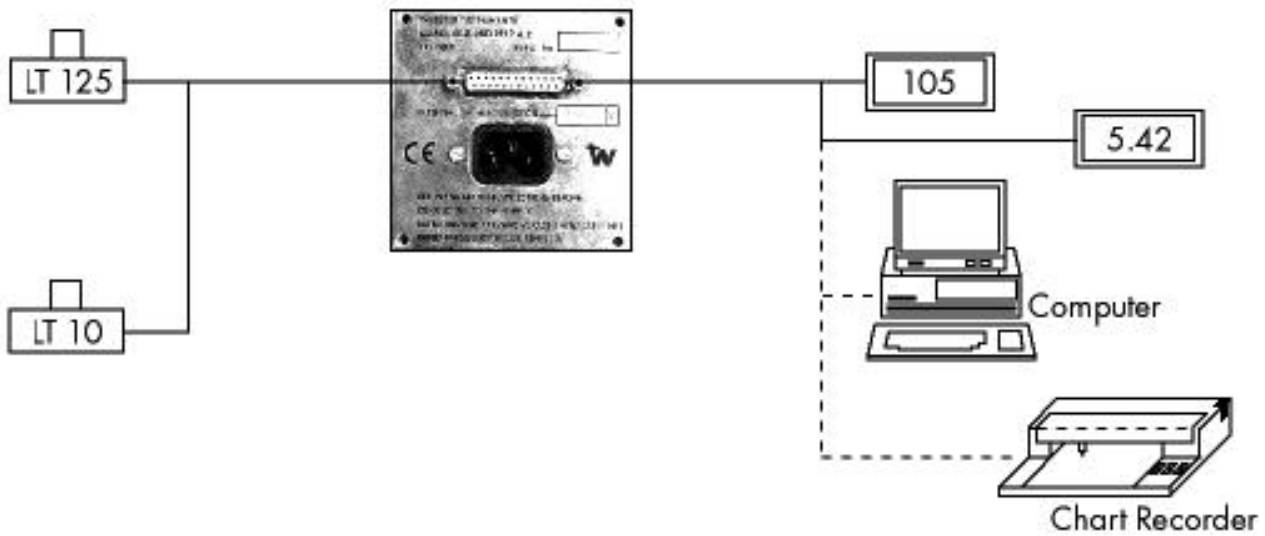
Built by

Getting started

The current output can be connected to a variety of different devices, such as digital readouts, data acquisition systems, and chart recorders.

FLOW BLOCKS

READOUTS

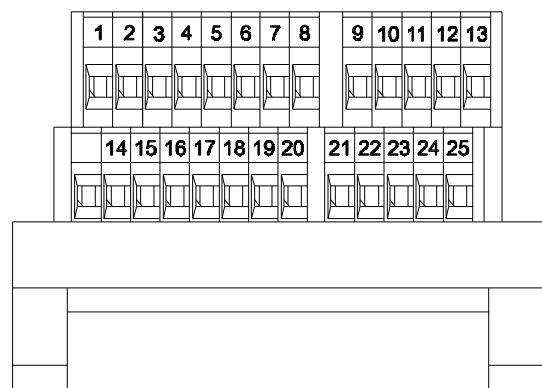


Connecting up the FC 2420

In the majority of cases the FC 2420 will be supplied pre-configured to specific Webster sensors, details on how to alter the settings are provided in the next section. Where the frequency-current converter is pre-configured set-up is very quick, simply involving connecting the sensors, output device and the power cable. Connection is either direct via a 25 way D connector or via an optional Din rail connector. The table below shows the pin out.

