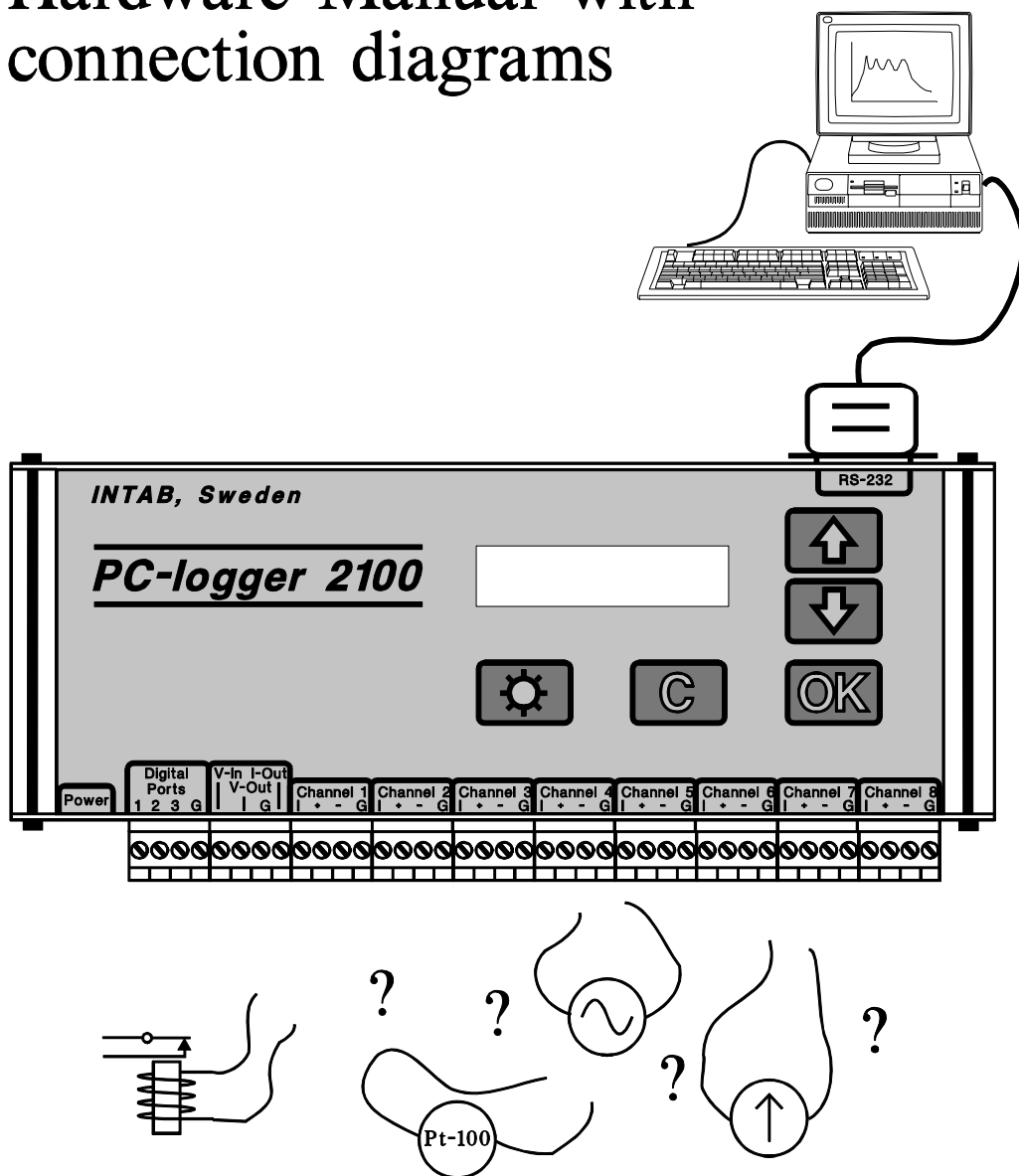


PC-Logger 2100

user's manual

Hardware Manual with
connection diagrams



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September 2004

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1 OVERVIEW

A "PC-logger 2100" together with our software and a personal computer running Windows™, constitutes a versatile and powerful data acquisition/recording system.

PC-logger 2100 is a complete logger useful for many purposes. It will, for example, easily replace/outdate any strip chart recorder.

The logger measures the full range of industrial analogue signals: +/-10V, +/-1V and +/-20mA. It is also possible to directly connect thermocouples for temperature measurements. Cold Junction compensation and linearization are internally handled by the logger. It is also possible to measure temperature by means of RTD's (e.g. Pt100 sensors).

In addition to the analogue inputs the logger is equipped with 3 counter inputs. These can be used for event (pulse) counting, e.g. flow, rpm, etc.

Recordings can be made directly to the storage media on the host computer (On-line recordings) or temporarily to the internal memory in the logger.

(Off-line recordings) During Off-line recordings there is no need for the host computer to be connected to the logger. This way the computer can be used for other purposes during off-line recordings.

Main features

- **8 analogue inputs.**
- **Range and measurement type are user configurable through software. (10V, 1V, 100mV, 50mV, 20mA, Thermocouple type: J, K, R, S, T, E,...)**
- **16 bit resolution AD converter.**
- **3 counter inputs. (plus 3 digital inputs and one Alarm Output.)**
- **Constant current source suitable for Pt100 measurements.**
- **On-line recording directly to computer.**
- **Off-line recordings using internal memory of 224KB.**
- **Voltage output for transducers etc.**
- **Display and keys for easy handling.**
- **Fully compatible with Intab's "EasyView Pro"**
- **Small dimensions: 250 x 110 x 40mm.**

To fully understand the potential of the PC-logger 2100 we strongly recommend the studying of this entire manual with emphasis on chapter 3 which describes how to connect sensors and transducers.

How the PC-logger is handled using our software and a PC is explained in the program manual and by the program itself through its user-friendly and self-explanatory menus.

Those users who intend to write their own software to collect data are recommended to obtain the "Command Manual" that describes available commands and their syntax.

1.1 On-line and Off-line recordings

PC-logger 2100 can make recordings in two different ways: On-line and Off-line.

An On-line measurement is performed with the computer connected to the logger during the entire recording. Measured data are continuously transferred from the logger to the computer and stored on disk.

During the recording it is also possible to analyse/evaluate the measurements in real-time on the computer screen. You can also analyse previously acquired recordings while the current recording is taken care of in the background.

An Off-line recording should be initiated by transferring measurement parameters from the computer to the logger. These parameters tell the logger how to perform its recording and contain information about: interval, active channels, channel configuration, etc. (See also software manual.) All parameters are valid until a new set is transferred.

The PC-logger can then, after the parameters have been transferred, be disconnected from the computer. The recording is started using the keys on the logger itself. During the recording, the data is stored in the logger's internal memory which has a capacity of appr. 110.000 values.

When the recording is completed the logger is again connected to the computer for transferral of collected data to disk.

1.2 Memory Capacity during On-line and Off-line recordings

Every stored sample occupies 2 bytes of memory.

When making On-line measurements, it is the amount of free space on the computer's disk (floppy disk or hard disk) that limits the length of the recording. For an Off-line recording the limiting factor is the internal memory capacity of the logger. This memory of 224k Bytes can hold 112 000 values.

The parameters that affect the maximum recording length (or duration) are: Sampling Interval, Reduction Factor (Averaged Value), Number of channels used and of course if it is an On-line or Off-line recording.

