K-Factor Scaler F5140
and
Programming Kit F5141

Installation & Operating Instructions

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INTRODUCTION

The Flo-tech K-Factor Scaler is a field adjustable frequency divider, which interfaces the output signal from a turbine meter with a magnetic pick-up to the input of a PLC, RTU, CPU data acquisition card, or similar totalizer device. The adjustable frequency divisor, referred to as the K-factor, allows the pulses being sent from a turbine meter to be divided into a recognizable unit that an end device, such as a PLC can count and display.

OPERATING PRINCIPLE

Fluid moving though a turbine flow meter causes the rotor to rotate in relation to the flow rate. The rotation of the rotor blades cuts through the magnetic field generated by the magnetic pick-up which in turn generates a frequency output signal that is directly proportional to the speed of the rotor.

The signal produced is received by the K-Factor Scaler input amplifier, which has an input sensitivity of 30 mV p-p to 30 V p-p. The signal is then sent to an onboard microcontroller, which acts as a divisor with a range of 1 to 999,999,999. The divisor (K-factor) is user adjustable through the optional programming software kit. The microcontroller handles the dividing process by counting the input pulses and comparing it to the programmed K-factor value. Once the count equals this value, an output pulse occurs for a selectable time period and the counting process starts over.

In addition, if the K-factor is set to 1, the K-Factor Scaler can be used as a pre-amplifier where the frequency from a low-level turbine meter is proportional to the logic level frequency output needed by a PLC or CPU data acquisition card. This option allows the end device to control the dividing process of the turbine meter output to a recognizable flow rate.

SPECIFICATIONS

External Power:
Input Voltage; 8.5 to 30 Vdc (Diode protected)
Maximum Current draw; 18 mA (using internal resistor @ 30 Vdc input)

Environmental:
Operating Temperature; -22 ˚F (-30 ˚C) to +158 ˚F (+70 ˚C)

Inputs:
Magnetic Pick-up Input
Frequency Range; 0 to 4000 Hz
Trigger Sensitivity; 30 mV p-p to 30 V p-p

Output Signal:
Max. Voltage; 30 Vdc
Max Power; 0.25 W
Pulse Type (using internal pull-up resistor);
VH = Power Input Voltage – 0.7 Vdc
VL = Less then 0.4 V @ max input power
Pulse Type (using external pull-up resistor);
VH = Input Voltage to external pull-up resistor
VL = [VH /(selected resistor value + 47)] × 47
Pulse Length; 150µs, 1ms, 25ms, 100ms, 500ms, 1s, or Auto mode selectable.

Output Options:
Jumper Configurations
Internal Pull-up; 3.6K Ω to device power
External Pull-up; Open collector

Enclosure:
ABS with mounting flanges

INSTALLATION

The programmable K-Factor Scaler was designed to provide a field adjustable frequency divider that converts the low level frequency output from a turbine meter into a scaled square wave output signal. Refer to **Figure 1** below for the I/O terminal connections. The board connections include Power Input, Turbine Meter Input, and the Pulse Output to a totalizing device.

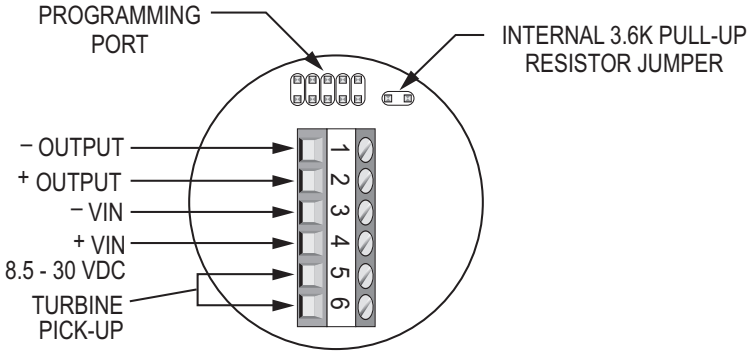

Figure 1
Board Connections

Enclosure Mounting

The enclosure has four (4) mounting holes for easy mounting.

Power

The K-Factor Scaler requires 8.5 - 30 VDC to operateand is protected by a diode. Polarity is shown in **Figure 1** above.

Turbine Meter

The turbine meter connections are non-polarized. Shielded twisted pair wire is recommended for this connection to the turbine meter.

Pulse Output

Either the internal or external pull-up resistor must be used for the K-Factor Scaler to provide an output pulse. This option is controlled by the onboard jumper. With the jumper installed, the internal pull-up resistor is connected.