Pin	To	Pin	To
1	Ch 2 - IN	Blank	N/A
2	GND IN	14	GND IN
3	Ch 1 - IN	15	GND IN
4	GND IN	16	GND IN
5	GND IN	17	GND IN
6	GND IN	18	+ 5 V
7	GND IN	19	+ 5 V
8	N/A	20	N/A
9	N/A	21	N/A
10	N/A	22	N/A
11	GND OUT	23	Ch 2 - OUT
12	GND OUT	24	GND OUT
13	GND OUT	25	Ch 1 - OUT

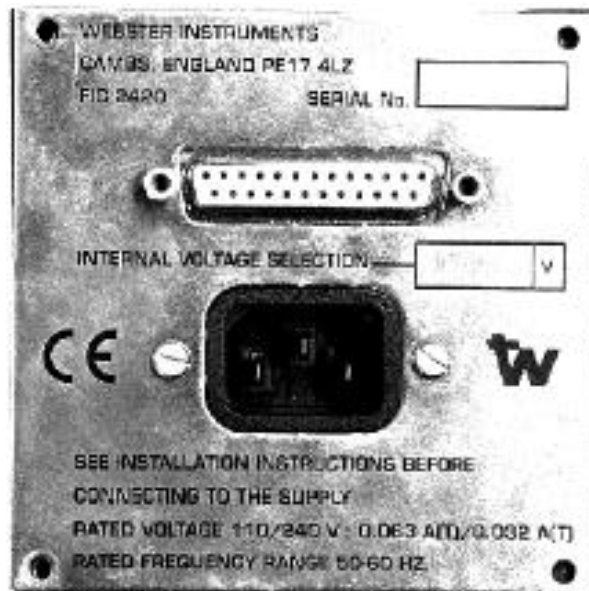
**Using optional
DIN-rail connector**



- Connect a flow meter with a standard transducer to Pins 3 & 4 or 1 & 2.
- Connect a flow meter with a magneto-resistive transducer to Pins 3, 4 & 19 or 1, 2 & 18. (Where possible terminate the cable screen to the entrance of the metal enclosure using a suitable gland)
- Output devices should be connected across Pins 13 & 25 or 23 & 24.

On the back of the FC 2420, the INTERNAL VOLTAGE SELECTION is recorded (see below), check that the voltage is correct for your local mains supply - 240 V in the UK.

Plug the 25-pin connector into the socket on the rear of the device (see below).



Plug the power lead into the rear of the device and connect to the mains.

In use

There are three lights on the front of the FC 2420

- Channel 1 and Channel 2 will light up in the case of a loop fault, i.e. if the connection to the readout (or other device) is broken.
- Power is lit when the device is on.

Changing the device settings

Ensure the device is disconnected from the mains.

Remove the four screws from the back panel and slide off the cover to expose the dipswitches. See the diagram at the back of this manual for details of where the switches are located.

For use with Webster flow meters

The FC 2420 contains two microprocessors, one for each channel. Each microprocessor is dedicated to a certain type of flow meter. This is due to each flow meter having its own characteristics that are stored in an EPROM at the point of manufacture. Each processor has a set of 10 dipswitches that are used to control the K factor for flow meters and number of teeth for tachometers.

Each of the microprocessors can be used either for the flow meter for which it was originally configured or a tachometer. Current output is proportional to input value / full-scale. A table of full-scale values and Webster flow meter nominal K factors is shown below.

Webster flow meters have the following characteristics - listed by type.

Note: When used with a tachometer, speed is a percentage of full scale (1 kHz or 60,000 rpm)

Turbine type	Full-scale lpm	Nominal 'K'	Adjustment 'K' factor
LT5	5	7800	5
LT10	10	6300	5
LT20	20	6300	5
LT50	50	620	0.5
LT125	125	610	0.5
LT250	250	132.6	0.1
LT300	300	132.6	0.1
LT400	400	132.6	0.1
LT500	500	59.5	0.04
LT750	750	57.92	0.04

The dipswitches (J1 & J2) have the following settings when used for measuring flow.

Note: Switch 6 dictates whether the EPROM is being used with a flow meter or a tacho. Switch 7 can be used to simulate a maximum flow / min flow for checking the device. See Advanced features.

Switch No.	Description	Binary weighting	
		Open	Closed
1	K-factor b0	0	1
2	K factor b1	0	2
3	K factor b2	0	4
4	K factor b3	0	8
5	K factor sign	+	-
6	Sensor type	Tacho	Flow
7	Simulate input	N/A	N/A
8	N/A	N/A	N/A
9	K factor b4	0	16
10	K factor b5	0	32

There follows a series of examples.