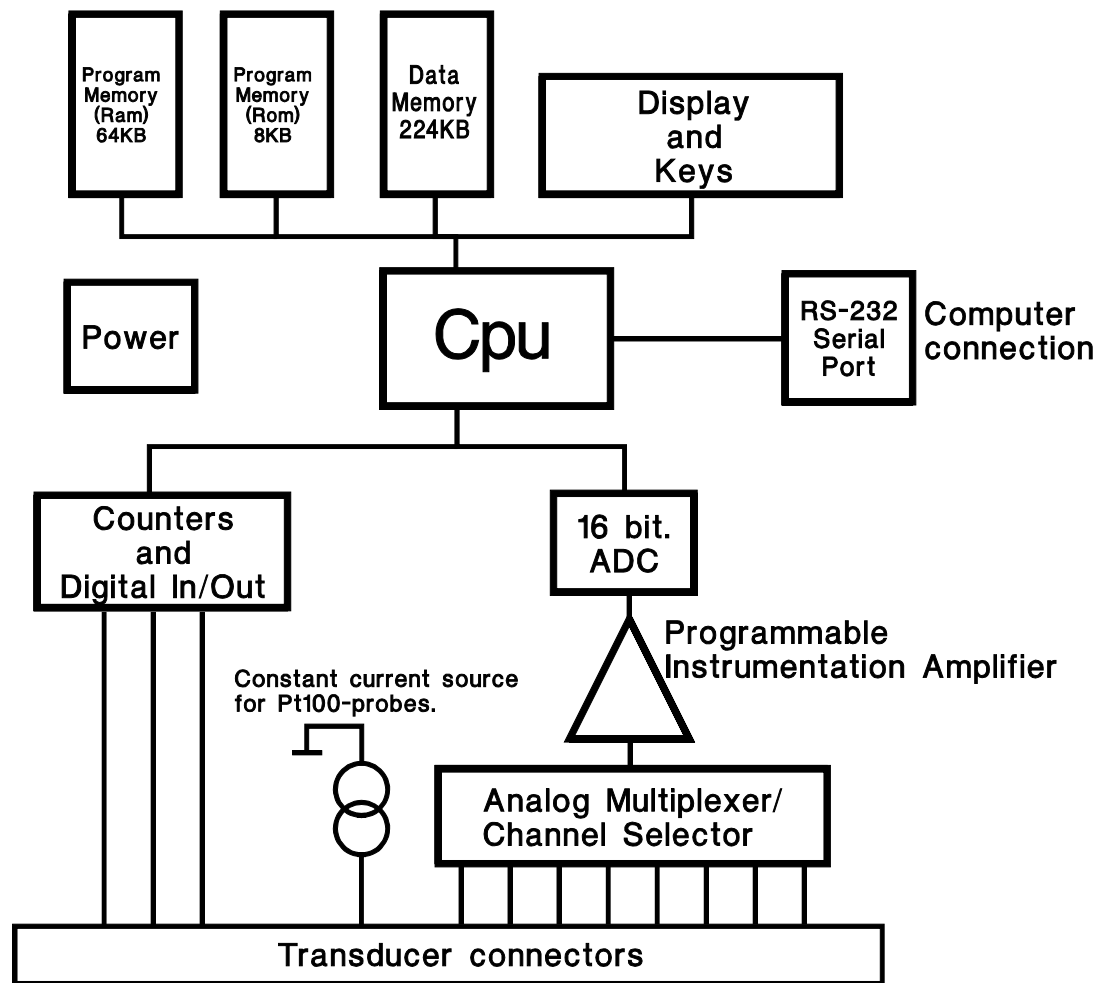
When using Intab's software, the user is always informed of how long the recording can last while entering the various parameters.

Example: Off-line-recording.

The PC-logger can sample on 8 channels, 10 times each hour during 2 months.
 $(0,1 \times 224.000) / (2 \times 8) = 1400 \text{ hours! (58 days)}$

Please note that the PC-logger only can handle **one recording at a time**. If an Off-line recording is started before the previous Off-line recording was transferred to disk, the first one will be lost!

1.3 Functional Block Diagram



The illustration above shows a simplified diagram of the building blocks of the 2100-logger. In addition to what is shown, there is separate power input and an auxiliary voltage output for supplying sensors.

Note that the control program of the 2100 resides in RAM. This makes it a simple operation to modify or update the logger by simply downloading a new program from the computer: BOOT. (See also chapter 6)

1.4 Display and Keys

An LCD and adjacent keys are incorporated to make it possible to handle the unit when disconnected from computer.

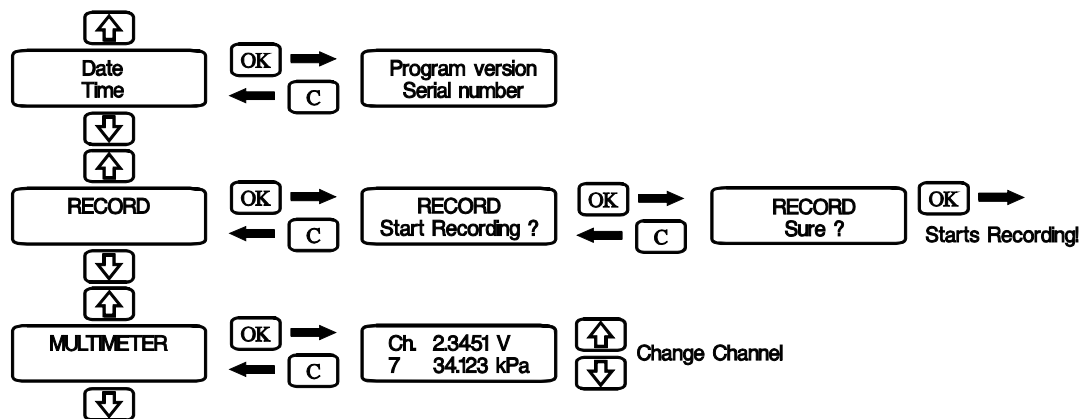
They are used to start and stop recordings and to check sensor signals and wiring.

Select one of three main functions using up/down arrows.

"**MULTIMETER**" is used to check correctness of sensor signals. Scroll between channels with up and down arrows. The upper line of the display shows sensor output voltage or current. The bottom line shows the (linearly) transformed value with the engineering unit you have assigned to it. (See also "x-form" in the software manual.)

"**RECORD**" should be selected to stop or start recordings. Remember that a start erases the previous recording, so don't forget to transfer it first.

The display has a built in lamp. Turn it on and off with the lamp key. To conserve power it will automatically be turned off after about 15 seconds.



Note that "RECORD" will also contain the information "Recording on" if a recording is in progress.

1.5 Power Requirements

The "2100 PC-logger" is normally powered by the supplied mains adapter. It supplies 12V at a max of 500mA.

The 2100 is fitted with internal rechargeable batteries. They will give the user at least 8 hours of continuous operation without mains supply when fully charged.

These batteries are trickle-charged by the mains adapter.

There is no danger of overcharging the batteries. They should be left on charge even if the "2100" isn't to be used for a long time. This will prolong battery life and ensure fully charged batteries at all times.

Batteries should be replaced at least once every four years.

Some applications require the PC-logger to be powered by other sources. Use a cable fitted with a "TA3F" (Switchcraft) connector to connect to, for example, a car battery.

The logger will "fall asleep" about 2 minutes after the last command or key-stroke has been entered. This property saves the power in the rechargeable batteries for when it is needed.

Incoming serial (RS-232) commands or pressing the "C"-key will wake the "2100".

