Anville Instruments Ltd

Series 420SB Data Acquisition System

Hardware User Manual
(QP10)

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NOTICE

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CONTENTS

AN OVERVIEW OF THIS USER MANUAL

This manual is divided into 4 parts. Part I introduces you to the SERIES 420SB. Starting with Part II, the manual shows you how to configure and operate the unit. After mastering the system, you can use the manual as a handy reference. When you need help with a specific problem, turn to the appropriate area of the manual that describes that part of the system.

To give you an idea of the manual's layout, here is a description of each part of the manual:

- Part I describes the hardware for both the SERIES 420SB and the computer system.

- Part II describes system hardware configuration and tells you how to connect the different types of sensors.

- Part III tells you how to connect the SERIES 420SB unit to your computer.

- Part IV provides specifications for the SERIES 420SB equipment.

PART I: INTRODUCTION TO SERIES 420SB

OVERVIEW

Welcome to the SERIES 420SB Data Acquisition Unit which provides 16 general purpose analogue inputs, 8 digital inputs and 8 digital outputs. The units operate in conjunction with a wide variety of bespoke or SCADA computer based software packages. The SERIES 420SB is connected to a compatible computer system which provides the SDADA software operating environment working under Windows 3.x, Windows for Work Groups, Win'95/98 and Windows NT

The compact hardware provides thermocouple and general purpose analogue inputs, digital inputs and digital outputs. Connection to a computer, using the supplied cable, is made via an RS422/423 serial link. An additional RS422/423 connector allows you to 'daisy-chain' two SERIES 420SBs together if more analogue inputs are needed. The SERIES 420SB's internal microprocessor converts all inputs into their correct engineering units for transmission to the host computer.

COMPATIBLE COMPUTER SYSTEM

Your computer system should comprise a system unit, SVGA monitor, keyboard and printer. The system unit must be have 486 processor, a 100Mbyte hard disk with at least 30 Mbytes free for system software and 8Mbytes of RAM. A reasonably sized hard disk is necessary for storing SERIES 420SB data files if logging for long periods.

Comment:

System Unit and Memory

The system unit is the large box component of the computer. The back of the unit supports all ports used for connecting your peripheral equipment including the SERIES 420SB. Your SERIES 420SB will plug into to either COM1 or COM2 serial ports using the supplied data cable but on some system units the mouse could be using COM1, which means using COM2 instead. It is also possible that COM2 is a 25-pin connector. In this case you'll need a 25-pin (female) to 9-pin (male) adapter. A printer port is also required.

The system unit houses the PC's main microchip and the computer's internal memory as well. The memory has several names. You commonly hear it referred to as RAM (Random Access Memory).

The SVGA Monitor

The television-like screen is called the monitor. The monitor is one place where graphical data and spreadsheet data will be sent for viewing. Your monitor plugs into the back of your system unit .

The Printer

Your printer provides a more permanent way of recording your SERIES 420SB's system results. It can be used to provide hard copies of on-screen information and spreadsheet data. The printer can be described as the `typewriter' of a SCADA logging system. The printer plugs into the parallel port at the back of the system unit.

The Keyboard

The keyboard plugs into the back of your system unit. Most of the keys are the same as a standard typewriter. The letters and numbers in the large centre of the keyboard produce the characters that you type on-screen. In the main you will use only these keys in conjunction with using your mouse.

PART II: SERIES 420SB CONFIGURATION

Box Address

Your SERIES 420SB is supplied with its' address set to zero. An address is set by the positions of switches 1 to 4 of the UNIT CONFIGURATION switch array. See SERIES 420SB side panel.

If more than one SERIES 420SB is to be used on the computer port, it will be necessary to alter switch settings of any additional SERIES 420SBs thus providing each one with a unique address. For example, box 1 will have address 0, box 2 address 1 and so on. To initialise switch settings, power to the SERIES 420SB must be turned off then on.

The table below provides configuration address and switch settings.

Switch setting 1 2 3 4	Unit address
on on on on	0
off on on on	1
on off on on	2
off off on on	3
on on off on	4
off on off on	5
on off off on	6
off off off on	7
on on on off	8
off on on off	9
on off on off	10
off off on off	11
on on off off	12
off on off off	13
on off off off	14
off off off off	15

Unit Configuration Table

Communication Baud Rate

Your SERIES 420SB is supplied with baud rate set to 9600. If you need to change the baud rate, use switches 5 and 6 of the UNIT CONFIGURATION switch array. The following table gives switch settings for specific baud rates. To initialise switch settings, power to the SERIES 420SB must be turned off then on. Please note that whichever baud you configure, you must also set the same baud in Windows Control Panel to match. See below how to do this.