Examples of how to change the K factor

The 'K' difference (desired K factor - nominal K factor) should be divided by the Adjustment factor and the result converted to a 6 bit binary number. This binary pattern is used to set the dipswitches. This is explained in more detail in the following examples.

Example 1 - LT125 flow turbine

'K' factor 621.5

Sensor type: Flow

Nominal 'K' factor for LT125 = 610

Adjustment factor = 0.5
 $621.5 - 610 = 11.5$
 $11.5 / 0.5 = 23$
 $23 = 0 + 16 + 0 + 4 + 2 + 1$ (binary = 010111)
 Note: OPEN = 0, CLOSED = 1

For this example the switches would be set as follows: -

1	CLOSED	b0
2	CLOSED	b1
3	CLOSED	b2
4	OPEN	b3
5	OPEN	Sign
6	CLOSED	Sensor type
7	OPEN	Simulate input
8	OPEN	N/A
9	CLOSED	b4
10	OPEN	b5

Example 2 - LT500 flow turbine

'K' factor 58.6

Sensor type: Flow

Nominal 'K' factor for LT500 = 59.5
 Adjustment factor = 0.04
 $58.6 - 59.5 = -0.9$
 $-0.9 / 0.04 = -22.5$ (Round to -23)
 $-23 = 0 + 16 + 0 + 4 + 2 + 1$ (binary = 010111)
 Note: OPEN = 0, CLOSED = 1

For this example the following links would be required: -

1	CLOSED	b0
2	CLOSED	b1
3	CLOSED	b2
4	OPEN	b3
5	CLOSED	Sign
6	CLOSED	Sensor type
7	OPEN	Simulate input
8	OPEN	N/A
9	CLOSED	b4
10	OPEN	b5

To re-calibrate a flow meter against a reference standard

In many environments a separate reference flow meter will be kept against which periodic checks can be made. The reference flow meter and the unit to be checked should be connected in series and oil circulated through them until the required temperature is achieved.

Set the flow with the reference flow meter to approximately 63% of the full scale. It is assumed here that the reference flow meter and the unit to be checked are the same size.

Record the flow reading displayed. If necessary change the dipswitches starting with the least significant bit (b0) until the readout displays the same value as the reference, increasing the 'K' factor will reduce the displayed value.

Note: that the adjustment range will always have a small step (since it is a digital system). However this step will always be small compared to the accuracy of the system.

Example: -

LT125, Engineering units LPM flow rate displayed = 83 LPM

Changing b0 of the 'K' adjustment will change the value displayed by 0.07 LPM
 I.e. 0.085% of the indicated reading.

For use with tachometers

The switches have the following settings when used for measuring speed.

Note: When used with a tachometer, speed is a percentage of full scale (1 kHz or 60,000 rpm). Switch 6 dictates whether the EPROM is being used with a flow meter or a tacho. Switch 7 can be used to simulate a maximum freq. / min freq. for checking the device. See Advanced features.

Switch No.	Description	Binary weighting	
		Open	Closed
1	Factor b0	0	1
2	Factor b1	0	2
3	Factor b2	0	4
4	Factor b3	0	8
5	Factor sign	/ (divide)	* (multiply)
6	Sensor type	Tacho	Flow
7	Simulate input	N/A	N/A
8	N/A	N/A	N/A
9	Factor b4	0	16
10	Factor b5	0	32

Examples of how to configure a tachometer**Tachometer Configuration - Hz / N (RPM / N)**

The FC 2420 can easily be configured as a Tachometer.

The divide factor is set in a similar way to the 'K' factor.

Example 1

Shaft with a 12-tooth gear wheel sensed by a MT1A magnetic sensor.

Convert the number of teeth per revolution into binary, 12 decimal = 001100.