Internal Pull-up Resistor

The internal pull-up resistor allows for simple installation but care must be taken to ensure that the device being connected to by the pulse output can handle voltage levels as high as the supply feeding the K-Factor board. Another important setup consideration when using the internal pull-up resistor is to make sure the output pulse from the K-Factor board can supply enough current for the receiving device to be able to read the pulse. The available current that the K-Factor board can supply to the receiving device can be calculated with the following equation.

$$\text{Available Current} = \left(\frac{\text{Input Voltage - 0.7 V}}{3600\ \Omega + 47\ \Omega} \right)$$

Verify that the receiving device input current requirement is below this value for proper operation. Otherwise, an external pull-up resistor less then 3.6K will have to be used.

External Pull-up Resistor

Using an external pull-up resistor offers the end user greater flexibility of controlling the output pulse provided by the K-Factor board to the receiving device. Since power sources and receiving devices differ between users, different resistor values may be required by different setups.

The external pull-up resistor is connected between the receiving device's input and external power source. This power source would be the maximum input voltage (of the pulse) to the receiving device. Refer to the following equation to help determine the resistor value needed.

$$R = \left(\frac{\text{Supply Voltage}}{I} \right)$$

Where: ***R*** = Resistor value in Ohms
Supply Voltage = External supply voltage connected to the external pull-up resistor
I = Input current required by the receiving device in amps

After the Resistor value has been calculated, make sure in the following equation, that "P" is less than or equal to 0.25. "P" represents the power capability of the output and should not exceed 0.25 Watts. Exceeding this value could damage the K-Factor board. Raising the Resistor value will decrease the available power output.

$$P = (\text{Supply Voltage}) \left(\frac{\text{Supply Voltage}}{R + 47} \right)$$

STARTUP and CONFIGURATION USING OPTIONAL PROGRAMMING SOFTWARE KIT (F5141)

The programmable K-Factor Scaler can be factory or user configured through a serial port of a PC by a Windows® compatible software utility. A programming adapter is required that interfaces the serial port from the PC to the programming port on the board.

To program the K-Factor Scaler, begin with the power turned off and connect the adapter cable to the K-Factor Scaler board. See **Figure 2**. Then, connect the Serial -to-TTL converter (black box) to the adapter cable. Next, attach the serial extension cable to the Serial-to-TTL converter and connect the opposite end to an available 9-pin serial port of a PC. Lastly, make sure power is being supplied. Power must be supplied to the K-Factor Scaler in order to program.

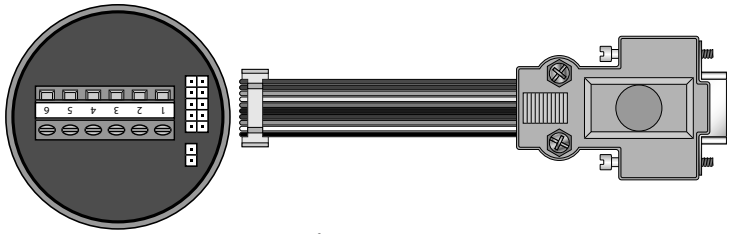

Figure 2
Interface connection

The programming software is divided into two columns as shown in **Figure 3**. The 'Program Values' column is the information that is to be programmed into the K-Factor board and can be entered by the user. The 'Board Values' column is Read ONLY and indicates the information that the K-Factor board currently contains. The 'Board Values' column will only display the contents of the board after a program, read, or verify function was performed.

The proper computer serial port must be selected within the K-Factor Programming software for it to communicate with the board. This is done by going to TOOLS – COM PORT, from the menu bar, and selecting the Com Port (1 through 16) that the serial programming cable is connected to on the computer.

If the serial port selected is invalid, the software will show the message "ERROR- Invalid Com Port" when trying to program the board. If the serial port selected is the incorrect port (or if there is a problem with the cable), the software will show the message "<< No Response>>" after trying to program the board. All information under the 'Program Values' column must be entered before the software will allow the board to be programmed.

The PROGRAM button programs the K-factor, Pulse Width, and Pulse Output to the K-Factor board. After the program function is complete, the board is automatically read and verified. The K-Factor board will retain these values when disconnected from power and can be re-programmed at any time.