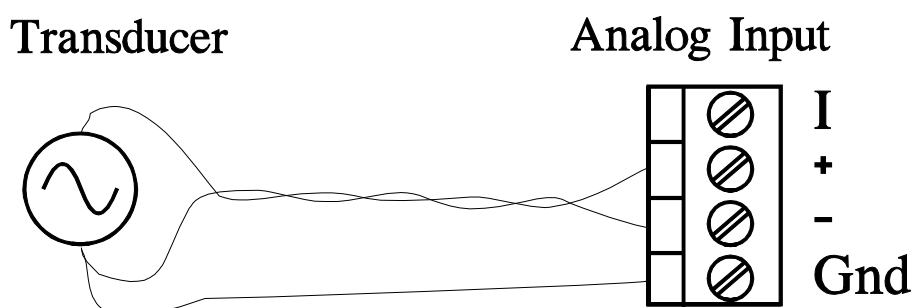
The built in real time clock will wake the logger in time for every sample if a recording is in progress.

EasyView Pro automatically supplies the right time to the logger. Make sure that your computer has the correct time.

2 ANALOGUE INPUTS / RANGES

All analogue channels are DIFFERENTIAL. They measure the voltage between - and GND and the voltage between + and GND. The subtraction is then performed internally.

Standard inputs are balanced. This makes them very insensitive to noise if the signal source is correctly connected. A signal cable consisting of a twisted pair can be very long if the lowest potential of the source is connected to ground via a separate cable.



Each channel is individually programmable. It can via the software be set to measure voltage, current or temperature (thermo emf). The range (=sensitivity) for each unit (voltage, current, temperature) is also programmable. This versatile property can be compared to the rotary switch on an ordinary multimeter with the difference that the user has to press a few keys on the computer instead (see software manual). Several types of T/C's can be employed in the same recording and still be correctly linearized.

2.1 Ranges

There are approx. 25000 divisions of each range. To put it in other words: each range has a resolution of FS/25000.

Here is a table of main ranges and their resolutions:

RANGE	RESOLUTION
+/- 10V	400 μ V
+/- 1V	40 μ V
+/- 100mV	4 μ V
+/- 50mV	2 μ V
+/- 20mA	0.8 μ A

Each channel has an internal **shunt** (51ohms) that is used to measure **current**. It must be **connected manually** via an external jumper in the screw terminal (see Section 3.4.2.)

NOTE that the shunt will overheat if subjected to more than 80mA.

2.2 Temperature measurements - T/C's

The "2100" is specially adapted for temperature measuring using thermocouples. The high resolution of the A/D converter makes it possible to record temperatures in excess of 1000°C with a resolution of 0.1°C using thermocouples of type "K".

Thermocouples are active sensors that don't require powering to supply a signal. They are highly non-linear but are linearized by the "2100".

A thermocouple is, in its simplest form, a pair of wires of dissimilar metals that are soldered together at one end. The other end is connected to the two screw terminals of a channel. The difference in temperature between the soldered end and the screw terminals gives rise to a voltage that can be measured.

This voltage is different for different thermocouple materials. Simply "tell" the software which type(s) you are using by specifying J, K, T; S, R or ...etc. for each channel before starting a recording.

2.2.1 Ranges and linearization

Different types of thermocouples have differing levels of output. They therefore have differing fields of application most often depending on the temperature range to be measured.

What two materials make up the couple may also be of a certain importance. We will however have to assume that this is known to the user.

Below is a short summary of the properties of the most common types of thermocouples. It is included to help in selecting type and range for your application. "K" is the most common type.

"Cold Junction" = 0°C

TYPE	mV at 200°C	mV at 600°C	mV at 1200°C	MAX temp °C
K	8.137	24.902	48,828	1370
J	10.777	33.096	-----	760
T	9.286	-----	-----	400
S	1.440	5.237	11.947	1760
R	1.468	5.582	13.224	1760

Thermocouples are highly un-linear. This is corrected by the internal program of the "2100".

Thermoelectric voltage is measured (in mV) and then adjusted for the cold junction temperature according to the type specified. This adjusted voltage is then used as input variable to a linearizing table. The table (one for each thermocouple type) is constructed so that its contribution to the measurement error is negligible.

(+/-0.05°C for T<250°C; +/-0.15°C for T>250°C and "K"-type)

2.2.2 Cold Junction Compensation

When using thermocouples to measure temperature it is almost always necessary to know the temperature of the "cold junction". Thermoelectric voltage has to be "adjusted" with respect to this temperature.

Thermoelectric voltage is the result of the **temperature difference** between the "cold junction" and the "hot junction".

A solid state temperature sensor has been placed centrally in the screw terminal area of the analogue board. Its temperature is automatically sampled every time a temperature measurement is taken. All temperature measurements are thus compensated for the actual temperature of the terminals themselves.

Some precautions have to be taken if the "2100" is exposed to rapid temperature gradients. Since temperature is measured in one point only, a gradient from one side of the unit to the other may cause misreadings.

By giving the unit time to reach a stable temperature before recordings are started and by protecting it from sudden changes of ambient temperature a very high degree of accuracy can be achieved.

2.3 Temperature measurements - Pt100 sensors

The "2100" can also take temperature readings from a Pt-100 sensor. This is achieved by conventional four wire resistance measurement technique.

A constant current is passed through the sensor via one pair of wires. The voltage developed across the resistor (a Pt-100 is a temperature dependent resistor) is measured by a channel via the second pair of wires.

The constant current is available at terminal "I-out" on the left-hand side of channel 1. Several Pt-100's can be connected in series to the same current source. (See next chapter).

3 CONNECTIONS

3.1 Power Supply

Power is applied through a TA3F (Switchcraft) female cable connector connected as follows: .

socket no. 1: + 12-15VDC at max 150mA

socket no. 2: 0V

socket no. 3: + 10-15VDC at max 80mA

Connecting power through pin 3 is an **alternative** to pin one. It saves power by not charging the internal accumulators.

Power can also be connected via screw terminals **Vin** and **Gnd**. They are paralleled by pins 3 and 2 respectively.

3.2 Computer

The PC-logger 2100 connects to a serial port of a computer via supplied spiral cable.

The 15 pin D-sub connectors has the following pins and signal names:

pin no. 2 : Tx

pin no. 3 : Rx

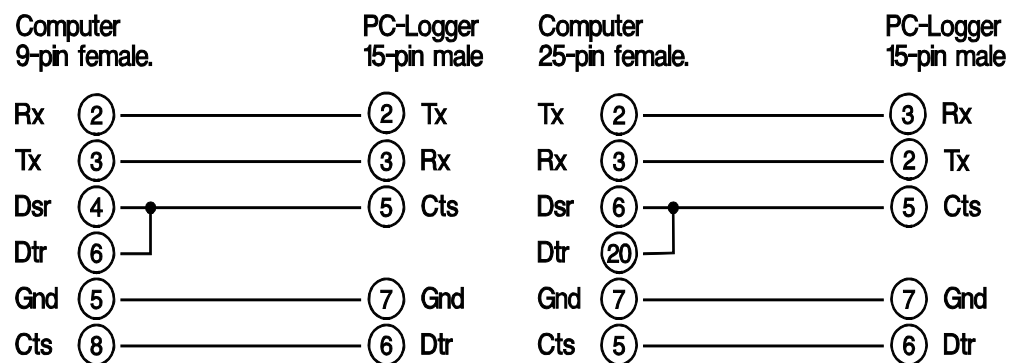
pin no. 5 : CTS

pin no. 6 : DTR

pin no. 7 : Signal return (Gnd)

Leave all other pins unconnected.!

Typical computer-to-PC-logger cables:



3.3 Connecting Sensors and Transducers

Several years of experience has shown us that 95% of all problems are the result of erroneous connection of sensors. To avoid measurement errors, noise pickup and other strange phenomena, it is of paramount importance that all sensors and signal sources be correctly connected. Chapters 3.3, 3.4 and 3.5 of this manual must be considered a “compulsory curriculum” to achieve this.