Sensor type: Tacho

Therefore for this example the dipswitches would be set as follows: -

1	OPEN	b0
2	OPEN	b1
3	CLOSED	b2
4	CLOSED	b3
5	OPEN	Sign

6	OPEN	Sensor type
7	OPEN	Simulate input
8	OPEN	N/A
9	OPEN	b4
10	OPEN	b5

Example 2

To measure a tacho-generator (3 pulses per revolution) using a TG1A.
Convert the number of pulses per revolution into binary, 3 decimal = 000011.
Sensor type: Tacho

Therefore for this example the dipswitches would be set as follows: -

1	CLOSED	b0
2	CLOSED	b1
3	OPEN	b2
4	OPEN	b3
5	OPEN	Sign
6	OPEN	Sensor type
7	OPEN	Simulate input
8	OPEN	N/A
9	OPEN	b4
10	OPEN	b5

Tachometer Configuration - Hz * N (RPM * N)

The multiply factor is set in a similar way to the 'K' factor.

Example 1

Shaft connected via a 36:1 reduction gearbox sensed with a MT1A monitoring a 4-tooth gear wheel.

Convert the number of revolutions per pulse into binary, $36/4 = 9$ decimal = 001001.

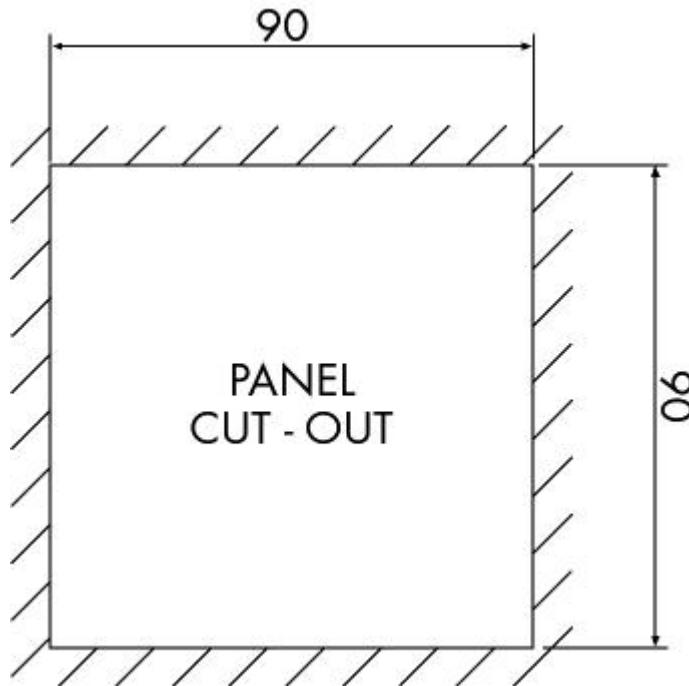
Sensor type: Tacho

Therefore for this example the dipswitches would be set as follows: -

1	CLOSED	b0
2	OPEN	b1
3	OPEN	b2
4	CLOSED	b3
5	CLOSED	Sign
6	OPEN	Sensor type
7	OPEN	Simulate input
8	OPEN	N/A
9	OPEN	b4
10	OPEN	b5

How to install the FC 2420 in a panel

Cut panel aperture as shown below.



Advanced features

Please refer to the diagram on the back page.

How to simulate zero and full scale input values without having a sensor connected

Connect the output from the FC 2420 to an ammeter or a digital display. Switch on the power to the device. Set dipswitch 6 to CLOSED to represent a zero input frequency and change the position of dipswitch 7 to display the current output. This will be either 0 or 4 mA depending on whether the jumper link is present or not - see below. Now set dipswitch 6 to OPEN to represent a full-range input frequency and again change the position of dipswitch 7 to display the current output. This will be either 16 or 20 mA depending on whether the jumper link is present or not - see below. When you have finished testing, reset dipswitch 6 to OPEN for a tachometer or CLOSED for a flow meter. Switch the power off prior to using the device again.