Switch settings 5 6	Baud rate
on on	1200
off on	2400
on off	9600
off off	19200

Communication Format

The communication format is fixed and will consist of 8 data bits, 1 stop bit, no parity, flow control- none. Please note that if you are **not** using the SERIES 420SB's software it is very important that you set the communication format and baud rate for the chosen serial port using WINDOWS Start, Settings, Control Panel before operating the SERIES 420SB.

Analogue Outputs (option)

Two analogue outputs may be factory fitted to the SERIES 420SB. Configuration details are shown below with connections being made via a 4- pin plug in terminal block.

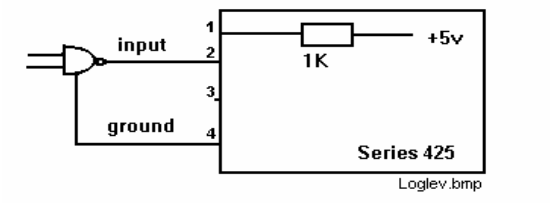
Pin no.	Signal name	Pin no.	Signal name
1	anout ground	2	anout 2
3	anout ground	4	anout1

Frequency Input

The Series 420SB provides inputs for measuring both pulse count and frequency (Hz). The type of input configuration is dependent on the type of signal output from equipment connected to the logger. Selection of counter or frequency is made during software configuration. Connections to the logger are made via a 4-way screw block plug. The table and diagrams below show pin and input connections.

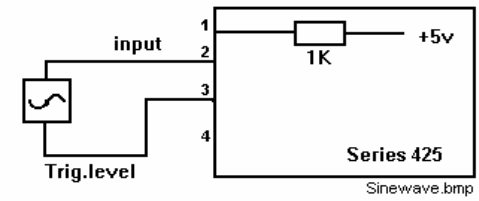
Pin No.	Signal Name	Pin No.	Signal Name
1	+5V output	2	input
3	trig. level	4	ground

A logic level/uni-polar input with a signal level of between 0V to 5V (CMOS/TTL) would (generally) use the connections shown in the Logic Level Input Circuit diagram. 0V to 2.4V ±100mV = logic 0; 2.6 ±100mV to 5V = logic 1. Pulse count input has a range of 0 to 65535 counts. Counts are not cumulative; each 'new' count will replace the previous count.



Logic Level Input Circuit

An AC signal/bi-polar input, from 0 to 65Khz, would (generally) be measured using the Zero Crossing Level circuit connections with voltage levels from 100mV peak-to-peak to 10V peak-to-peak. Voltage levels below 100mV will not be 'seen' by the logger.



Zero Crossing Level Circuit

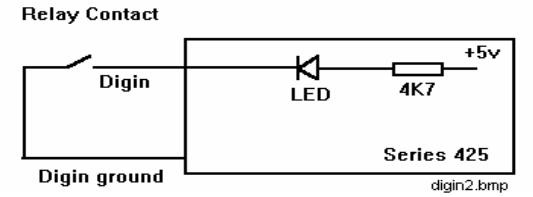
The +5VDC on pin 1 can be used to power devices where the current requirement is not more than 5mA.

Digital Inputs (digin)

The SERIES 420SB provides 8 optically isolated digital inputs. With reference to the table below, digin signals on pins 2-5 are measured with respect to pin 1 and digin signals on pins 5-8 are measured with respect to pin 6.

Pin	Signal name	Pin	Signal name
1	ground	6	ground
2	digin 1	7	digin 5
3	digin 2	8	digin 6
4	digin 3	9	digin 7
5	digin 4	10	digin 8

The input connector provides access to one end of the LED of an optical isolator with a 4K7 series resister to limit current. Connections are via a 10-pin plug supplied with the unit.

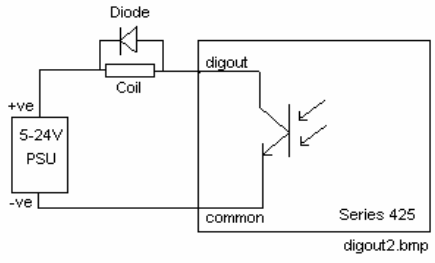


A typical digital input circuit

Digital Outputs (Digout)

The SERIES 420SB provides 8 digital outputs. These are open collector transistor type outputs capable of directly driving relays. With reference to the table below, digout on pins 2-5 are with respect to pin 1 and digout on pins 5-8 are with respect to pin 6. Connections are via a 10- pin plug supplied with the unit.