Sensors, transducers and process signals connect to the screw terminal along the side of the "2100". All screw terminals are detachable. Terminal assignment and polarity are also printed along the side, see illustration below.

	P1			P1, P2 and P3 are digital and counter inputs.
	P2			
	P3			
	Gnd			
	V-In			V-In is auxiliary PSU input
	V-Out			
	Gnd			
	I-Out			V-Out is an auxiliary voltage supply for transducers.
	I			
	+			
	-	Channel 1		
	Gnd			
	I			I-Out is a constant current source (0.500mA) for four-wire resistance measurements (f.ex. Pt100)
	+			
	-	Channel 2		
	Gnd			
	I			
	+			
	-	Channel 3		To measure 20mA process signals you must connect a jumper between "I" and "+" on respective channel.
	Gnd			
	I			
	+			
	-	Channel 4		
	Gnd			
	I			
	+			
	-	Channel 5		For differential measurements you connect the two signals between ground and "+", and ground and "-".
	Gnd			
	I			
	+			
	-	Channel 6		
	Gnd			
	I			
	+			
	-	Channel 7		For single ended signals you connect a jumper between "-" and "Gnd" of respective channel.
	Gnd			
	I			
	+			
	-	Channel 8		
	Gnd			

Connection terminals for sensors and transducers.

3.3.1 Differential Inputs

OBSERVE !!!

When connecting signals from sensors and/or transducers some simple rules about referencing them to logger signal ground must be followed.

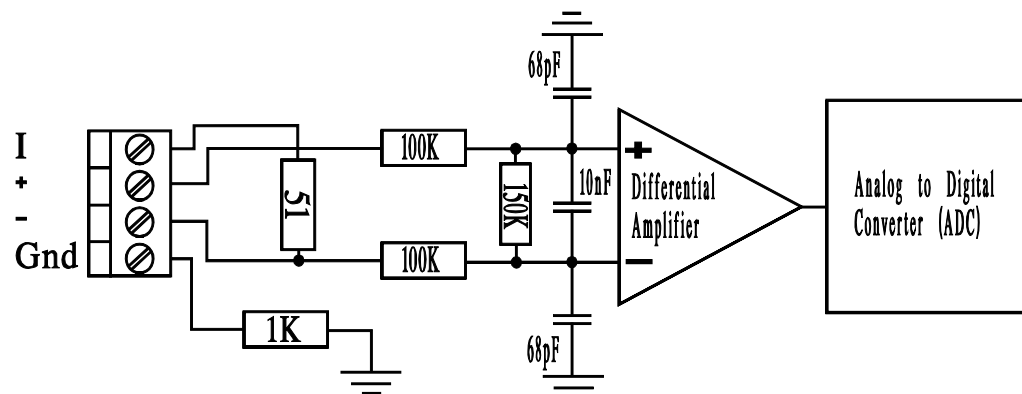
All analogue channels are **differential** with a very high impedance to signal ground. Their inputs have no internal connection to signal ground.

Differential channels measure (as the name implies) the difference in voltage between the + and the - in relation to signal ground.

Another way of saying this is that each channel really measures two voltages:

- the minus input measures the voltage between signal ground and "-";
- the plus input measures the voltage between signal ground and "+";
- the difference between these two voltages is then calculated internally and finally presented as the channel value.

A third way is to say that signals must never be allowed to float electrically with respect to signal ground of the "2100". They **must** in some way **be connected**!



The figure above shows one input channel. Note that the ground sign point is common to all circuitry and channels.

3.3.2 Common Mode

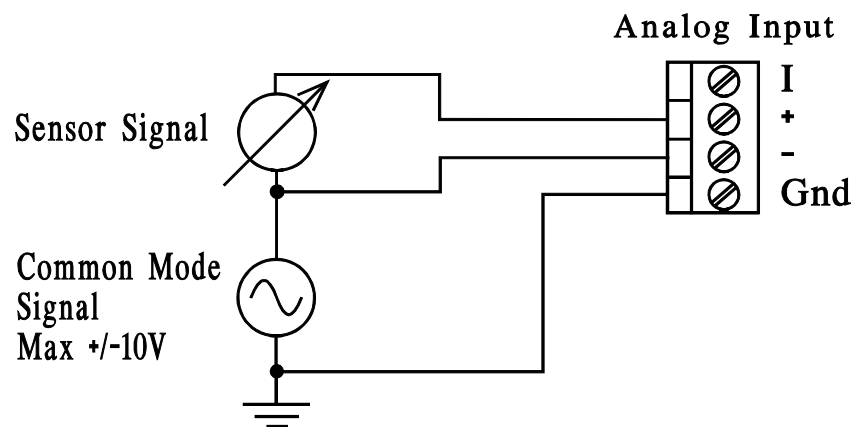
To maintain accuracy in your measurements you have to make sure that no signal is outside the common mode range. The difference signal that is to be measured may not have a common voltage with respect to signal ground that exceeds 10V (see figure below)

A sensor that is left "floating" with respect to signal ground may easily drift outside this range because of leakage voltages or static electricity. This will result in, to say the least, unpredictable measurements, but will not damage the inputs as long as they are within 30 Volts from signal ground. (see also technical data: Max overvoltage).

(The shield of shielded cables may be connected to signal gnd at one end only!)

Those users who always have "floating" signals should "ground" all negative inputs by connecting a short jumper between "-" and "Gnd" of the terminals of each channel.

It should also be pointed out that water must, almost invariably, be considered to be a conductor.



3.4 Examples

Below follow a few examples of how to connect different sensors and signals to the "2100".

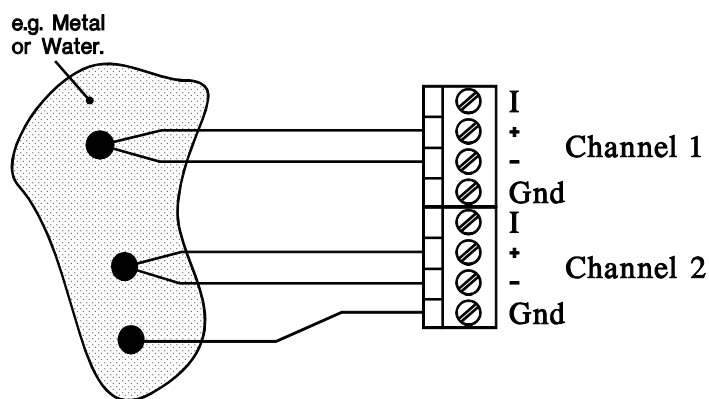
It is always a good idea, not to say good practise and a sign of competence, to first draw a schematic diagram of how sensors are to be connected to the PC-logger and how they may be interconnected. This will save a lot of time by avoiding common pitfalls like reversed or mixed-up leads, ground loops and floating signals.

3.4.1 Thermocouples T/C

There are two ways of connecting thermocouples. See examples below. They differ in the way the signals are referenced to signal gnd.

The two methods can of course be combined.

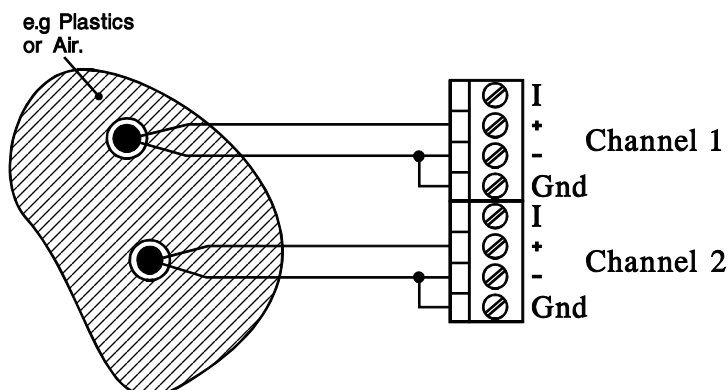
1) Thermocouple hot junction in contact with conducting object :



Connect object to be measured to PC-Logger signal ground via a separate lead. One lead is enough for all channels monitoring the same object: Gnd is common to all channels. (Remember?)

Examples: Water temperature at several places in a large vessel ; several thermocouples along a metal pipe.

2) Thermocouple hot junction in contact with non-conducting object :



To prevent the measured signal from "floating away", each sensor "-" must be jumpered to signal "Gnd".

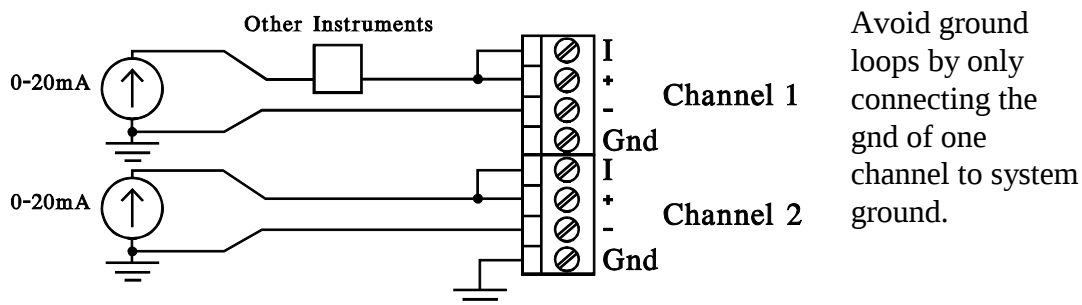
Examples: Measuring air temperature or plastic container surface temperature.

3.4.2 20mA Current Loops

Current loops can be connected in a number of ways. They are basically the same but appear to be different because they are powered and/or referenced to gnd differently. Below are a few examples with illustrations.

NOTE : The shunt resistor must for current measuring be manually connected via a small jumper (=short wire) between "I" and "+". See schematic diagram of inputs in section 3.3.1.

1) Connecting current loops with common ground points:

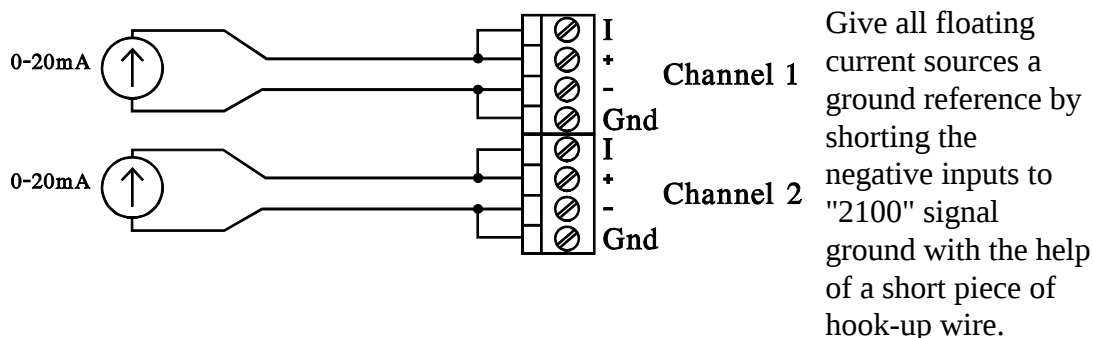


NOTE! Ground loops can give rise to considerable measurement errors !

Try to keep other instruments in the source path of the transmitter. This will make it impossible to exceed the common mode range. You can of course also connect them in the return path (ground side) if you make absolutely sure that the common mode range (10V) isn't exceeded.

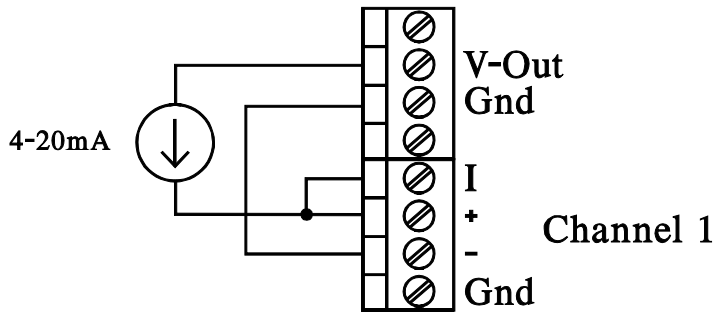
Add resistances of inserted instruments to make sure. The sum may not exceed $10V/20mA=500\Omega$!

2) Connecting ungrounded (floating) current loops:



Again it must be stressed that "floating" is meant in respect to "2100" signal ground, not any other ground that may be lying around (like safety earth/ground)! This, of course, also does not necessarily mean that it is floating with respect to other grounds! Confused? - Get an electronics engineer to help you!

3) Connecting two wire transmitters using "2100" V-Out as power source:

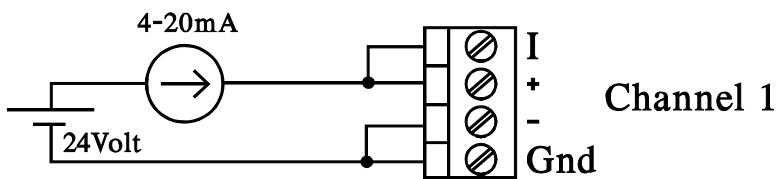


The auxiliary V-Out can be used to power external equipment like 20mA transmitters. It is actually just the mains adapter voltage that is passed on to the screw terminal.

In the example at left the V-out supplies power to the transmitter.

Current from the transmitter passes into shunt at "I" and developed voltage is measured by at "+". From "-" comes return current that is fed back to "Gnd" at the same time establishing ground reference.

4) Connecting two wire transmitters with external power source:



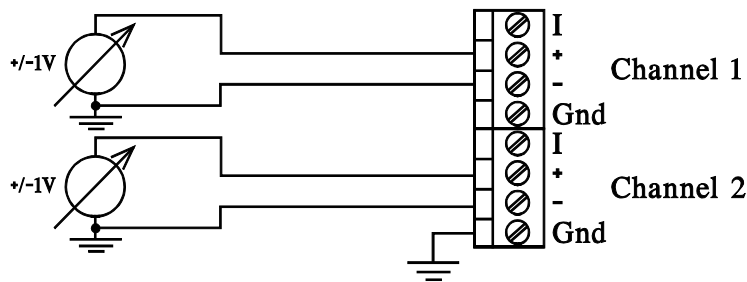
Two wire transmitter may sometimes require higher voltages to work properly. In those cases you must use an external PSU.

Connection follows same rules as above but the V-Out is replaced by an external supply.

3.4.3 Voltage output transducers

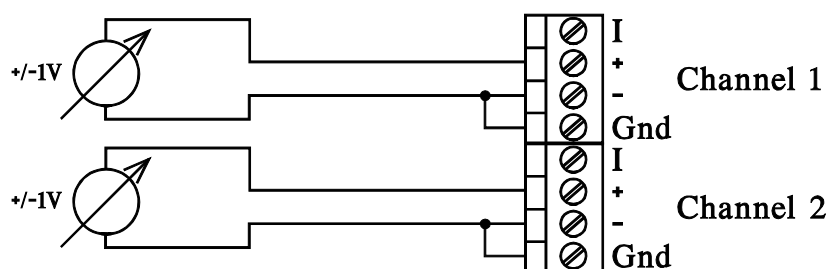
Connect each transducer according to one of the methods below.
Which one you use depend on whether your signal is floating or not.
The two methods may **of course** be combined.

