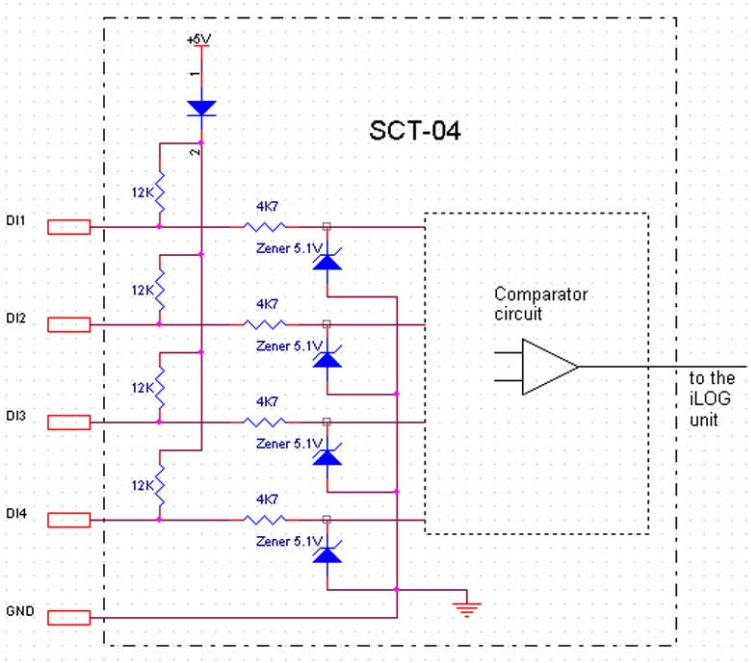
1. Pulse input circuit

iLOG RTU/data loggers feature two high speed pulse inputs (DI3, DI4). The following picture contains the SCT-04 digital input circuit.



Picture 1: SCT-04, Digital input circuit

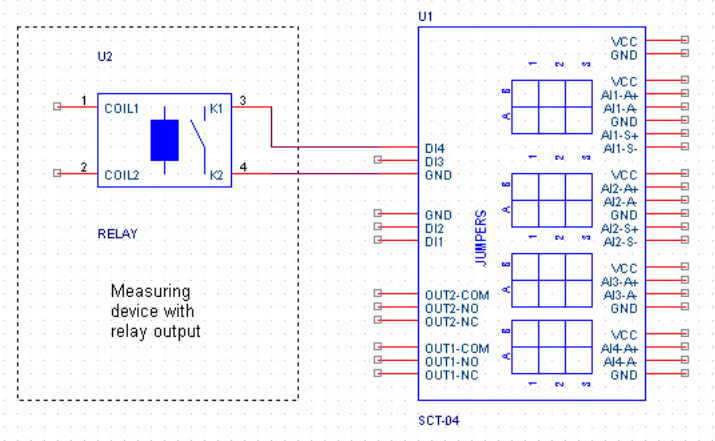
The input resistance is 12K. The comparator circuit inverts the input signal with following thresholds:

iLOG input state = '0', for unconnected or input signal > 2V.

iLOG input state = '1', for input signal < 1.8V.

Note: iLOG data loggers use interrupt processing for serving the pulse inputs. Input signals must be clean, good shaped, without bouncing. The maximal frequency is limited by the external circuits to 3.2kHz per channel.

1.1. Connecting a device with relay output

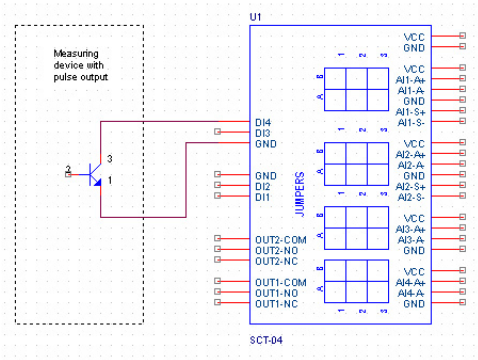


Picture 2: SCT-04, Connecting a device with relay output

Relay output signals are often bounced and are not recommended for applying to the pulse inputs.

1.2 Connecting a device with open collector output

This is the recommended signal input for the pulse inputs.



Picture 3: SCT-04, Connecting a device open collector output

The inpedance of the input circuit is 12K connected to 5Vdc. The input current is 0.4mA.