Pin no.	Signal name	Pin no.	Signal name
1	ground	6	ground
2	digout 1	7	digout 5
3	digout 2	8	digout 6
4	digout 3	9	digout 7
5	digout 4	10	digout 8



A typical digital output circuit

PART III: CONNECTING THE SERIES 420SB TO YOUR COMPUTER

IMPORTANT NOTE: please refer to **PART IV: SPECIFICATIONS** if you **do not** intend using the cable supplied.

NOTE: Pins 6 and 8, pins 7 and 8 of the 'D' type plug are no longer linked for RS232 or RS422 operation. Units are factory set for the required protocol. However, cables with links fitted can still be used. Pin configuration details are retained for reference.

The SERIES 420SB is supplied with a 2 metre length cable (which meets the requirements of RS232) fitted with 9 pin 'D' type plug and socket. The system requires transmit (Tx), receive (Rx) and ground connections for most applications, so these are the only signal connections made in both plug and socket. Pins 6 and 8 or pins 7 and 8 are linked depending on serial data transmission protocol. Links are made in the cable plug end that is connected to the logger. Cable wiring details are given below.

Pin	Signal name	Signal direction	Wire
2	Tx	to Computer	white
3	Rx	from Computer	black
5	signal ground		screen
6	RS422 link	Linked to pin 8	
7	RS423 link	Linked to pin 8	
8	+5V		

Pins 1,4 and 9 are not used.

The SERIES 420SB has two serial port connectors, SERIAL IN and SERIAL OUT. As a general rule, SERIAL OUT will be connected to your computer in a single unit installation. Where a second unit is used, it will be connected into the system by 'daisy chaining' the SERIAL IN to the SERIAL OUT of the first unit.

Cable connections for ‘daisy chaining’ a SERIES 420SB are given in the table below.

Pin	Signal name	Signal direction	Wire
2	Tx	to next 425SB	white
3	Rx	from next 425SB	black
5	Signal ground		screen
6	RS422link	Linked to pin 8	
7	RS423 link	Linked to pin 8	
8	+5V		

RS422 Transmission

If the overall line length (distance) between your PC and the second daisy-chained logger exceeds 30 metres (approx. 65 feet) an RS422 serial card must be fitted to your PC to maintain signal integrity. RS422 signal titles and pin connections are given in the table below. In addition the serial cable link between pins 7and 8 must be removed and pins 6 and 8 linked. See previous table.

Pin	Signal Name	Signal Direction
1	Txb	to computer
2	Txa	to computer
3	Rxa	from computer
4	Rxb	from computer
5	ground	

Power Up

Note: *in order to comply with European EMC legislation the Series 420SB must be connected to mains earth. No action is necessary if the supplied mains adapter is used.*

The SERIES 420SB is dc powered requiring +5V at 0.5A and +24V at 0.2A. The unit is normally supplied with a 230V AC mains adapter which will provide correct input voltages. Power enters the SERIES 420SB via the 4 pin connector on the rear panel. Where several units are to be mounted within an enclosure it may be beneficial to power them from a Common supply. Power connection details are:

Pin	Signal name
1	Earth

2	0V
3	+5V
4	+24V

Front Panel Connection Details

All front panel connections are made through convenient solderless screw 6-way terminal blocks supplied with the SERIES 420SB.

Analogue Inputs

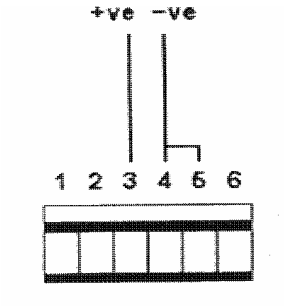


Figure 1 Voltage input

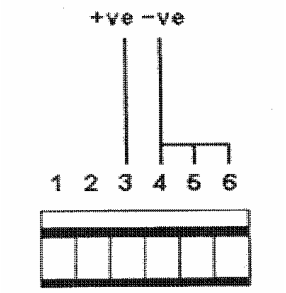


Figure 2. Current loop input: 4 to 20mA (powered by transmitter or other external source)

CAUTION
Where** thermocouples **are used involving fluids or condensing gases, for example with Autoclaves, they must be connected to the data logger in one of two ways:
1. ***At a point lower than the logger, remove at least 2.5cm of insulating material from the thermocouple wire.***
2. ***Make thermocouple connections to the logger via flying leads, either below logger level or at a distance of 0.5 metres, with an in-line cable mounting socket attached.***

Both of these methods ensure that any liquids migrating up the thermocouple wire due to the capillary effect, escape before reaching the logger. Serious damage to the logger will result if liquid is allowed to enter.