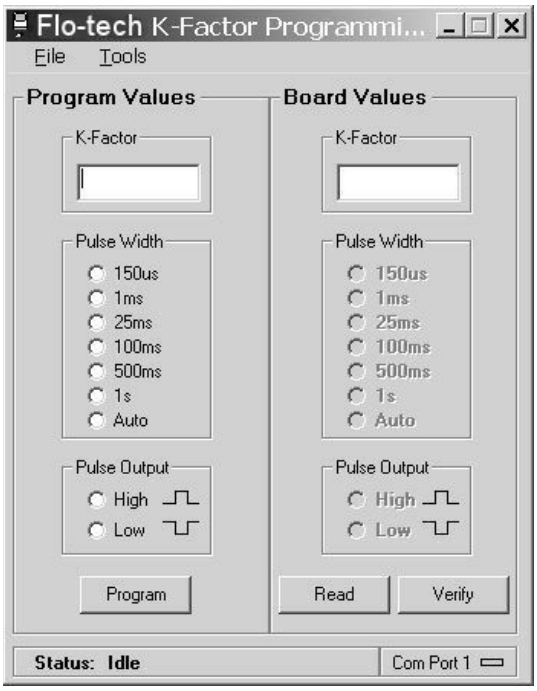

Figure 3
Programming software screen

The READ button reads the current information from the K-Factor board and displays it under the 'Board Values' column of the PC software.

The VERIFY button performs the same function as the READ button but compares the Board Values to the Program Values and displays an error if the two do not match.

Configuring and programming the K-Factor board consists of the following four items:

- Setting the K-factor (divider)
- Setting the output pulse width
- Setting the output level normally high or normally low
- Setting the pulse to use the internal or external pull-up resistor

Setting the K-factor

The K-factor is the ratio of input pulses per each output pulse and can be viewed as a divisor. The minimum K-factor can be set to 1 where each input pulse yields an output pulse. The maximum K-factor can be set to 999,999,999 where it would take this many input pulses to yield one output pulse.

The K-factor is set by entering it into the 'Program Values' column of the software under K-Factor. The K-factor will be programmed into the board when the Program button is pressed, but note that all values must be entered before programming is allowed by the software.

Setting the output pulse width

The output pulse width is the length of time the pulse remains active before resetting to its resting state. The K-Factor has a total of six different pulse widths to choose from. Some end devices require that the pulse be a certain length or longer in order for proper detection of each incoming pulse. For these devices, it's important to select a pulse width that is long enough for the end device to recognize.

The pulse width option is set by selecting the desired pulse width radio button in the 'Program Values' column of the software. The Pulse Width option will be programmed into the board when the Program button is pressed, but note that all values must be entered before programming is allowed by the software.

In addition to six pre-set pulse widths to choose from, another option is also available called "Auto" mode. This mode acts in the same manor but does not restrain the output pulse to a specific length. Instead, it varies and is dependent on output frequency. The higher the output frequency, the shorter the pulse width output. The lower the frequency output, the longer the pulse width output. This option turns off the 'Pulse Output' option because it does not apply in this mode.

Setting the output level normally high or normally low

Most end devices will be unaffected by this setting, but the K-Factor Scaler has the ability to invert the output pulse level. This option is set by selecting the desired pulse output radio button in the 'Program Values' column of the software. The Pulse Output option will be programmed into the board when the Program button is pressed, but note that all values must be entered before programming is allowed by the software.

When the Pulse Output option "High" is selected, the output level is normally low and the duration of the selected pulse width is high. When the Pulse Output option "Low" is selected, the output level is normally high and the duration of the selected pulse width is low.

Setting the output pulse to use the internal or external pull-up resistor

Either the internal pull-up resistor or an external resistor must be used for the K-Factor Scaler to provide an output pulse. This option is controlled by the onboard jumper and not by software.

With the jumper installed, the internal 3.6K pull-up resistor is connected to the input voltage of the board. With the jumper uninstalled, the internal pull-up resistor is disconnected and an external pull-up resistor and supply voltage is required.

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When returning equipment for service, a Returned Goods Authorization (RGA) number must be obtained from our Service Department. Please contact them by phone at 800-433-5263 or 262-639-6770 or by e-mail to flo-techtechhelp@racinefed.com.

All returns go to the following address and must include the RGA number on the outside of the box:

Flo-tech
Division of Racine Federated Inc.
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Racine, WI 53406-3738 USA
Attn: RGA # xxx-xxxx

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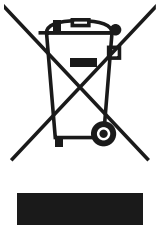

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