1.3 Connecting a device with push-pull output

Devices with push-pull output are also applicable.

Note: Output voltages higher than +5V or negative voltages (lower than GND) will be clamped from the comparator input protection zener (see Picture 1) and may overload the output stage of the external device. The inpedance of the input circuit is, in this case, 4.7K. An external transducer with 24V output must be capable of driving a current of 5 mA.

2. Pulse counting input configuration

The function of digital inputs DI3 and DI4 can be selected between following modes (**Setup>Measurement>Pulse IN>Counting mode**):

- : Pulse counting disabled (default). The respective input acts as a normal digital input.

L: For low frequency signals in the range of 0.001 to 12 Hz. The iLOG unit measures the signal period with 1ms resolution. This mode should be selected for input frequencies of maximal 10Hz. Raw scale is 0..12000 for 0-12Hz with 0.1 Hz resolution, which means that a display value of 6452 is corresponding to 6.452 Hz.

H: For higher frequency signals in the range of 10 to 1000 Hz. The iLOG unit measures the signal frequency in a period of 10 seconds. Raw scale is 0-12000 for 0-1200 Hz with 0.1Hz resolution which means that a display value of 6452 is corresponding to 645.2 Hz.

C: Counter function.

T: Totalizer function.

Attention: A digital input selected for conditional logging cannot be used for pulse counting.

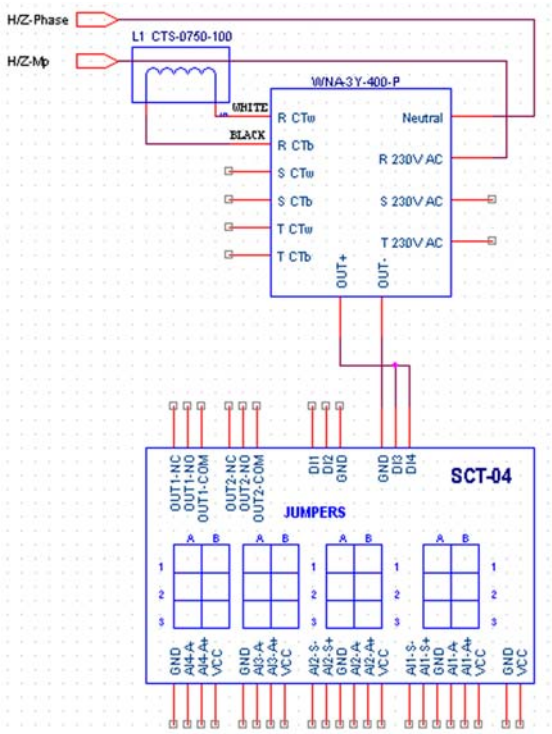
Options L and H generate the virtual analog channels AI5 for DI3 and AI6 for DI4 respectively. Option C for DI3 and DI4 generates the virtual analog channels AI7 for DI3 and AI8 for DI4 respectively. The **Setup>Measurement>Analog IN** menu option can be used to set the scaling values for these analog channels.

The counter and totalizer functions establish a 4 byte counter with preset and clear for the corresponding digital input. Logging is disabled for the totalizer function.

3. Application: Recording Power and Energy using a WATTNODE® transducer

3.1 iLOG Firmware versions > 1.6

Wattnode P-Series from Continental Control Systems LLC are low cost Watt/Watt-hour transducers with pulse output. The Wattnode model used for this application is WNA-3Y-480-P with a CTS-0750-100 current transformer.



Picture 4: Connecting a Power/Energy transducer to the pulse inputs

The transducer has an open collector output, which is connected to both inputs DI3 and DI4. Input DI3 is configured as frequency input (Option 'H') to record Power (kW) and DI4 is configured as pulse counter (Option 'C') to record Energy (Watt-hours, Wh).

The manufacturer of the transducer supplies following information for computing Power and Energy from pulse frequency and pulse count respectively:

The power is a function of the pulse frequency, while the energy is a function of the count of pulses. The variable ***nCTs*** is the maximum number of CTs (current transformers) that the WattNode model can use. The variable ***CTAmps*** is the full-scale current rating of the CTs. Note: If the wires being measured are passed through the CT(s) more than once, then the full-scale CT current is divided by the number of times that the wire passes through the CT. ***VAC*** is the nominal phase voltage of the WattNode model. The variable ***PulseFreq*** is the pulse frequency from the WattNode, while ***Pulses*** is the total accumulated count of pulses. ***FSHz*** is the full-scale pulse frequency printed on the rear label of the WattNode. The values of the constant parameters are in the following table.