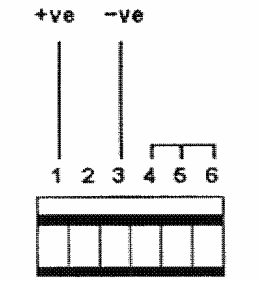


Figure 3. Current loop input: 4 to 20mA (powered by Series 420SBSB)

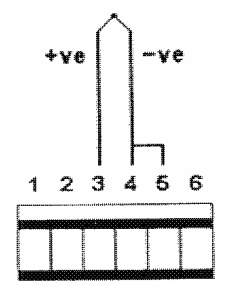


Figure 4. Thermocouple input
Note: do not fit link between pins 4 and 5 if using grounded thermocouples

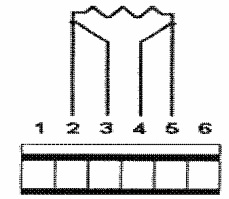


Figure 5. Pt100 or resistive inputs

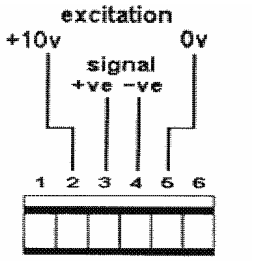
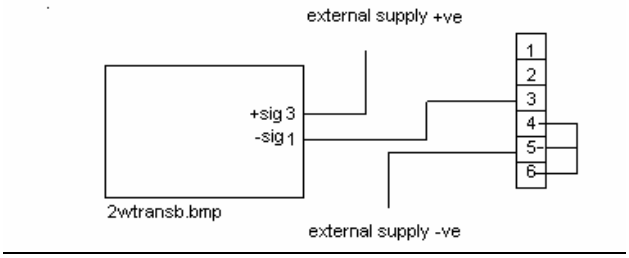


Figure 6. Transducer input

Transducer Connections - 4-20mA output.

Please note that this wiring diagram is an alternative to Figure 2 and should be used if a transducer, connected as Figure 2 does not respond. The example shows how you would connect a 2-wire transducer to the unit using an external +24V DC source.



PART IV: SPECIFICATIONS

DATA LOGGER

Construction

The SERIES 420SB data logger is constructed as a metal box formed by 2 U-shaped sections. A bottom box section forms the mount for printed circuit boards (PCB). All components are mounted on the PCBs. A top box section locates over the bottom section, allowing access to connectors and switches and is secured into position using 4 M3x6mm screws. Four rubber feet are screwed to the bottom.

Dimensions: 269mm long, 150mm wide, 95mm deep (including feet).

Connectors

- 16 inputs (combinations of thermocouple and general purpose connectors).
- 2 RS423 ports

- 1 digital input
- 1 digital output
- 1 analogue output (option)
- 1 power input
- 1 frequency input

Switches

- 4 unit configuration
- 2 baud rate

Mounting and Ventilation

To mount a logger, remove rubber feet and use the same screw locations. Maximum screw length penetration is M3x4mm. It is dangerous to exceed the recommended penetration length as damage to internal components could occur.

The logger requires no special ventilation requirements.

Cleaning

Loggers are easy to clean. Use a non-abrasive or foam cleaner.

ANALOGUE INPUTS

Direct Voltage and Current

Range	Resolution	Accuracy
±10mV	1uV	±0.02%
±100 mV	10 uV	±0.02%
± 1V	100 uV	±0.02%
± 10v	1 mV	±0.02%
4-20mA	0.01%	±0.02%

Thermocouples

Input range °C	Input function	Resolution °C	Accuracy °C*
-200 to +400	T thermocouple	0.1	± 0.5
-100 to +200	T thermocouple	0.01	± 0.25
-200 to +1200	K thermocouple	0.1	± 0.5
-100 to +200	K thermocouple	0.01	± 0.5
-100 to +1100	J thermocouple	0.1	± 0.5
0 to +1300	N thermocouple	0.1	± 0.5
-100 to +1000	E thermocouple	0.1	± 0.5
0 to +1700	R thermocouple	1	± 4
0 to +1700	S thermocouple	1	± 4
0 to +1800	B thermocouple	1	± 4

* Note: accuracy includes cold junction error when using thermocouple sockets but not when using general purpose sockets.