1) Connecting signals having a common ground point:



Connect the sensor common (or ground) to "2100" ground at **one** of the channels.
If you connect more than one you will create a "ground loop" which may be detrimental to your measurements.
("Gnd" for all channels are really the same point with several connections !)

2) Connecting "floating" signals:

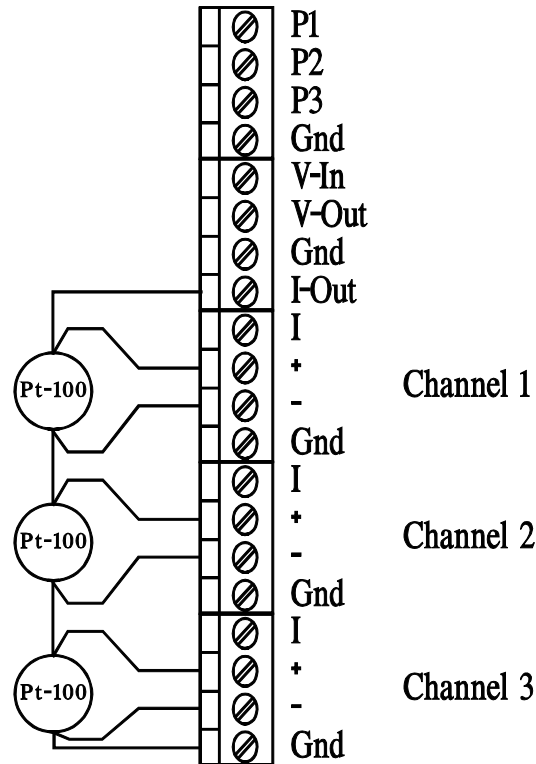


Each individually "floating" source must be referenced to "2100" Gnd by shorting "-" to "Gnd" with a piece of wire.

3.4.4. RTD (Pt100) sensors

Using the built-in (I-Out) constant current source (0.500mA) and "four wire technique" it is easy to measure resistance. In a **Pt100**, resistance varies with temperature. The relationship between temperature and resistance is very nearly linear.

Several Pt100 sensors can be connected in series to the same current source. See figure below.



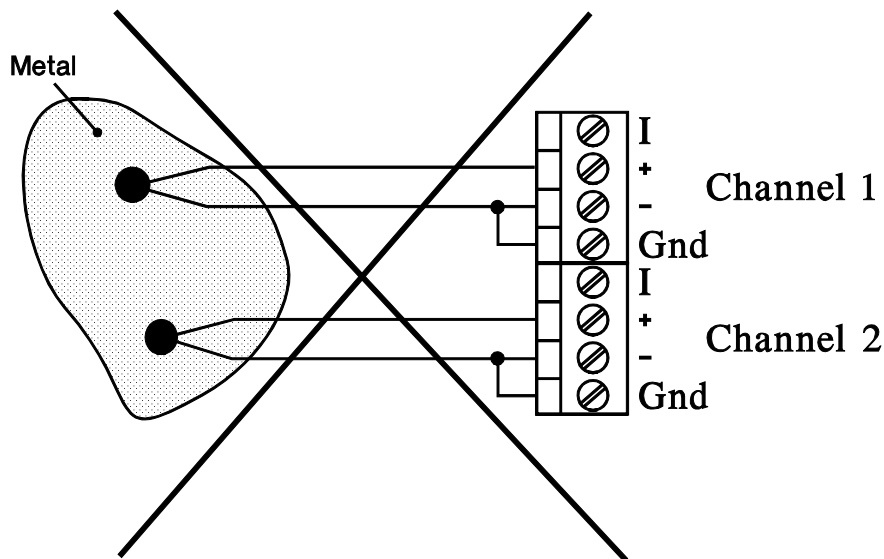
Channels that are to measure temperature using Pt100 sensors should be set to FS=100mV.

Resistance is calculated from read voltage by $R = U / 0.5\text{mA}$. (This is a linear transformation that is extremely easy to realise using the "transform" function of the software)

A Pt100 has a nominal resistance of 100Ω at 0°C . Resistance then increases by approximately $0.39\Omega/^\circ\text{C}$. The Pt100 is slightly non-linear so for more accurate readings the linear transform should be applied around the temperature-points of interest. For large swing readings with great accuracy, a polynomial (e.g. the Callendar-van Dusen equation) for calculation of temperature from resistance should be employed.

3.5 Common errors when connecting transducers

1) Ground Loops



Two bare wire thermocouples are soldered to the same metal object. A ground loop results because "Gnd" of both channels are connected to "-".

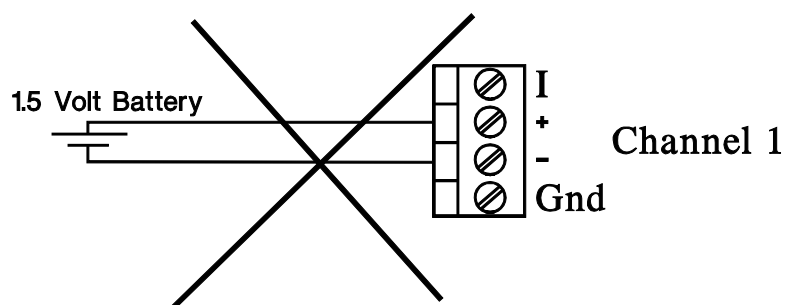
The loop can be followed along the line: Gnd(1) - negative side of T/C(1) - metal object - negative side of T/C(2) - Gnd(2) - Gnd(1). (All Gnd:s are the same electrical point)

Solution 1: Disconnect **one** of the jumpers between "-" and "Gnd".

Solution 2: Isolate T/C tips electrically from object.

Solution 3: (The best) Connect as in 3.4.1. : 1)

2) "Floating" signals with no Gnd reference :



A common battery is connected between "+" and "-" of a channel. There is no connection to "2100" Gnd.

Solution : Place a jumper between "-" and "Gnd" of the terminals!

4 DIGITAL PORTS - COUNTERS

The "2100" has, in addition to the 8 analogue inputs, three digital ports. These ports, called P1, P2 and P3, have their main use in pulse-counting applications. P1 can also be programmed as an output for alarm related purposes.

Pulse counting channels have channel numbers 25 to 27.

Digital inputs appear in channel 31 as one digital bit per input: P1=bit0, P2=bit1, P3=bit2. The numeric value is the sum of the binary weights of the three bits.

The **digital output** is reflected in channel 32. It has the value 0 for a non-active output and 1 for an active output.

This rather strange channel numbering is the result of our effort to keep it compatible with PC-loggers 3100i and 3150i.

4.1 Counters

Flow sensors that output an electric pulse for every unit volume that has passed it are a perfect match for these inputs. By noting counter value and resetting it every Δt you get a very exact figure for flow.

Flow, as you well remember, is volume per time, or litres per Δt , or litres per minute or ...

Each counter can count up to 65535 then it wraps around and starts at 0 again. You have to make Δt short enough so that this doesn't happen.

The counters have two basic modes of operation: Reset mode and Accumulating mode.

4.1.1 Reset mode

By "Reset mode" we mean the "flow measuring" mode mentioned above. The counters are read and reset in the same operation every Δt .

Counters appear as if they were analogue channels showing pulses (or litres or..) per Δt .

4.1.2 Accumulating mode

In Accumulating mode the counters are read every Δt but not reset. The stored value can then be looked upon as the integral from the time of the start of the recording up to the "present".

4.2 Digital Inputs

The status of the three digital inputs are reflected in channel 31. By monitoring these along other signals you can make sure that valves or switches assume the right status at the correct time and correlate this with other measured parameters.

These inputs must be externally "debounced" if mechanical switches are used as "sensors" or fitted with filters if the electrical environment is noisy.

4.3 Digital Output

The digital output is mainly used as an alarm output.

It may also be used for switching purposes, e.g. switching power to external equipment.

The EasyView Pro software supports alarm programming.

5 CONNECT DIGITAL PORTS

The digital ports are multifunctional. The same pins are used for status input, counter input and alarm output. This makes it absolutely necessary to exercise **utmost care** when connecting external equipment to them.

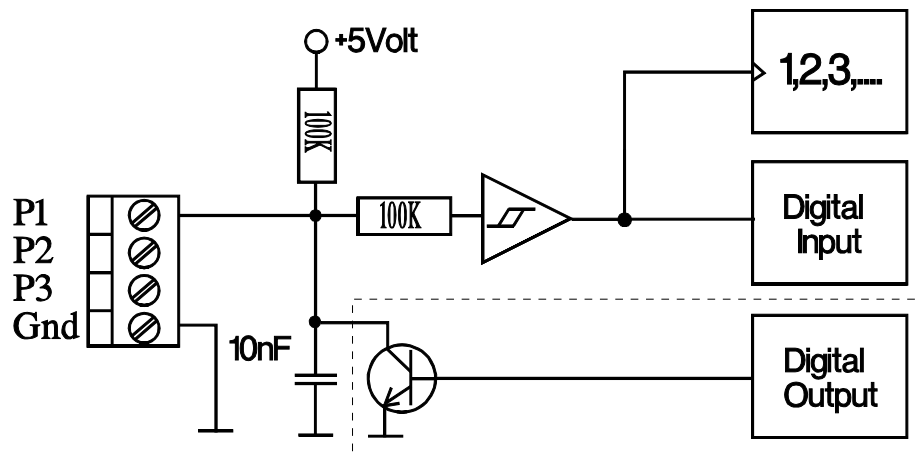
The schematic diagram below shows the details of one of these ports (P1). Ports P2 and P3 are identical but do not have the output transistor (the parts within dashed lines).

Definitions:

A "1" is defined as a shorting of the input/output to ground.

A "1" therefore corresponds to 0V on the input/output.

An unconnected port, consequently, is seen by the logger as a 0 (zero).



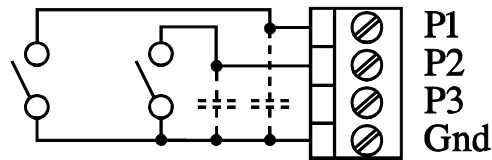
NOTE!

Note that the digital output of P1 has the digital output transistor across it. This will cause contention if it is set to a 1 (see definition above) when there is a signal coming in to the input. Make doubly sure that the digital output is set to 0 (zero) before using the digital input.

Also note that the 10nF capacitor limits the frequency response of the input to 1000Hz.

5.1 Switch / Relay on Digital Input

NO or NC contact devices for status indication or counting are best connected as shown below.



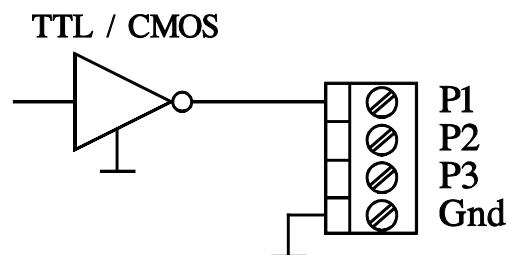
If need be, you can debounce switches by connecting a capacitor externally. (See dashed capacitor in the figure above.) A 0.1uF capacitor will give a time constant of 10 milliseconds, 1uF increases the time constant to 100 milliseconds and 10uF to about 1s.

Contact bounces usually die down within 100ms but may last longer than 200ms if contacts are extremely bouncy.

5.2 TTL/CMOS signal on digital input

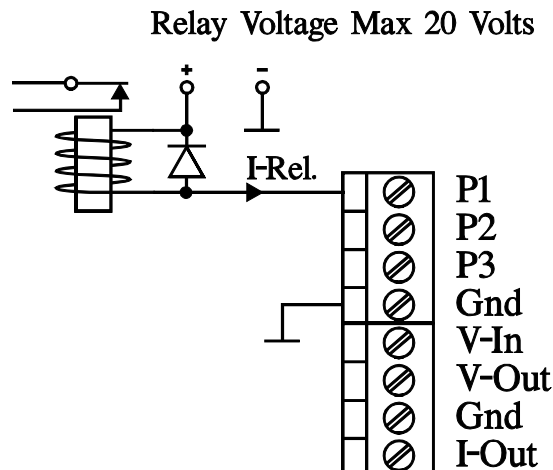
TTL and CMOS signals are easily connected. No special interface is needed. Just make sure that the signal grounds of the two systems interconnected this way are also connected.

Make sure that all signals are below the absolute maximum of 20V.



5.3 External relay on digital output

The digital output is designed as a relay driver. It will activate an external relay that in its turn will start an alarm bell or siren. The relay is easily connected. Simply follow the diagram below.



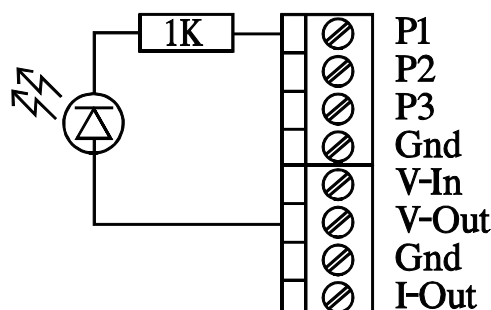
Make sure that the current I-Rel doesn't exceed 100mA. Currents above this will damage the output transistor.

The expert engineer immediately calculates this to also mean that the coil resistance of a relay may not be less than 150Ω if it is powered by 15V.

If a relay is connected to the output as in the example above it must have a built in clamp diode. Some relays don't have this. In those cases you must connect one yourself. Observe polarity when connecting it and make sure it can withstand at least **twice** the relay voltage and carry a current of **at least** 200mA.

5.4 Status Led on digital output

Shown below is how the digital output can be used to switch a led indicator on and off. V-Out is used to supply power.



6 MISCELLANEOUS

6.1 Reset of the PC-logger 2100

The PC-logger model 2100 can be reset by temporarily shorting sockets 7 and 8 of the 15 pole D-sub connector.

Resetting the logger will result in it losing its internal controller program, all measurement parameters and all measurement data it may have stored.

Its internal controller program must then be re-booted and new parameters supplied before recordings can be started again. See also next section.

There should never really be any need to reset the "2100" at all.

Only **very** heavy electrical and RF interference may make it lose track of its internal controller program and necessitate a reset and subsequent re-boot.

If you think it needs a reset because measurements are "off", it is more than likely that you yourself have made a mistake in connecting signals. Check connections instead!

6.2 Controller Program

The internal controller program of the "2100" is stored in RAM (Random Access Memory). This makes it possible to reload (boot) it if it is lost due to a reset. It is also very simple to up-date or up-grade the "2100" with new or customised controller programs by simply downloading them by booting from the software. Booting is done by having the "2100" connected to the correct serial port of your computer. Please see the software manual on how to BOOT.

6.3 50/60Hz Adaption

The PC-logger family all (except "f" models) have some sort of integrating A/D converters. As you know, the time integral of a sine wave that is symmetrical to zero has the exact value of zero if integrated for exactly one period.

In practice this means that all interference from mains is effectively filtered from the measured signal.

The default setting is for 50Hz mains environment. For countries with 60Hz mains, like the US, the unit has to have its integration time changed from 20ms to 16.667ms.

This is easily achieved by, in the software, entering the EasyTerm "terminal emulator", (see software manual) and then typing the command `HERZ:60[Enter]`.

(Don't forget to connect the logger to the computer first.)

If you aren't sure what setting you have, you may ask: `HERZ:?[Enter]`.

Go back to Europe and revert to 50Hz setting by: `HERZ:50[Enter]`

7 TECHNICAL DATA / SPECIFICATIONS

7.1 ANALOGUE DATA

7.1.1 Method of measurement

Δ - Σ -conversion.

7.1.2 Measurement interval

Programmable in 1s steps - min 1s

All channels are sampled with the same Δt

All channels sampled within the same second.

7.1.3 Inputs

8 differential inputs.

Impedance : Min 400k Ω between + and -

Min 5M Ω to ground reference

Overvoltage protection: 30V continuous at voltage input.

Max input current: 80mA continuous at shunt (current) input.

NOTE Current input shunts are 51 Ω resistors.

7.1.4 Ranges

Four voltage ranges and one current range are available on all channels

+/- 10V;

+/- 1V;

+/- 100mV;

+/- 50mV;

+/- 20mA; (*)

Each channel has an associated current shunt (51 Ω)

It is connected by jumpering "I" and "+" in the detachable screw terminal.

(*) NOTE : Max allowed current is 80mA

7.1.5 Divisions/Dynamic ranges

All ranges resolve to approximately +/-25 000 divisions.

The ADC has a resolution of +/-15 bits.

The smallest discernible input change is calculated by FS/25000.

The 10V range has an approximate resolution of 10/25000=0.4mV.

7.1.6 Resolution

10V	0.4mV
1V	40μV
100mV	4μV
50mV	2μV
20mA	0.8μA

Thermo emf 50mV FS:

T/C J	0.1°C
T/C K	0.1°C
T/C T	0.1°C
T/C S	0.3°C
T/C E	0.1°C

7.1.7 Accuracy

(at 25°C)

Voltage ranges

10V	+/- (100ppm + 2 divs.)
1000mV	+/- (200ppm + 2 divs.)
100mV	+/- (300ppm + 2 divs.)
50mV	+/- (400ppm + 2 divs.)
20mA range	+/- (300ppm + 2 divs.)
"Cold Junction"	+/- 0.5°C

7.1.8 Temperature Coefficient

Ambient temperature variations affect readings by max 50ppm/°C.

7.1.9 Noise

Maximum noise level at +/-15 bit resolution is +/-1 bit (=division)

Use averaging to filter noisy signals.

The "Math" section of the PC-logger software can, using simple formulas, apply digital filters to noisy signals.

7.1.10 Common mode

Common mode range at FS range 10V	min +/- 5V.
Common mode range all other ranges	min +/- 10V.
CMRR: (dc)	min 80dB

7.1.11 Constant Current Output

The constant current output supplies 0.500mA into loads of a maximum of 5kΩ.

Accuracy	+/-0.2% at 25°C.
Tempco	max 50ppm/°C

7.2 DIGITAL PORTS - COUNTERS

7.2.1 Digital Output

Output:	1; Paralleled by digital input no. 1
Output type:	Open collector with passive pull-up (100kΩ) to 5V
Max current:	100mA. (at 25°C +/-10°C)
Max voltage:	20V (at 25°C +/-10°C)

7.2.2 Pulse Inputs and Digital Inputs (at 25°C +/-10°C)

No of inputs	: 3 (no.1 paralleled by digital output)
"Low" logic level	: Max 0.8V
"Hi" logic level	: Min 3.5V or open (internal pull-up)
Max input voltage	: 20V
Max pulse freq. (*)	: Min 65kHz at 5V in and 50% duty cycle
Max pulse freq. (*)	: Min 30kHz at 10V in and 50% duty cycle
Max pulse freq. (*)	: Min 20kHz at 15V in and 50% duty cycle
Min pulse width	: Max 15μs
Max counter reading	: 65.535

(*) With a passive sensor output (open collector, relay contacts, switch contacts etc.) the maximum input frequency is limited to 1000Hz by the 10nF capacitor on the input.

7.2.3 Auxiliary voltage output : V-Out

Voltage:	10-18V derived from connected mains adaptor
Current:	Max 200mA with supplied mains adaptor. Max 1A other external power source.

Note: V-Out is active only when the PC-logger is "awake".

When off line recordings with long sampling intervals are in progress, the "2100" falls asleep between samplings. This means that power via V-Out is switched on a few seconds before the sample is taken and then switched off again as the "2100" goes back to sleep.

7.3 INTERNAL DATA STORAGE CAPACITY

The PC-logger 2100 can store in excess of 112 000 values (off-line).

The data RAM is backed up by a lithium battery that will retain data in case of power failure.

Lithium battery life is 10 years.

7.4 COMPUTER INTERFACE

Computer communication is in serial form.

The serial standard is a subset of RS-232.

Format: 8 bit ASCII, 1 Start bit, 1 Stop bit, No parity bit

Baud rate: 9600 Baud

7.5 POWER REQUIREMENTS

Voltage: 12-18V DC (*)

Current: ca 60mA (charging current 35 mA)

Current w/o charging batts. : ca 25mA

(Power via Vin or pin 3 of the TA3F connector. Voltage requirement in this case is 10V.)

NOTE! With the display back-light on, the current consumption increases by ca 130mA.

(*) At elevated input voltages (>15V) the temperature inside the "2100" rises. This affects measurement accuracy. (See also temperature coefficient).

7.5.1 Built-In accumulators

Charging time: ca. 24 hours for full capacity.

Should be left on charge even when not to be used for longer periods

Capacity: At least 8 hours continuous operation with fully charged accumulators.

7.5.2 Mains Adapter

Voltage: 12-18V

Current: Min 250mA

7.6 MECHANICAL

Length: 247mm

Height: 110mm

Width: 36mm

Weight: 1.1kg

We believe the information in this manual to be correct. Should there arise questions about the validity or meaning of information herein we appreciate if information about this could be forwarded to us.

Because development work continuously improves our products we reserve the right to make changes without any notice.

In consequence we cannot assume responsibility for any consequential or other damage resulting from the use of this instrument.

8 Questions and Answers

Q: I am recording ambient air temperature using T/C's type "K" and all values are jumping up and down. Some values, like -3000°C, are absurd! What causes this?

A: You have forgotten to connect the "-" input to Gnd. Your signal is floating around without any connection to ground reference. See chapter 3 .

Q: I am logging temperature with T/C's type "K". The logger indicates a rising temperature when I actually lower it. Why is this?

A: You reversed the T/C leads. The red wire is the negative lead.

Q: I am going to log temperature in two places along a metal hot water pipe. Both thermocouples are welded to the pipe. How do I go about connecting them to the logger?

A: Since both hot junctions are in contact with a metallic object only one negative lead should and may be connected to "Gnd". Alternatively you may run a separate wire from the pipe to "Gnd". All other methods will result in ground loops that may spoil your measurements.

Q: I want to sample data at the highest possible rate. The memory has to hold data of a full week.

How do I calculate the shortest possible sampling interval?

A: The memory of the "2100" can hold 112 000 values.

1 week = 604 800 seconds. $604\,800 / 112\,000 = 5.4$!

Select an interval of 6 seconds for a week long recording on one channel.

You don't really have to make calculations like this. The software will always tell you how long the memory will last for every set of parameters you program.

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