WattNode Model	Possible FSHz Values *)	nCTs	VAC
WNA-1P-240-P	2.667, 193.3, or 773.3 Hz	2	120
WNA-1P-240-P	2.667, 193.3, or 773.3 Hz	2	120
WNA-3Y-208-P	4.000, 290.0, or 1160 Hz	3	120
WNA-3Y-480-P	4.000, 290.0, or 1160 Hz	3	277
WNA-3D-240-P	2.667, 193.3, or 773.3 Hz	2	240
WNA-3D-480-P	2.667, 193.3, or 773.3 Hz	2	480

* 'Possible FSHz Values' represent order options for the transducer.

Below are the equations used to compute the power and the energy.

$$\text{Power (W)} = \frac{\text{nCTs} * \text{VAC} * \text{CTAmps} * \text{PulseFreq}}{\text{FSHz}}$$

$$\text{Energy (Wh)} = \frac{\text{nCTs} \cdot \text{VAC} \cdot \text{CTAmps} \cdot \text{Pulses}}{\text{FSHz} * 3600}$$

The chosen transducer (WNA-3Y-480-P) has the following specifications:
FSHz = 290Hz
nCTs = 3
VAC = 277
The current transformer CTS-0750-100 has a full scale current of **100A**.
The full scale value for a measured frequency of 290Hz is calculated to **84.1kW**.
The Watt-hours per pulse is calculated to **0.0796 Wh/pulse**.
The iLOG measurement parameters are set to the following values:

Setup>Measurement>Pulse IN>Counting mode>DI3 → 'H'
DI3 is configured as frequency input to record Power (kW).
Setup>Measurement>Pulse IN>Counting mode>DI4 → 'C'
DI4 is configured as pulse counter to record Energy (Watt-hours)

Setup>Measurement>Analog IN>Channel 5>Scale Low → 0
Setup>Measurement>Analog IN>Channel 5>Scale High → 84
Note: Acceptable values for scale low and high are integer values limited in the range of -32767 to +32767.
Setup>Measurement>Analog IN>Channel 5>Sensor low → 0
Setup>Measurement>Analog IN>Channel 5>Sensor high → 2896
Note: The sensor low value for frequency channels is always 0. The sensor high value is the maximal transducer output frequency * 10. Acceptable values are limited to 32000, which corresponds to an external frequency of 3.2kHz.
The value 2896 represents the frequency reading (ADC output) for the scale high value of 84kW (289.6 Hz).
Setup>Measurement>Analog IN>Channel 8>Scale factor → 0.0796
Note: Acceptable values for Counter channel scale factors are in the range of 0.0000 to 1.0000.

3.2 Earlier Firmware versions (< 1.7)

Earlier iLOG firmware versions differ in the following points, relatively to the pulse inputs operation:

- The scale factor for Counter channels is not provided.
- The raw scale of frequency channels (sensor low, high) is 0..4095. The sensor high value (4095) corresponds to a input signal frequency of 999.9 Hz for 'H' selection and 9.999 Hz for the 'L' selection.

The respective settings for these versions would be:

Setup>Measurement>Pulse IN>Counting mode>DI3 → 'H'

DI3 is configured as frequency input to record Power (kW).

Setup>Measurement>Pulse IN>Counting mode>DI4 → 'C'

DI4 is configured as pulse counter to record Energy (Watt-hours)

Setup>Measurement>Analog IN>Channel 5>Scale Low → 0

Setup>Measurement>Analog IN>Channel 5>Scale High → 84

Note: Acceptable values for scale low and high are integer values limited in the range of -32767 to +32767.

Setup>Measurement>Analog IN>Channel 5>Sensor low → 0

Setup>Measurement>Analog IN>Channel 5>Sensor high → 1186

The sensor high value of 1186 represents the raw reading (raw scale: 0..4095), which corresponds to the frequency of 289.6 Hz.

A scale factor for Channel 8 (Counter) is not supported in these versions. It can be applied in the data collection application. The iBase application provides a field for this purpose in the **Channel Edit Form**. Raw data are multiplied with this factor value during data importing.