How to change from a 4-20 to a 0-16 mA current loop

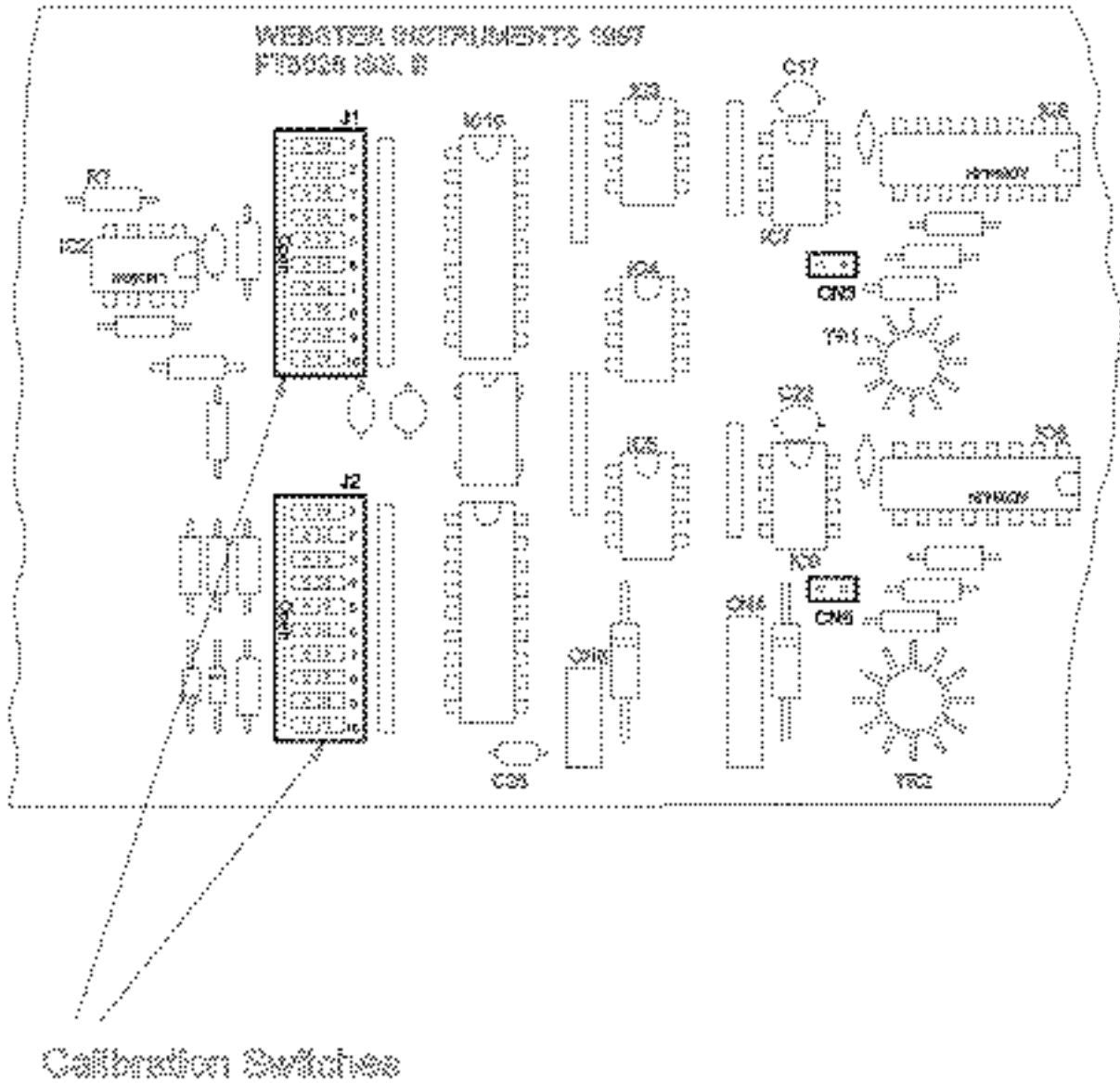
Each channel can be set to supply either a 4-20 mA signal or a 0-16 mA signal. To change between the two types, simply requires removing or inserting the bridge piece CN5 (channel 1) and CN3 (channel 2).

- If the jumper link is present output will be 4-20 mA
- If the jumper link is removed output will be 0-16 mA

How to sum the two outputs

Since the output from the FC 2420 is a true current source, the output from the two channels can be easily summed to provide a single output ranging between 8-40 mA or 0-32 mA. To do this requires connecting together the output from the two channels.

Diagram of the FC 2420 processor circuit board.



- J2** - Dipswitches for channel 1
- J1** - Dipswitches for channel 2
- CN5** - Current range jumper link for channel 1
- CN3** - Current range jumper link for channel 2

End of FC 2420 User Instructions