PT100 - 100 ohms @ 0°C, 4 wire connection

Range °C	Resolution °C	Accuracy °C
-100 to +600	0.1	+/-0.5
-100 to +200	0.01	+/-0.2

Pressure transducer/load cell

Range	Resolution	Accuracy
±10 mV	1 uV	±0.02%
±100 mV	10 uV	±0.02%
±1V	100 uV	±0.02%
±10 V	1 mV	±0.02%

Signal conditioning

For thermocouple, PT100 and pressure transducers.

Transducer energisation

- For PT100: switched constant current of 1mA.
- For pressure transducer/load cell: switched constant voltage of 10V.
- For 4-20mA current loop: switched constant voltage of 24V.

Input switching

Reed relay - 3 pole switching.

Engineering units

As appropriate or selectable:
mV, V, mA, C, % (as appropriate or selected).

Scan speed

8-16 inputs per seconds
Configuration using X-425SB software.

Serial link

RS232 or RS422. Choice dependant on cable length.

Cable length

Maximum cable length for RS232 operation is approximately 30 metres.
Maximum cable length for RS422 operation is approximately 1.5 kilometres.
To avoid electrical interference the serial cable should be installed away from other cables particularly mains voltage cables. Ideally the serial link should be installed in it's own trunking

Cable Type

For runs of up to 30 metres: two pair, overall foil shielded, 24 AWG, polyethylene insulated, PVC screened.
Type: 0S2P24, UL style 2464 obtainable from Farnell Electronic Services (FES)

For runs of up to 1.5 kilometres: two pair, overall foil shielded, 24 AWG, polyethylene insulated, PVC screened.

Type: FB0S2P24, UL style 2919 obtainable from FES.
Type 2, UL style 2493 obtainable from RS Components, part no. 368-738.

Note: only 2 wires are used: BLACK from red/black twisted pair and WHITE from white/black twisted pair.

Baud rate

Four baud rates are available: 1200, 2400, 9600,19200.

Daisy-chained linked loggers

Maximum number of loggers that can be daisy-chained is 16

Environmental Operating Range

0° C to 40° C.

Power supply

+5V @ 0.5 Amps and +24V @ 0.25 Amps.

OTHER INPUTS/OUTPUTS

Frequency input

Optically isolated frequency and pulse count.
Frequency range 0 to 65khz or 0-65535 counts (software configured).
Signal level 100mV pk-pk to 10V pk-pk or CMOS.

Digital inputs
Voltage free contact, TTL or CMOS optically isolated.

Digital outputs
Open collector transistor, max sink current = 500mA. Max switching voltage = 24VDC.

Analogue outputs

Isolated 0 to 10V; accuracy ±0.1%.
COMPUTER

- Processor type: 486SX/DX
- Processor speed: 33MHz
- Machine memory (RAM): 8Mb
- Display type: VGA
- Hard-disc size: 100Mb
- Pointer device: Mouse, tracker ball (some laptops).
- Serial ports: 2.
- Printer/parallel ports: 1

POWER SUPPLY SPU 41-16

The power supply is an AC/DC switching power supply providing 30 watts of continuous output power. The supply is enclosed in plastic case with IEC320 inlet connector to mate with interchangeable mains cable for world-wide use. This model complies with CUL, TUV, and CE requirements.

Input

Voltage: 90 to 264 VAC
Frequency: 47 to 63Hz

Current: 1.2A (rms) @ 230VAC
Inrush current: <60A peak at 230VAC cold start

Output

Voltage:+5V DC @ 3.0A max, ripple and noise 50mV
Voltage: +24V DC @ 1.0A max, ripple and noise 150mV
Power range: 0 to 30 watts
Over voltage protection: 110-140% of nominal output voltage
Over load protection: pulsing mode, auto recovery.
Line regulation: +/- 0.5% max at full load

DC pin chart

Wire	Pin	Voltage
Screen	1	earth
Black	2	0V
Brown	3	+5V
Green	4	+24V

Environmental
Operating temperature: 0 to 30°C @ 100% load; 0 to 40°C @ 60% load
Relative Humidity: 20 to 90%

General

Efficiency: 78% min at 30W output
Hold-up time: 12 msec min
Withstand voltage: I/P-O/P:3KVA, I/P-FG: 1.5KVA, 1 min
Insulation resistance: 10 Mohm min from output to ground
EMC standards EN55022, IEC801-2, 3, 4
Safety standards UL 1950
CSA C22.2 NO.234

Notes: