Nova Flow

Energy Calculator

Plug-n-Flow Architecture

USER'S MANUAL

HP-305
September 2012

HOFFER Flow Controls
Perfecting Measurement™

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FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting HOFFER FLOW CONTROLS:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

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Disclaimer

Specifications are subject to change without notice.
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Specifications

General Specifications

Environmental

Operating Temperature:	-20°C to 70°C -40°C to 70°C, with heater option. (Only available with NEMA enclosure option)
Storage Temperature:	-40°C to 85°C
Humidity:	0-95% Non-condensing

Approvals and Regulatory Compliance

CE

Standards:

- AGA 8/API 14.2
- AGA 7
- OIML Tc 8 Sc 7, R117, R118
- ISO 6551, 7637
- NIST Handbook 44, 3.37

Enclosure

1/2 DIN panel mount, aluminum housing
Optional Ex proof, NEMA 4X

Power Supply

10 to 30 Volts DC, 2A max
85 to 265 VAC, 50/60Hz, 400mA max

Display

128x64 graphical display displays 4 parameters simultaneously
Easy scroll through matrix of 48 parameters
LED back light
Adjustable contrast

Keypad

3 soft keys
14 assigned keys
Embossed overlay
Stainless steel membrane switches

IR Interface (Optional)

Front panel infrared transmitter/receiver for remote operation and communication

Diagnostics

Multiple error messages
Failure detection for RTD and all analog inputs
System configuration and diagnostics from a PC computer through RS-232 port

Field Expandable Hardware and Software

Easy to add and replace modules
Software configuration based on installed modules

Diagnostics
Multiple error messages
Failure detection for RTD and all analog inputs
System configuration and diagnostics from a PC computer through RS-232 port

Field Expandable Hardware and Software
Easy to add and replace modules
Software configuration based on installed modules

Alarms
Multiple visual/audio alarms
HI/LO, HI/HI, LO/LO

Power and Energy
Supports Power and Energy calculations for heating and cooling applications
Separate registers available for Peak and Off-Peak times
Two Peak times may be configured within a 24-hour period
Optional dual flowmeter system is available for detecting fluid losses in heating and cooling systems

Flow Compensation and Calculation Methods
20-point flow linearization
FWD/REV tables for two channels
Mass and Volumetric calculations available for fluids
Up to 4 fluid properties tables

Security Features
Audit Trail with Time/Date/ID stamping for configuration changes

Hardware Specification

Nova Flow construction allows full flexibility in selecting flow computer functions. The base Nova-Flow unit provides one flow meter input, and 8 digital I/O lines. Each I/O line can be configured as Input or Output. The unit has 8 expansion slots for optional I/O modules. Almost any combination of modules can be selected to meet the customer's individual needs.

BASE UNIT

Flow Meter Input
Selectable: Magnetic coil, MCP coil, TTL, Open Collector, Dry Contact
Frequency range: 0.2 to 5,000 Hz.
Amplitude: 10mVrms to 30Vrms

Digital I/O
7 digital lines selectable for Input or Output
One optically isolated Digital Output
Software configurable function: pulse output, remote clear, batch start/stop, batch control, alarms.
Selectable voltage level:0-5V, 0-10V, or Open Collector rated at 30Vdc, 250mA max.

Auxiliary 24 Vdc power supply @ max 100mA

OPTIONAL MODULES

Dual RTD and Dual Analog Input Module

Includes two RTDs and two analog inputs
Compatible with 100, 1000, and 2500 Ohm RTD probes
Analog inputs configurable for temperature, pressure, density, specific gravity, or flow
Accuracy 0.025%
Resolution 12 bit
Range 4-20mA, or 1-5V
Over voltage and over current protected

Analog Output Module

12 bit true D/A
Selectable 4-20mA, 1-5V
Current sourcing, or powered from external power supply

Dual Relay Module

Includes two SPDT relays
Dry Contact or Solid State Relays
Dry Contact: Vmax 125Vac, Imax 10A / Vmax 250 V ac, Imax 5A
Solid State: Vmax switching 175Vdc, Imax switching 250mA, Imax carry 1.5A
Software configurable for flow, temperature, pressure, and density alarms (high and low)

RS232 Port Module

Includes one RS232 serial port, screw terminal or DB9 connector
Printing, configuration, MODBUS interface

RS485 Port Module

Includes one RS485 serial port, screw terminal connector
Printing, configuration, MODBUS interface

Dual Pulse Out Module

Scaled pulse per unit of measure
Voltage level: 0-5V, 0-12V, Open Collector 30Vdc, 250mA max.

Flow B Module (second flow input)

Magnetic coil, MCP coil, TTL/CMOS, Open Collector, Dry Contact
Quadrature input for magnetic coil, ISO6551 level B compliant
Frequency range 0.2 to 5,000 Hz
Amplitude 10mVrms to 30Vrms

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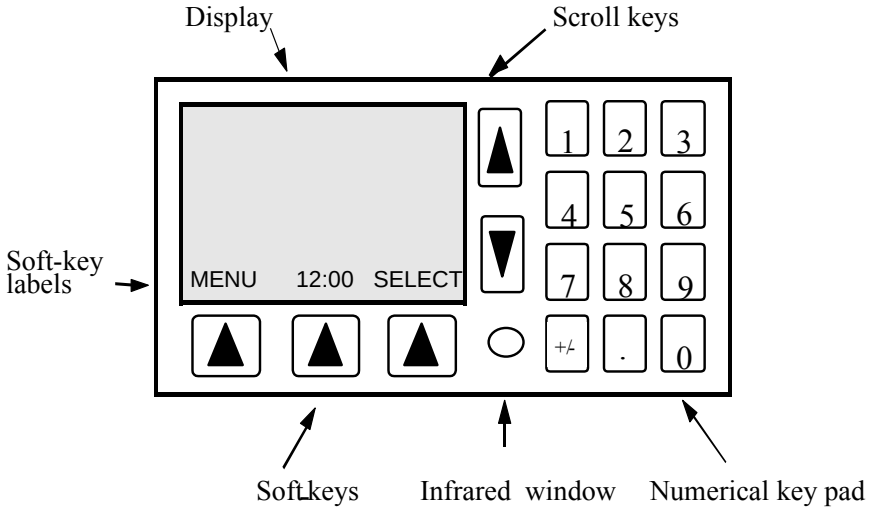
Architecture

The Nova-Flow Energy Calculator architecture allows for many combinations of software and hardware options. Its modular design can accommodate a variety of flow applications. The Nova-Flow chassis has 8 expansion slots accessible through the rear panel to install optional "plug-in" modules. There are several modules for various input signals, output signals, and communication requirements.

Front Panel

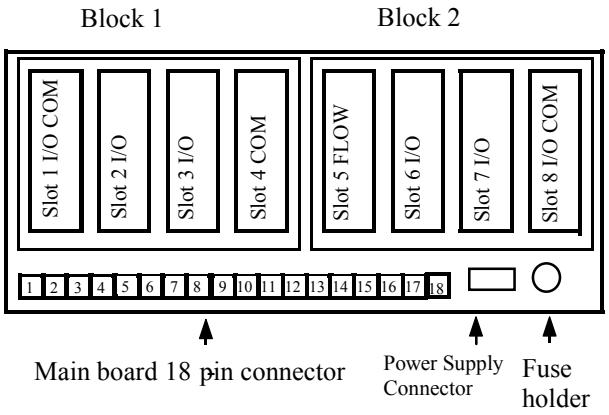
Nova-Flow has a graphical display with 64x128 pixel resolution. It displays five lines of text: four lines are used for process parameters, and the fifth line at the bottom of the display is used for software-controlled key labels. There are three software-controlled keys (soft-keys) located under the display, two scroll keys on the right side of the display, and a numerical keypad. Soft-key functions vary with the operating mode of the unit. The soft-key labels are displayed above the soft-keys and change according to the operating mode. Two scroll keys (UP and DOWN) are used to select display parameters, and to navigate through the program menu. The numerical keypad is used to enter numerical values, or to select items in the menu. Under the scroll keys there is an infrared window for communication with computers equipped with IR interface.

Nova-Flow Front Panel



Rear Panel

The main board 18 Pin connector provides connection for all standard circuits: the flow meter input, auxiliary 24 Vdc output, and 8 digital I/O lines configurable for either input or output.



There are 8 optional module slots grouped in two blocks: Block 1 and Block 2. Each block consists of four slots. Each slot has a specific functionality that has to be matched with the module type. Slot #5 is for flow meter module only, slot #4 is for communication modules only. Slots 2,3,6,7 are for input/output modules only, slots 1,8 are for use with input/output and communication modules.

Slot 1	Input/output modules and Communication modules
Slot 2	Input/output modules
Slot 3	Input/output modules
Slot 4	Communication modules
Slot 5	Flow meter module
Slot 6	Input/output modules
Slot 7	Input/output modules
Slot 8	Input/output modules and Communication modules

Slot/Module Compatibility Table.

Optional Modules

There are three types of optional modules: input/output (I/O), communication (COM), and flow meter modules. When installing a module, the type of module has to be matched with the type of slot in the Nova-Flow chassis.

The following modules are available:

I/O Modules:

RTD/Analog Input
Analog output
Dual relay
Pulse out

Com Modules:

RS232
RS485

Flow Meter Module:

Flow B

A combination of the above modules results in over 50,000 different configurations available for Nova-Flow.

Optional Modules

Module Name	*Function*	*Available slot*	*Code #*
RTD/ANALOG IN	Dual RTD 2 or 3 wire, and dual analog input 4-20mA, or 1-5V	1, 2, 3, 6, 7, 8	T1-T16*
ANALOG OUT	Analog output 4-20mA, or 1-5V	1, 2, 3, 6, 7, 8	A7, A8*
RELAY	Dual SPST relay	1, 2, 3, 6, 7, 8	R1, R2*
PULSE OUT	Pulse output for frequency above 1Hz	1, 2, 3, 6, 7, 8	P
RS232	Serial communication, terminal block	1, 4, 8	S2
RS232-DB9	Serial communication, DB9 connector	1, 4	S9
RS485	Serial communication, terminal block	1, 4, 8	S4
FLOW B	Flow meter input with pulse security	5	BM, BRF

*See model number designation section

Notes!

1. When a module is installed, removed, or moved to a different slot, the software configuration has to be changed accordingly. Refer to section “Slot configuration”.
2. Hoffer recommends that Slot 1 is always equipped with a serial communication module to allow configuration changes from a PC computer.

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Model Number & Hardware Code

Nova Flow Model Number:

NFEN-A7-S2-MB-1-M-T1-1-H/L R1-P-F-BP-SP

Analog Outputs
(A7) 4-20mA
(A8) 1-5Vdc

Communication Ports
(S2) RS232/ Screw Terminal
(S4) RS485/ Screw Terminal
(S9) RS-232-S9

Scaled Output Pulses
(MB) Mother board
(P) Dual High Speed Output

Number of Channels
(1) Single Channel
(B) Dual Channel, Bi- directional
(PSB) Pulse Security
(B3) 3 Channel Unit
(B4) 4 Channel

Flowmeter Input
(M) Magnetic Coil
(MC3PA) RF Coil
(RPR) Redi-pulse RF coil
(RPM) Redi-pulse Magnetic Coil
(DMX) Redi-pulse I.S. Magnetic Coil
(DRX) Redi-pulse I.S. RF Coil

Temperature/Pressure Compensation, Analog and RTD Inputs
(T1) Two 4-20mA, two 100 ohm RTD inputs
(T2) Two 1-5Vdc, two 100 ohm RTD inputs
(T3) One 4-20mA, one 1-5Vdc, two 100 RTD inputs
(T4) Two 4-20mA, two 1000 ohm RTD inputs
(T5) Two 1-5Vdc, two 1000 ohm RTD inputs
(T6) One 4-20mA, one 1-5Vdc, two 1000 ohm RTD inputs
(Z) Add (Z) Compressability software after all options above for gas

Power Input
(1) 115 Vac 50/60 Hz
(2) 220 Vac 50/60 Hz
(*) 10-30Vdc

Alarms
(H/L R1) ½ amp dual SPDT, high speed 200 Hz max
(H/L R2) Dual SPDT., 10 amp relays

Enclosure Style
(P) Panel Mount
(ND) Mounted on door with keypad accessible
(E) Explosion Proof, Visible thru window
(C) Portable

Accessories/Options
(F) Flowmeter mounted for (ND)
(H) Heater for (ND) & E options only

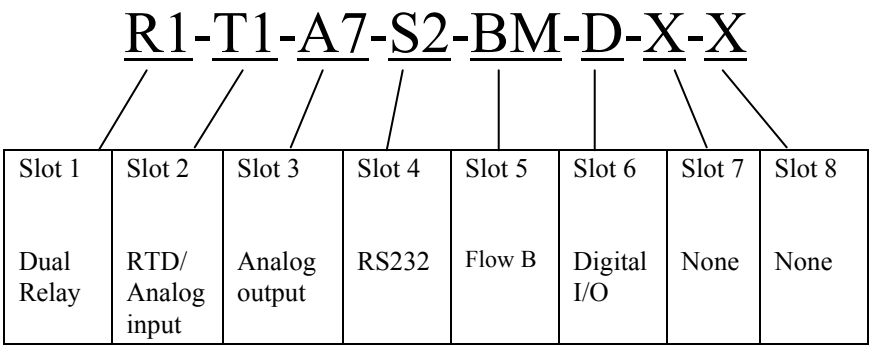
Backplane
(B) Second backplane, required if slots 6, 7, or 8 have been configured
(BPB) Use option if (B) dual channel has been equipped in slot 5

Special Features
(SP) Any special features that are not covered in the model number

Hardware Code

In addition to the model number Nova Flow units are labeled with a hardware code to help the factory identify installed hardware options. The hardware code consists of a string of up to 8 symbols representing modules in the order they are installed in the chassis. Each symbol stands for one module. An "X" indicates there is no module installed in the corresponding slot. The first four symbols represent modules installed in the Block-1, the second four symbols represent modules installed in the Block -2. The second four symbols are deleted if there are no modules in the Block-2 slots. This also indicates that the Block-2 board is not installed.

Hardware code example:



Module Code Table

Module name	*Description*	*Type*	*Code*	*Max #*
Flow B	Flow meter input, Mag or pulse coil	Flow	BM	1
Flow B	Flow meter input, RF coil	Flow	BRF	1
RS 232	Serial communication, screw terminal.	Com	S2	3
RS 232-DB9	Serial communication, DB9 connector.	Com	S9	1
RS 485	Serial communication, screw terminal.	Com	S4	3
RTD/Analog In - 1	2x 100Ω RTD, 2x 4-20 mA	I/O	T1	*
RTD/Analog In - 2	2x 100Ω RTD, 2x 1-5 V	I/O	T2	*
RTD/Analog In - 3	2x 100Ω RTD, 1-5 V, 4-20mA	I/O	T3	*
RTD/Analog In - 4	2x 1000Ω RTD, 2x 4-20 mA	I/O	T4	*
RTD/Analog In - 5	2x 1000Ω RTD, 2x 1-5 V	I/O	T5	*
RTD/Analog In - 6	2x 1000Ω RTD, 1-5 V, 4-20mA	I/O	T6	*
Analog Output	4-20mA	I/O	A7	2
Analog Output	1-5V	I/O	A8	2
Dual Relay -1	2x SPDT solid state	I/O	R1	3
Dual Relay -2	2x SPDT 10A, 250 VAC	I/O	R2	3
Digital I/O	7 TTL (5V) input/output lines	I/O	D	2
Pulse out	2x pulse output (<200Hz)	I/O	P	1

*Total 2 RTD/Analog modules can be installed.
Com = communication module, I/O = input/output module, Flow = frequency input module

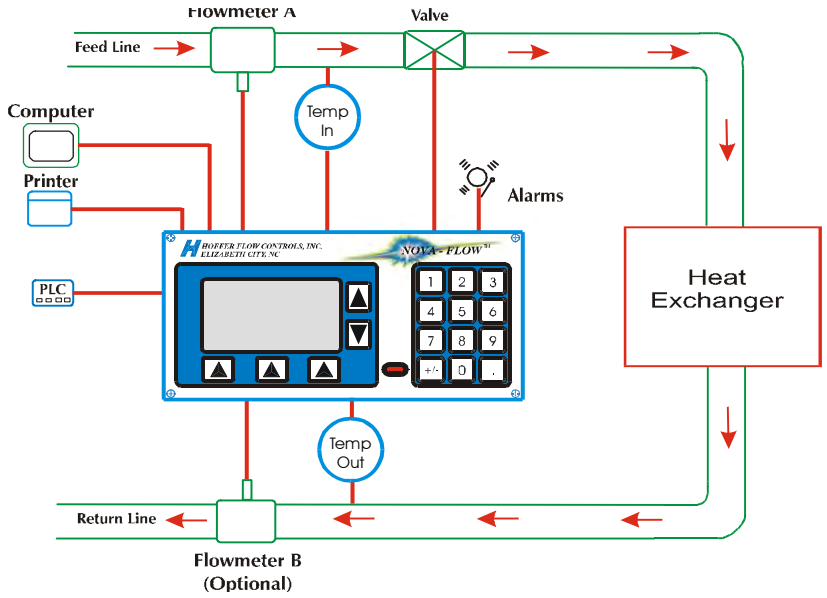
Operation

Overview

The Nova-Flow Energy Calculator is designed to measure the energy consumed in both heating and cooling systems. Temperature In and Temperature Out are measured from the corresponding feed and return line sensing devices. These measurements are used to calculate the flowing density and Differential Temperature (ΔT). The final variable necessary to calculate power and energy is Specific Heat, which is a user defined field located in the Fluid Properties menu. Power and energy are calculated as follows:

Power = Volumetric Flow Rate x Density x ΔT x Specific Heat

Energy = Mass Total x ΔT x Specific Heat



Operation

Energy is totalized based on the following criteria:

*If **Temperature In** > **Temperature Out**, Energy is totalized in the **Heating** register*
*If **Temperature In** < **Temperature Out**, Energy is totalized in the **Cooling** register*

The Energy register displays the sum of the Heating and Cooling registers**.**

NOTE: Although the present software allows the selection of an operating mode (Heating, Cooling, Heating/Cooling), this selection does not impact the operation of the flow computer since separate registers have been allocated for Heating and Cooling.

Single Flowmeter System

In single flowmeter system, it is assumed that the flowmeter is connected on the feed line. Density for mass calculations is based on the temperature measurement from Temperature In. Channel A is the designated flow channel for a single flowmeter system.

Dual Flowmeter System (Optional)

In a dual flowmeter system, the flowmeter on the feed line (Channel A) uses Temperature In to calculate density, while the meter on the return line (Channel B) uses Temperature Out. CH1/2 is the designated channel for displaying the results of math functions. For example, CH1/2 may be configured to display any fluid losses between the feed and return lines (Channel A – Channel B). This feature is useful for detecting leaks or other sources of fluid loss in the system.

Peak and Off-Peak

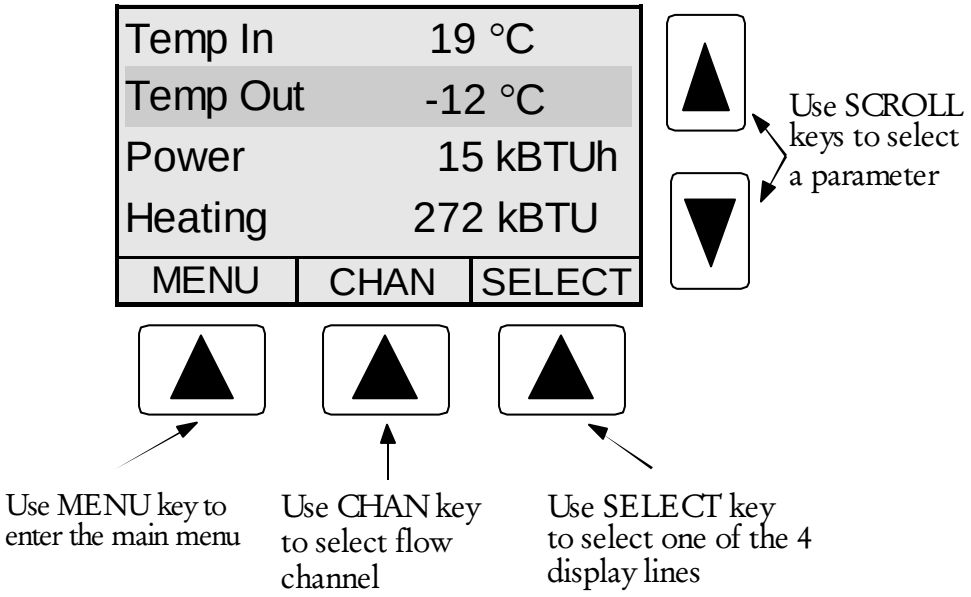
The Nova-Flow Energy Calculator allows Peak and Off-Peak times to be designated, so that energy totals are recorded into different registers, depending on the time of day. Two Peak times may be configured within a 24-hour period. Peak and Off-Peak times are programmed in the BTU Configuration menu.

The following section applies only to units that have already been programmed. For initial programming and set up refer to the Menu Structure section of this manual.

Displaying Process Parameters

The Nova-Flow energy calculator can simultaneously display any combination of four process parameters. To set a desired parameter on one of the four display lines press SELECT key until the line is selected, press CHAN key to choose a flow channel (on multi-channel systems), and then scroll through the parameters using SCROLL keys until the desired parameter is displayed.

Note: When a display line is selected, the center soft-key label changes from date/time to CHAN on multi channel system.



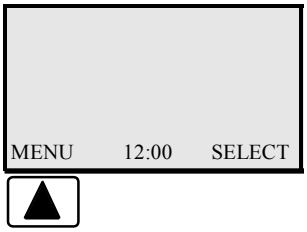
The following process parameters are available for display:

Parameter	*Display*	*Description*
Uncorrected Total	U/Total	Volumetric total at flowing conditions, calculated based on turbine calibration data (K-factor) stored in the Nova-Flow
Total	Total	Corrected total, compensated to a selected reference conditions, expressed in units of volume or mass, depending on calculation and compensation method.
Accumulated Total	AccTot	Accumulated corrected total
Uncorrected Rate	U/Rate	Volumetric rate at flowing conditions, calculated based on turbine calibration data (K-factor) stored in the Nova-Flow
Rate	Rate	Corrected rate, compensated to a selected reference conditions, expressed in units of volume or mass, depending on calculation and compensation method.
Temperature In	Temp In	Actual flowing temperature measured on the feed line. It will display a programmed default temperature whenever the default temperature is being used for calculation, or "N/A" when temperature is not selected for compensation.
Temperature Out	Temp Out	Actual flowing temperature measured on the Return line. It will display a programmed default temperature whenever the default temperature is being used for calculation, or "N/A" when temperature is not selected for compensation.
Differential Temperature	Diff. Temp	The result of Temp In – Temp Out, used to calculate energy.
Pressure	Pres	Actual flowing pressure. It will display a programmed default pressure whenever the default pressure is being used for calculation, or "N/A" when pressure is not selected for compensation.
Power	Power	The calculated rate of energy consumption based on mass flow rate, differential temperature and the specific heat of the fluid.
Peak Power	Peak Power	Displays the highest rate of power that has occurred during operation
Heating	Heating	Energy total based on Temp In > Temp Out
Accumulated Heating	Acc. Heating	Accumulated Heating total
Cooling	Cooling	Energy total based on Temp In < Temp Out
Accumulated Cooling	Acc. Cooling	Accumulated Cooling total
Energy	Energy	The sum of Heating Energy and Cooling Energy
Accumulated Energy	Acc. Energy	The sum of Acc. Heating and Acc. Cooling
Peak Energy	Peak	Energy totalized (Heating +Cooling) during programmed peak time.
Accumulated Peak Energy	Acc. Peak	Accumulated energy (Acc Heating + Acc Cooling) totalized during programmed peak time.
Off-Peak Energy	Off-Peak	Energy totalized (Heating + Cooling) during off-peak time.
Accumulated Off-Peak Energy	Acc Off-Peak	Accumulated energy (Acc Heating + Acc Cooling) totalized during programmed off-peak time.
Operating Time Since Last Clear	Oper. Time	Displays the time in HH:MM:SS since the last clearing of totals occurred.

On multi-channel system parameters are displayed with extensions Ch A, Ch B, Ch C, or Ch D to identify the flow channel they are associated with. Energy calculations are executed using channels A and B, however, Channels C and D may be used to monitor flowrates using an analog input.

Displaying Date and Time

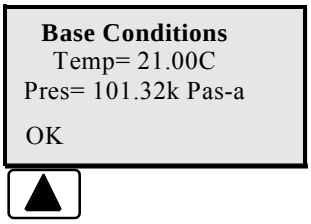
Time or date is displayed in the center soft-key field, when this field is not being used.



When time or date is displayed use the center soft-key to switch between the time and date.

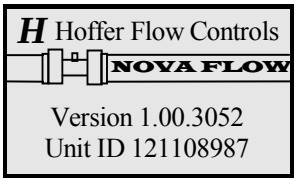
Displaying Base Conditions

Currently configured Base Operating Conditions may be displayed by pressing the +/- key on the numerical keypad.



Displaying Software Version and Electronic ID

The software version and unique electronic identification number may be displayed by pressing the decimal key on the numeric keypad.



Clearing

To access the clearing menu press MENU key, and select CLEAR using ARROW keys or the numerical keypad. Select an item from the menu and press the CLEAR key. A message "Are you sure" will be displayed. Press YES key if you still want to clear a register. After pressing the YES key to confirm, information stored in the register will be lost.

Clearing is not available while flow is present. A warning message will be displayed when CLEAR key is pressed while flow is present.

Printing

To access the printing menu press MENU key, and select PRINT using SCROLL keys or the numerical keypad. Select a desired item for printing and press PRINT key. The printing function is available while flow is present.

Example:

To print configuration data press MENU, select PRINT, CONFIGURATION, and press PRINT key.

Error Messages

There are a number of warnings and error messages that guide the user if there is an operational problem or conflict in the configuration parameters. When an error occurs the center soft-key label switches to "Errors". Press the ERRORS key to view and acknowledge errors. If there is more than one error message, press the key again until all messages are cleared. Refer to appendix D for the error messages list.

Passwords

The Nova-Flow unit has a two level password protection: operator and supervisor. At each level there are five user ID numbers available. Any configuration parameter that may affect the flow calculation is protected with the supervisor password. The unit is shipped unprotected, with all passwords set at 0000.

Diagnostics

To enter the diagnostic mode press MENU key, and select DIAGNOSTICS.

Programming

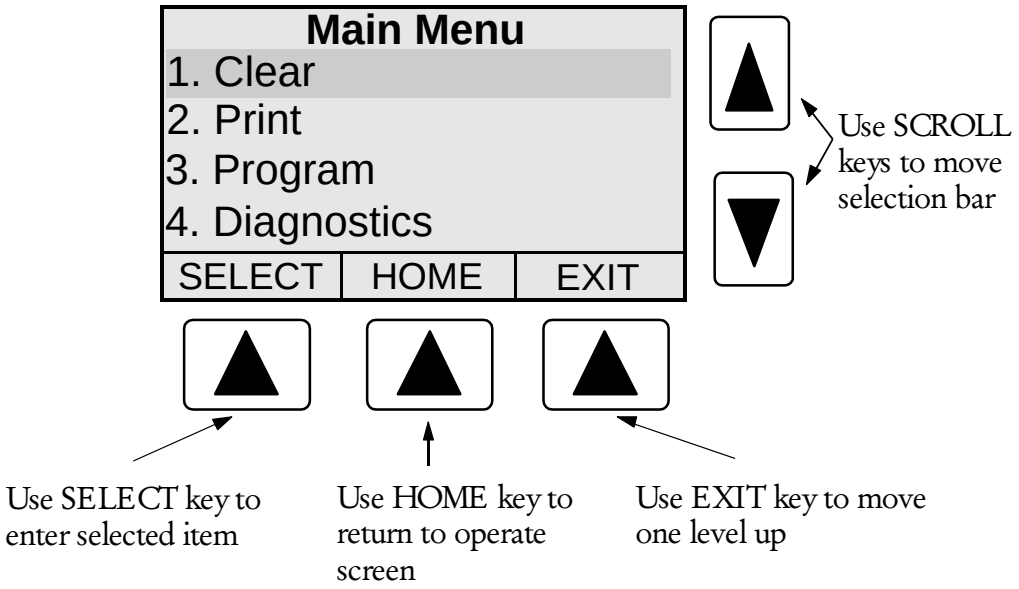
The Nova-Flow unit is shipped from the factory fully programmed per user specification. However, it is recommended to verify the program settings before the unit is installed. Programming may be performed from the Nova-Flow front panel, or from a personal computer using Hoffer configuration software. Connection to the personal computer can be established either through the RS232 cable, or the infrared interface.

The program menu may not be entered while flow is present. This prevents parameters affecting flow calculations to be changed during a process.

To enter the program mode press MENU key, and select PROGRAM.

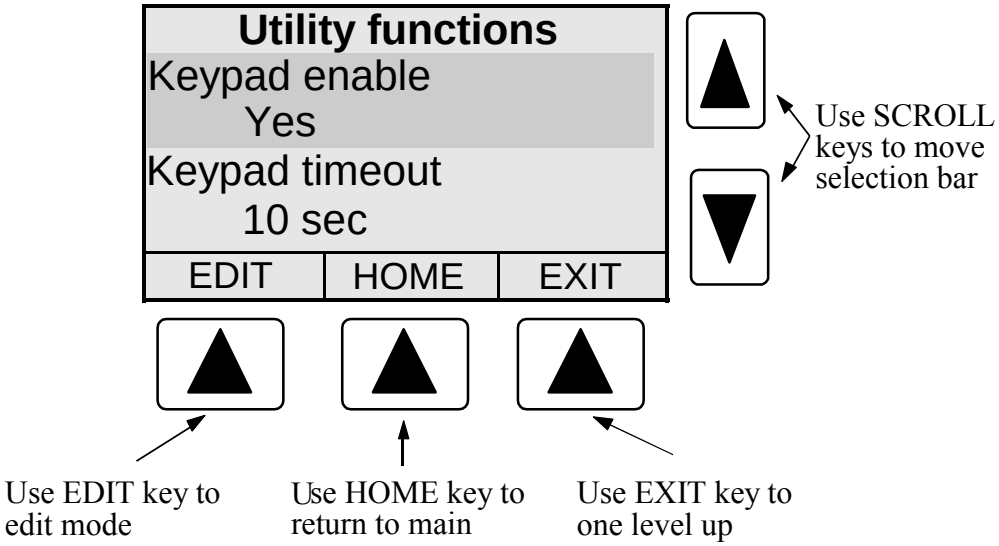
Selecting a Menu Item

The Nova-Flow program menu is a multi-layer matrix of submenus. Refer to the menu chart in the Menu Structure section for help navigating through the menu structure and locating a desired menu item.

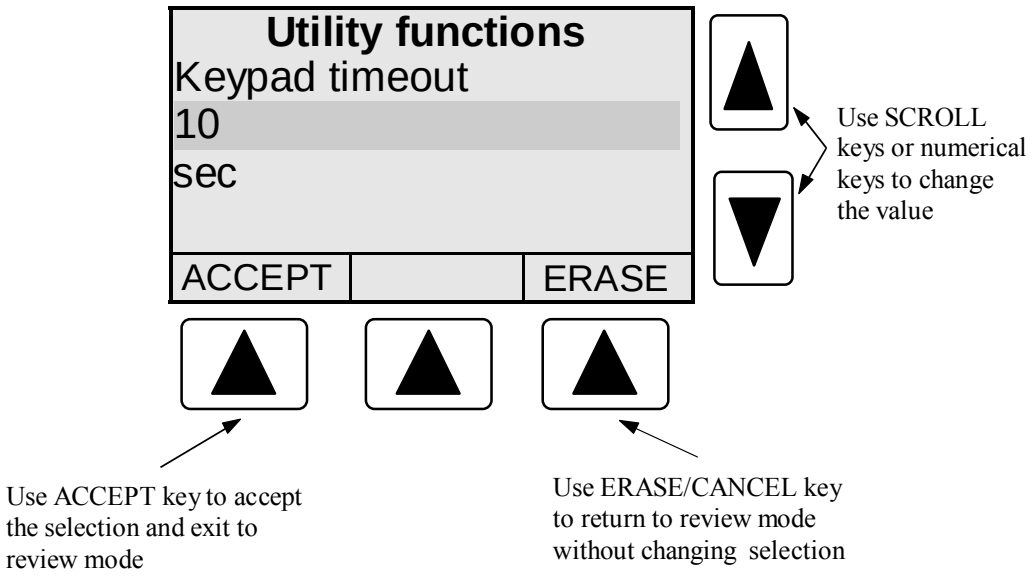


Reviewing Settings

Program settings are displayed at the lowest level in the program menu. Once a menu item is selected, it can be changed using the EDIT key.



Editing Program Settings



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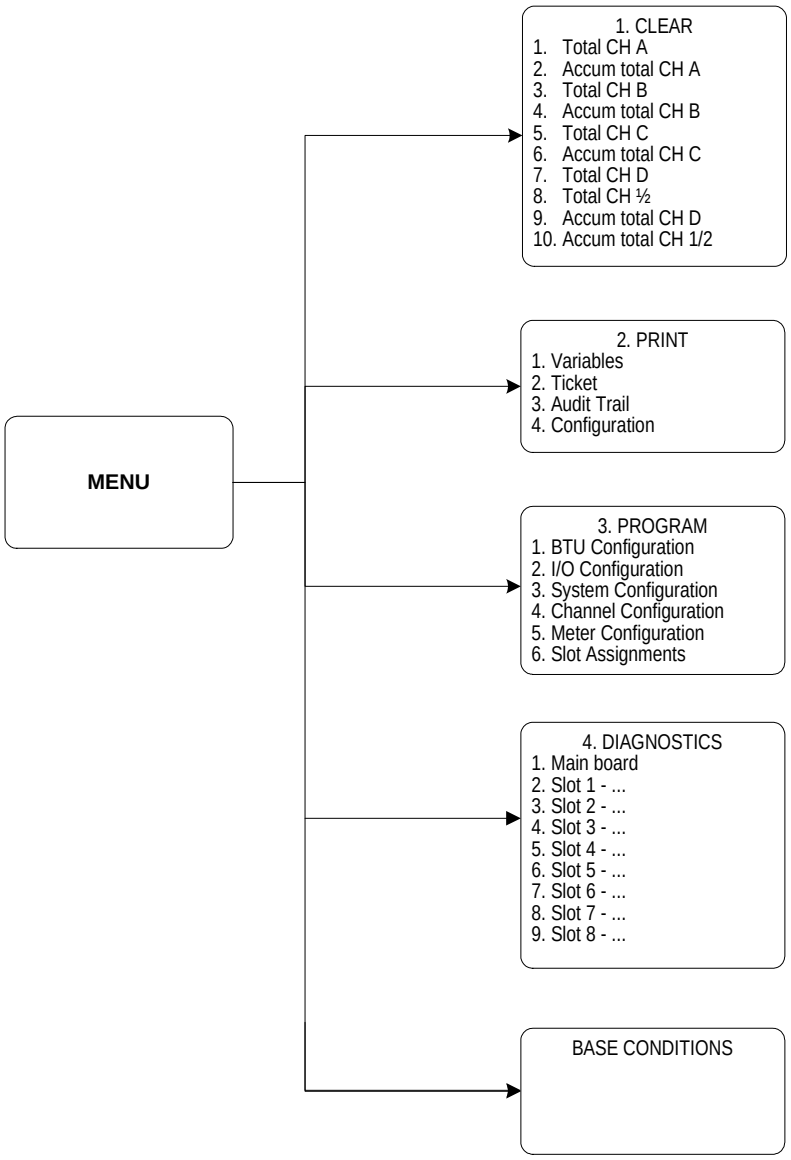
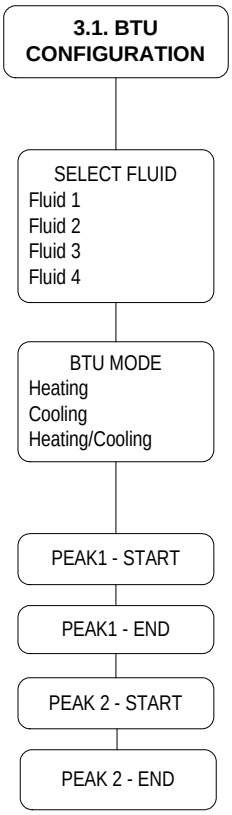
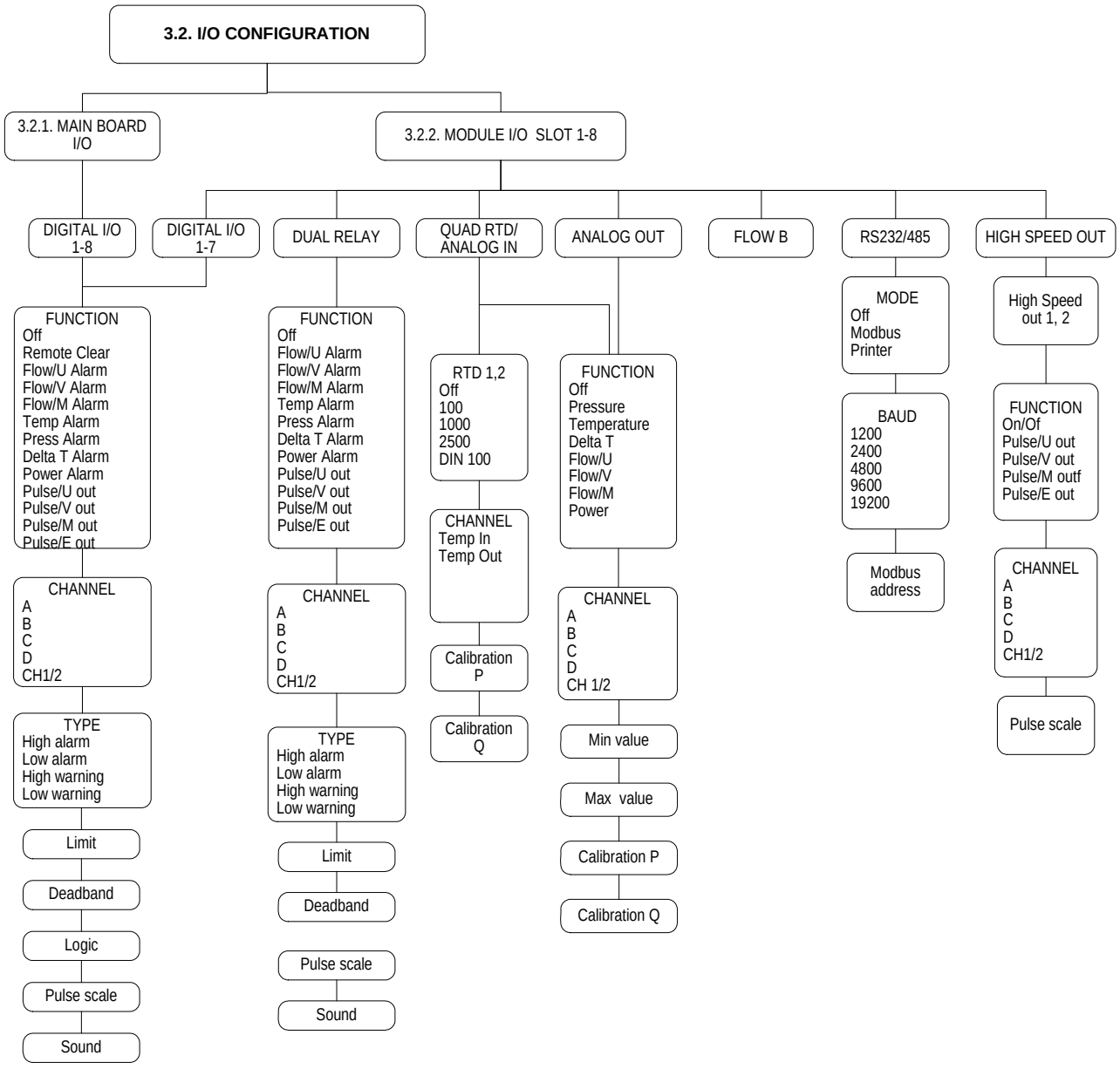
Menu Structure

The structure of the program menus varies depending on the type and number of optional modules installed in the Nova-Flow. Not all of the menu items described in this manual may be available on Nova-Flow.

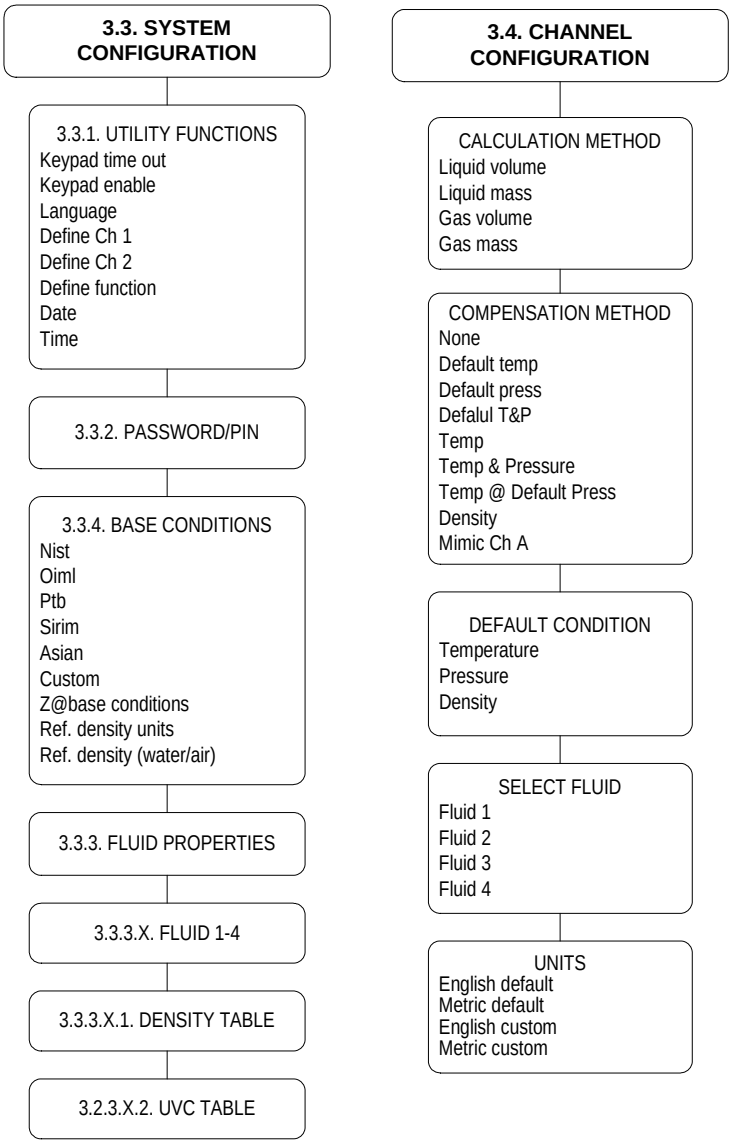


Program Menu

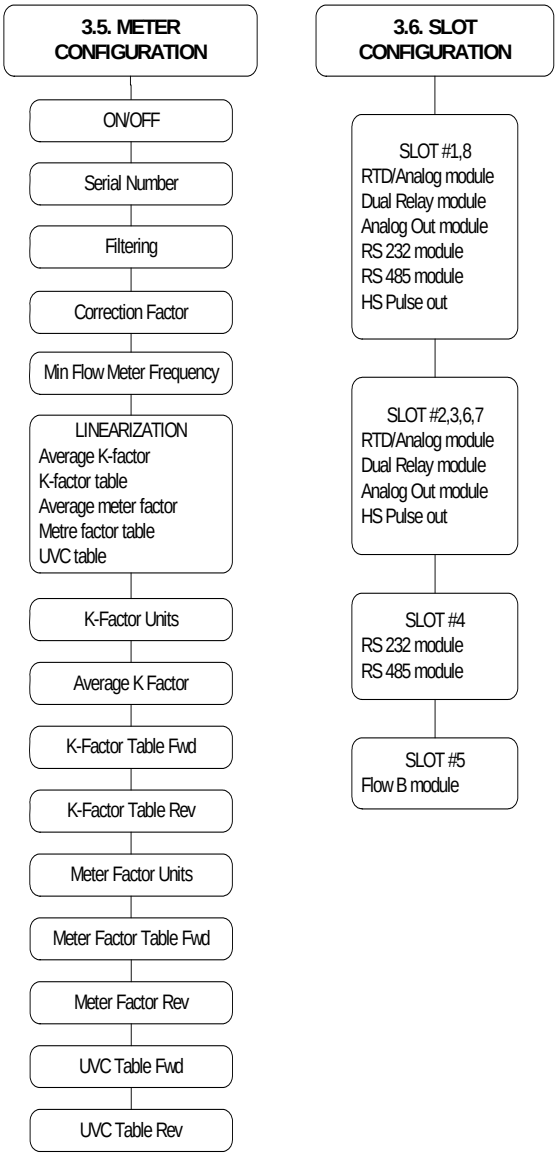



3.2. I/O CONFIGURATION
3.2.1. MAIN BOARD I/O
3.2.2. MODULE I/O SLOT 1-8
DIGITAL I/O 1-8
DIGITAL I/O 1-7
DUAL RELAY
QUAD RTD/ ANALOG IN
ANALOG OUT
FLOW B
RS232/485
HIGH SPEED OUT
FUNCTION
Off
Remote Clear
Flow/U Alarm
Flow/V Alarm
Flow/M Alarm
Temp Alarm
Press Alarm
Delta T Alarm
Power Alarm
Pulse/U out
Pulse/V out
Pulse/M out
Pulse/E out
CHANNEL
A
B
C
D
CH1/2
TYPE
High alarm
Low alarm
High warning
Low warning
Limit
Deadband
Logic
Pulse scale
Sound
FUNCTION
Off
Flow/U Alarm
Flow/V Alarm
Flow/M Alarm
Temp Alarm
Press Alarm
Delta T Alarm
Power Alarm
Pulse/U out
Pulse/V out
Pulse/M out
Pulse/E out
CHANNEL
A
B
C
D
CH1/2
TYPE
High alarm
Low alarm
High warning
Low warning
Limit
Deadband
Pulse scale
Sound
RTD 1,2
Off
100
1000
2500
DIN 100
CHANNEL
Temp In
Temp Out
Calibration P
Calibration Q
FUNCTION
Off
Pressure
Temperature
Delta T
Flow/U
Flow/V
Flow/M
Power
CHANNEL
A
B
C
D
CH 1/2
Min value
Max value
Calibration P
Calibration Q
MODE
Off
Modbus
Printer
BAUD
1200
2400
4800
9600
19200
Modbus address
High Speed out 1, 2
FUNCTION
On/Of
Pulse/U out
Pulse/V out
Pulse/M outf
Pulse/E out
CHANNEL
A
B
C
D
CH1/2
Pulse scale

Program Menu



Program Menu



1. CLEAR Menu

1. Total CH A
2. Total CH B
3. Accum Total CH A
4. Accum Total CH B
5. Total CH C
6. Total CH D
7. Accum Total CH 1/2

Select an item from the above menu and press the CLEAR key. A message "Are you sure" will be displayed. Press "YES" key if you still want to clear a register. After pressing the "YES" key to confirm, information stored in the register will be lost.

2. PRINT Menu

1. Variables
2. Ticket
3. Audit Trail
4. Configuration Data

Select a desired item from the above menu and press the PRINT key.

Variables for printing may be selected from the following list located in the Windows Configuration program:

Uncorrected Total
Uncorrected Accumulated Total
Total
Accumulated Total
Uncorrected Rate
Rate
Temperature
Pressure
Density

On multi-channel system variables are printed with extensions Ch A, Ch B, Ch C, or Ch D to identify the flow channel they are associated with. Energy calculations are executed using Channels A and B, however, Channels C and D may be used to monitor flowrates using an analog input.

Variables may be printed automatically at user-defined time intervals. This function is configured by entering an interval in minutes in the Print Frequency field located in the Windows Configuration Print Menu.

NOTE:
Selecting variables and setting the print time interval are available only from the Windows Configuration program.

3. PROGRAM Menu

1. BTU configuration
2. I/O Configuration
3. System Configuration
4. Channel Configuration
5. Meter Configuration
6. Slot Assignment

This section describes the program menu fields in detail. Whenever applicable the description is presented in the following format:

Address	*Menu item*	*Selection*	*Comments*

The paragraph numbers is this chapter correspond with the menu address. The address can be used as a shortcut to a menu item. A menu can be accessed quickly from the Nova-Flow front panel by pressing the MENU key and the address number on the numerical keypad.

An alternative method of accessing a menu item is using SCROLL and SELECT keys as described in the Operation section.

The lowest level submenu items have no numerical address assigned, and selections are made using the SCROLL keys.

Example:

Address	*Menu*	*Selection*	*Comments*
3.3.1	Date/Time	Enter date and time	This menu allows to set time and date.

*To access the **Date/Time** field using numerical address:*
press MENU key,
press "3" key,
press "3" key,
press "1" key,
scroll the selection bar down to Date/Time field.

NOTE: The Slot Assignments must be programmed before any other configuration can be performed, if the unit is being setup for the first time, or if there have been changes to the installed optional modules.

3.1. BTU Configuration

Address	*Menu item*	*Selection*	*Comments*
3.1	**Select Fluid**	Fluid 1 Fluid 2 Fluid 3 Fluid 4	Select the fluid table to be used for processing.
3.1	**BTU Mode**	Heating Cooling Heating/Cooling	Select mode of operation **NOTE: Although the present software allows the selection of an operating mode (Heating, Cooling, Heating/Cooling), this selection does not impact the operation of the flow computer since separate registers have been allocated for Heating and Cooling.**
3.1	**Peak1 Start**	Enter time	Enter start time for Peak period 1.
3.1	**Peak1 End**	Enter time	Enter end time for Peak period 1.
3.1	**Peak2 Start**	Enter time	Enter start time for Peak period 2.
3.1	**Peak2 End**	Enter time	Enter end time for Peak period 2.

3.2. I/O Configuration

3.2.1. Main Board I/O

3.2.1…8 Digital I/O 1-7

I/O1 through I/O7 can be configured for input or output by selecting a dip switch combination on the main board. Outputs are configurable for 5V, 10Vdc, or open collector. I/O 8 is an output only and can be configured as an opto-isolated output. Refer to the Hardware configuration section for details.

Address	*Menu item*	*Selection*	*Comments*
3.2.1	**Function**	Remote clear Flow alarm Temperature alarm Pressure alarm Delta T alarm Power alarm Pulse out (Flow, Energy)	Select a function for digital I/O line. Remote clear not available for I/O8.
3.2.1	**Channel**	Channel A Channel B Channel C Channel D Ch1/2	Select applicable flow channel for digital I/O. This menu applies to multi-channel systems only. Ch1/2 is defined in System Configuration (3.2.1)
3.2.1	**Type**	High alarm Low alarm High warning Low warning	Select a desired alarm type. This menu applies to alarm output only. Warnings display message on the front panel, and sounds the buzzer if sound is selected. Alarms display message, sounds buzzer, and logs error message into the error log.

3.2.1	**Limit**	Number	Enter an alarm set point within the operating range of the parameter (Min-Max).
3.2.1	**Deadband**	Number	Enter a value in the currently selected units alarm to avoid spurious switching around the alarm set point. Recommended value is about 1-5% of the range.
3.2.1	**Logic**	Active low Active high	For active low the output changes from high level to low level when alarm condition occurs. For active high the output changes from low level to high level when alarm condition occurs.
3.2.1	**Pulse scale**	1, 10, 100, 1000	Select a scaling factor. This menu applies to pulse output only. "1" means one pulse is output for each unit of volume.
3.2.1	**Sound**	On Off	Activates front panel buzzer when alarm condition occurs.

In the actual configuration the word "module" in the menu item is replaced with the name of the module installed in this slot, according to the Slot Assignment settings, chapter 3.5.

Example:

Slot 1- RS232
Slot 2- RTD/Analog
Slot 3- Relay
Slot 4- RS232
Slot 5- None
Slot 6- None
Slot 7- None
Slot 8- None

The above examples represent a configuration consisting of four modules installed in slots 1-4. To configure a module, select a desired slot in which the module is installed, and follow the corresponding module menu.

3.2.2. Module I/O Slots 1-8

Address	*Menu item*	*Selection*	*Comments*
3.2.2.1-8.	Slot 1-…8 module*	Varies with slots. Refer to table below	Select a slot to configure module installed in this slot.

In the actual configuration the word "module" in the menu item is replaced with the name of the module installed in this slot, according to the Slot Assignment settings, chapter 3.5.

Example:

Slot 1- RS232
Slot 2- RTD/Analog
Slot 3- Relay
Slot 4- RS232
Slot 5- None
Slot 6- None
Slot 7- None
Slot 8- None

The above examples represents a configuration consisting of four modules installed in slots 1-4. To configure a module, select a desired slot in which the module is installed, and follow the corresponding module menu.

Slot	*Compatible modules*
1	RTD/Analog Input, Analog output, Dual relay, Hi speed pulse out. RS232, RS485.
2	RTD/Analog Input, Analog output, Dual relay, Hi speed pulse out.
3	RTD/Analog Input, Analog output, Dual relay, Hi speed pulse out.
4	RS232, RS485.
5	Flow B.
6	RTD/Analog Input, Analog output, Dual relay, Hi speed pulse out.
7	RTD/Analog Input, Analog output, Dual relay, Hi speed pulse out.
8	RTD/Analog Input, Analog output, Dual relay, Hi speed pulse out. RS232, RS485.

Dual Relay Module
Relay 1, 2

Address	*Menu item*	*Selection*	*Comments*
	Function	Remote clear Flow alarm Temperature alarm Pressure alarm Delta T alarm Power alarm Pulse out (Flow, Energy)	Select a function for a relay output.
	Channel	Channel A Channel B Channel C Channel D Ch1/2	Select applicable flow channel for digital I/O. This menu applies to multi-channel systems only.
	Type	High alarm Low alarm High warning Low warning	Select a desired alarm type. This menu applies to alarm output only. Warnings display message on the front panel, and sounds the buzzer if sound is selected. Alarms display message, sounds buzzer, and logs error message into the error log.
	Limit	Number	Enter an alarm set point within the operating range of the parameter (Min-Max).
	Deadband	Number	Enter a value in the currently selected units to avoid spurious switching around the alarm set point. Recommended value is about 1-5% of the range.
	Sound	On Off	Activates front panel buzzer when alarm condition occurs.

RTD Input

Address	*Menu item*	*Selection*	*Comments*
N/A	RTD 1, 2	Off 100 1000 2500 DIN	Select a type of RTD probe. 100, 1000, 2500 are platinum 3902 material DIN is platinum 0385 material
N/A	Channel	Channel A Channel B Channel C Channel D	Select applicable channel.

Analog Input 1, 2

Address	*Menu item*	*Selection*	*Comments*
N/A	Function	Off Pressure Temperature Density Sp gravity Flow Mimic Ch A	Select a desired function for the analog input. Mimic Ch A is used to copy analog input data from Ch A for the selected input function.
N/A	Channel	Channel A Channel B Channel C Channel D	Select applicable channel.
	Min value	Number	Enter a number corresponding to the minimum value for the input range, in the units selected for the input.
	Max value	Number	Enter a number corresponding to the maximum value for the input range, in the units selected for the input..
	Calibration P	Number	See calibration procedure
	Calibration Q	Number	See calibration procedure

Analog Output Module

Address	*Menu item*	*Selection*	*Comments*
N/A	Function	Off Pressure Temperature Density Sp gravity Flow	Select a desired function for the analog output.
N/A	Channel	Channel A Channel B Channel C Channel D	Select applicable channel.
	Min value	Number	Enter a number corresponding to the minimum value for the input range.
	Max value	Number	Enter a number corresponding to the maximum value for the input range.
	Calibration P		See calibration procedure.
	Calibration Q		See calibration procedure.

Split Analog Out

A split analog output is available for Forward/Reverse applications. 4 mA is maximum reverse flow, 12 mA is 0 flow, and 20 mA is maximum forward flow. The FWD/REV function in the I/O Configuration for Flow B must be enabled. When entering Min and Max parameters for the Analog Output Configuration, enter the maximum reverse flow rate in the Min field preceded with a negative sign(-). Enter the maximum forward flow rate in the Max field.

Flow B Module

Address	*Menu item*	*Selection*	*Comments*
N/A	Error Detection	On Off	Activates transmission error detection circuit on dual coil meter systems. The circuit detects missing pulses or pulses induced on the transmission lines.
	Alt Function	Independent Forward/Reverse Manifold	Select Independent for independent operation of Channel A and Channel B. Select Forward/Reverse for bi-directional meters. Forward and reverse flow are being counted into registers A and B, respectively.
	Manifold Switch Level	Number	Enter a number corresponding to a manifold switch point in units of volumetric flow rate.
	Manifold Switch Deadband	Number	Enter a number corresponding to a manifold switch deadband in units of volumetric flow rates. The switch point value has to be within the overlapping range of the meters.

Manifold Application

In manifold application Channel A is assigned to the high flow range meter and Channel B is assigned to the low flow range meter. A combined total from both meters is calculated using A+B function. The manifold relay is activated and the manifold valve is closed when Nova Flow is powered up. The relay is deactivated and the valve is opened when flow rises above the value of Manifold Switch Point + Deadband. The relay is activated and the manifold valve is closed when flow drops below the Manifold Switch Point.

RS232 Module

Address	*Menu item*	*Selection*	*Comments*
N/A	Mode	Off Modbus Printer	Select Modbus for communication with a PC computer or Modbus master device. Select Printer for printing function.
	Baud	1200 2400 4800 9600 19200	Select a desired baud rate.

RS485 Module

Address	*Menu item*	*Selection*	*Comments*
N/A	Mode	Off Modbus	Select Modbus for communication with a PC computer or Modbus master device.
	Baud	1200 2400 4800 9600 19200	Select a desired baud rate.

Pulse Output Module

Address	*Menu item*	*Selection*	*Comments*
N/A	Function	On/Off Pulse/U Pulse/V Pulse/M	Select a function for the pulse out: U- uncorrected volume V- corrected volume M- mass
	Channel	Channel A Channel B Channel C Channel D CH1/2	Select a flow channel

3.3. System Configuration

3.3.1. Utility Functions

Address	*Menu item*	*Selection*	*Comments*
	Keypad enable	Yes No	If "No" is selected the front panel keys are disabled. To enable, press any key and enter a password when prompted.
	Keypad time out	Enter a number of seconds Range: 0-	If the unit is left in the program mode, it will switch back to the operate mode when limit is reached. Zero means the time out function is disabled.
	Language	English Spanish	Select a desired language.
	Date/Time	Enter date and time	This menu is used to set time and date.
	Define Ch1	Ch A Ch B	This function allows to calculate combined (+ or -) total from two flow channels. Assign channel A or B for operant Ch1 for math calculations.
	Define Ch2	Ch B Ch C Ch D	Assign channel B, C, or D for operant Ch2 for math calculations.
	Define function	Ch1-Ch2 Ch1+Ch2	Select addition or subtraction for calculating a net total.

3.3.2. Password/Pin

Address	*Menu item*	*Selection*	*Comments*

	Supervisor pin #1-5	Number	Enter a 4 digit for each supervisor pin number.
	Supervisor password	Number	Enter a 4 digit for supervisor password.
	Reenter password	Number	Enter the supervisor password again to confirm.
	Operator pin #1-5	Number	Enter a 4 digit for each operator pin number.
	Operator password	Number	Enter a 4 digit for operator password.
	Reenter password	Number	Enter the operator password again to confirm.

3.3.3. Fluid Properties

Density Table

Address	*Menu item*	*Selection*	*Comments*
3.3.3	Default conditions T, P, D, Sp Gravity	Number	Enter default temperature, pressure, density and specific gravity. Default values are used for calculation when a sensor fails, or when “default” is selected for compensation method.

3.3.4. Base Conditions

Address	*Menu item*	*Selection*	*Comments*
3.3.4.	Base conditions	NIST OIML PTB SIRIM ASIAN NORMAL CUSTOM NBP	Select a predefined set of base conditions, or select "custom" to enter user defined base conditions. Base conditions are used to calculate corrected volume.

3.4. Channel Configuration

Address	*Menu item*	*Selection*	*Comments*
3.4.	Calculation method	Liquid volume Liquid mass Gas volume Gas mass	Select an appropriate calculation method. When "volume" is selected, mass flow rate and mass total are not available. Liquids calculations are based on fluid property table programmed in the Nova Flow. Gas calculations are based on ideal gas equation and Z table programmed in the Nova Flow.
3.4.	Compensation method	Default temperature Default pressure Default T&P Temperature T&P Density T,P, &D *Mimic CHA	Select an appropriate compensation method. For T, P, D compensation an associated sensor has to be connected and an analog input has to be programmed accordingly. When a sensor fails, the default value is used for calculations. *Mimic CHA is added to the list of Compensation Methods for Channels B, C, and D. When this method is selected, compensation parameters for channel A are applied to the designated channel.
3.4.	Select fluid	Fluid 1 Fluid 2 Fluid 3 Fluid 4	Select a fluid table for the current flow channel. Up to four different fluids can be programmed in the Nova Flow and switched between flow channels A, B, C, D.
3.4.	Units	English default English custom Metric default Metric custom	Select a desired set of units of measure. For a complete list of available units and conversion factors refer to appendix xx.

3. 5. Meter Configuration

Address	*Menu item*	*Selection*	*Comments*
3.5.1.	On/off	On Off	"On" has to be selected to activate the flow channel operation.
	Filtering	Number	This number represents the amount of smoothing applied to the input signal coming from a meter. Default value is…
	Serial number	Number	Enter up to a 10- digit flow meter serial number
	Correction factor	Number	User selected number to correct the flow rate and total. Range: 0.5-1.5. Default value is 1.
	Linearization	Average K-factor K-factor table Average meter factor Meter factor table UVC table	Select an applicable method. The menus below will be displayed only when the associated method is selected.
	Minimum meter frequency	Number	Enter a frequency in Hz that is below an operating range of input frequency. Any signal at frequency below the min. value is considered a "noise" and it will be rejected. Default value is 0.
	K-factor units		Select units of measure for K-factor
	Average K-factor	Number	This menu is displayed when Average K-factor selected for linearization method. Enter a K-factor for the meter connected to this channel.
	K-factor table forward		This menu is displayed when K-factor table fwd is selected for linearization method. For every point of the table enter frequency in Hz and K-factor value.
	Meter factor units		Select units of measure for meter factor
	Average meter factor	Number	This menu is displayed when Average meter factor is selected for linearization method.
	Meter factor table		This menu is displayed when Meter factor table is selected for linearization method. For every point of the table enter frequency in Hz and K-factor value.
	UVC table		This menu is displayed when UVC table is selected for linearization method. For every point of the table enter frequency/viscosity in Hz/ctsk and K-factor value.

3.6. Slot Configuration

For each slot (1-8) select the module type that is installed in this slot. Select NONE, if there is no module installed in the slot. Note that the list of available modules for a given slot varies from slot to slot, according to the slot/module compatibility table.

Address	*Menu item*	*Selection*	*Comments*
3.6.1.	Slot 1	None RTD/Analog Input Analog output Dual relay Pulse out RS232 RS485	Select a module that is installed in this slot.
3.6.2.	Slot 2	None RTD/Analog Input Analog output Dual relay Pulse out	Select a module that is installed in this slot.
3.6.3.	Slot 3	None RTD/Analog Input Analog output Dual relay Pulse out	Select a module that is installed in this slot.
3.6.4.	Slot 4	None RS232 RS485	Select a module that is installed in this slot.
3.6.5.	Slot 5	None Flow B	Select a module that is installed in this slot.
3.6.6.	Slot 6	None RTD/Analog Input Analog output Dual relay Pulse out	Select a module that is installed in this slot.
3.6.7.	Slot 7	None RTD/Analog Input Analog output Dual relay Pulse out	Select a module that is installed in this slot.
3.6.8.	Slot 8	None RTD/Analog Input Analog output Dual relay Pulse out RS232 RS485	Select a module that is installed in this slot.

4. DIAGNOSTICS Menu

Nova-Flow provides diagnostic functions for testing Inputs and Outputs to verify hardware functionality. The Diagnostics Menu is conveniently located in the Main Menu at address 4. The table below illustrates the way in which the Diagnostics Menu is organized. This menu will change depending on how the I/O slots are assigned.

Address	Menu Option
4.1	Main board DigIO
4.2	Slot1 – Assigned Module Name
4.3	Slot2 – Assigned Module Name
4.4	Slot3 – Assigned Module Name
4.5	Slot4 – Assigned Module Name
4.6	Slot5 – Assigned Module Name
4.7	Slot6 – Assigned Module Name
4.8	Slot7 – Assigned Module Name
4.9	Slot8 – Assigned Module Name

Organization of Diagnostics Menu

Main Board Digital I/O

The Main board consists of 8 Digital I/O lines, of which I/O1-I/O7 can be configured as an input or an output and I/O8 only as an output. The figure below illustrates the layout of the Main board Digital I/O diagnostics screen. The 1s and 0s represent corresponding I/O lines, counting from left to right. For example, the first digit corresponds to I/O1, the next to I/O2, and so forth. A 1 represents a high signal level and 0 a low signal level. When a signal is applied to an input, the corresponding digit will toggle accordingly. When configured as an output, presses SELECT to highlight the appropriate I/O and use the SCROLL keys to toggle the output between high and low levels. The output may be monitored with an oscilloscope.

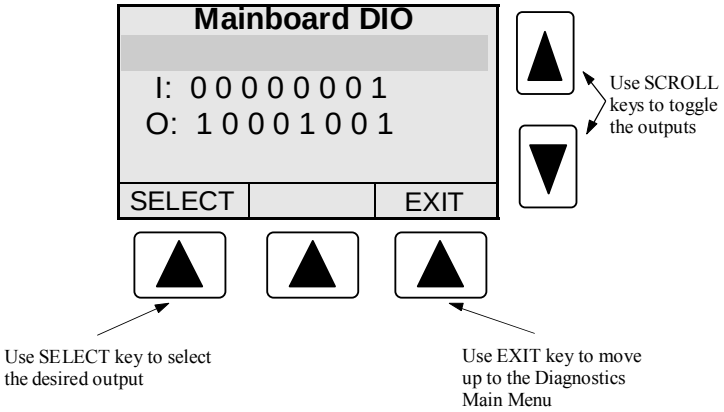


Figure 1. Main board Digital I/O Diagnostics Screen

Dual Relay Module

The relays may be tested by connecting an Ohmmeter or a continuity tester to the corresponding output pins of the module. Pressing the SELECT key toggles between Relay1 and Relay 2. Use the SCROLL Keys to activate and deactivate the relays. A 1 activates the relay and a 0 deactivates the relay.

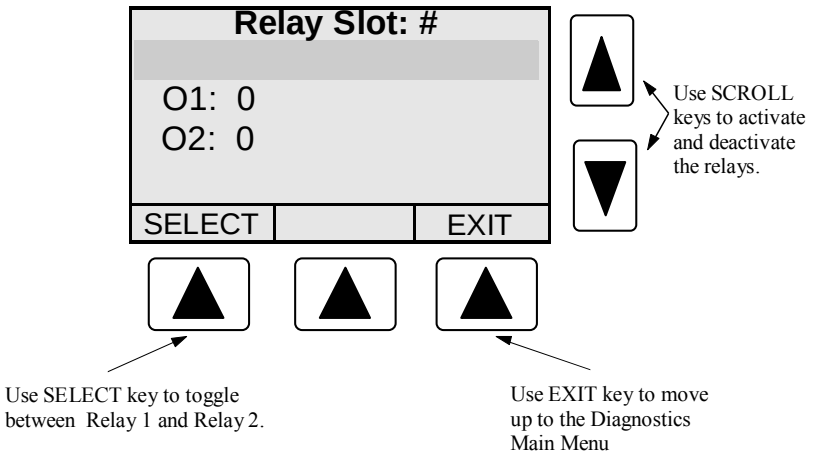


Figure 2. Dual Relay Diagnostics Screen

Dual Pulse Output Module

The pulse outputs may be tested by connecting an Oscilloscope or a Voltmeter to the corresponding output pins of the module. Pressing the SELECT key toggles between Output1 and Output2. Use the SCROLL Keys to toggle the outputs between high and low. A 1 outputs a high signal and a 0 a low signal.

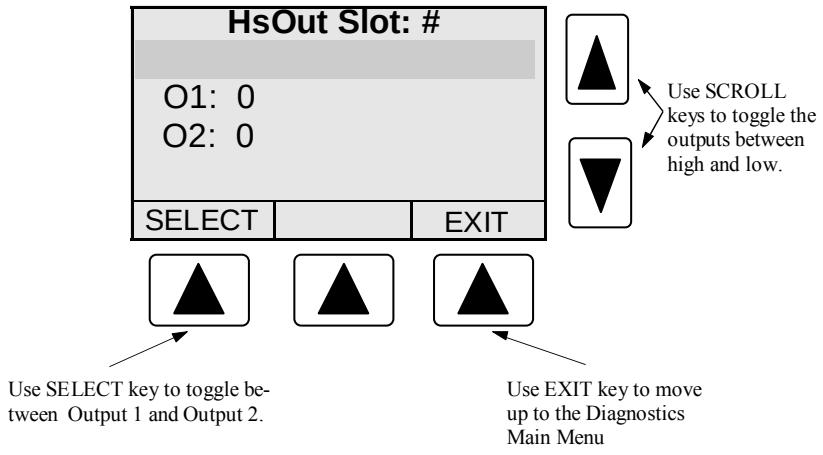


Figure 3. Pulse Output Diagnostics Screen.

Analog Output Module

The Analog Output Module may be tested by connecting a current measuring device, such as an amp meter, to the output pins of the module. Pressing the SELECT key selects the output. Use the SCROLL keys to increase or decrease the number of D/A counts. As the number increases, the output current should increase. As the number decreases, the output current should decrease. The range of D/A counts is from 0 to 4095.

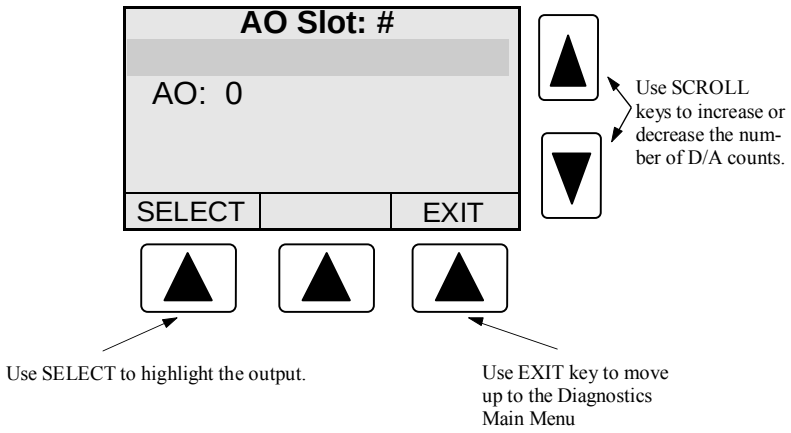


Figure 4. Analog Output Diagnostics Screen.

RTD/ Analog Input Module

Operation of an installed RTD/Analog module may be verified using diagnostics. There are four Analog Input labels each displaying a number of A/D counts. AI1 corresponds to RTD1, AI2 to RTD2, AI3 to Analog CH1, and AI4 to Analog CH2. A/D counts for a configured input should always be between 0 and 4095 during normal operation. As the transmitter signal increases, the number of A/D counts should also increase. As the RTD temperature increases, the number of A/D counts should also increase. If the counts become 0 or 4095, either the module has not been installed, configured, or calibrated, or there is an RTD or Transmitter failure.

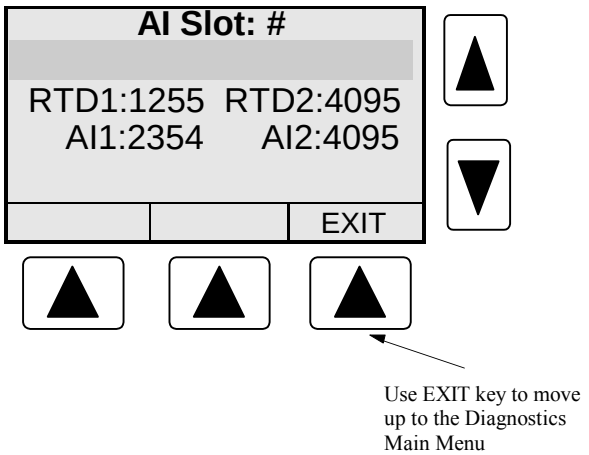


Figure 5. RTD/Analog Input Diagnostics Screen.

5. BASE CONDITIONS

Base temperature and pressure selected in the program menu can viewed in this menu. Nova Flow uses base conditions to calculate corrected total volume and corrected flow rate.

Communications

Nova Flow can be equipped with up to three serial ports and the infrared port. Serial ports can be used for programming the Nova-Flow, printing, communication with a personal computer, or with a Modbus master device. When all three ports are installed and active, the priority is given to the communication port in Slot 4.

For programming Nova-Flow from a personal computer using Hoffer configuration program refer to the Windows configuration section of this manual.

For serial port wiring refer to the Installation section of this manual.

Nova-Flow supports standard MODBUS RTU (binary) encoding.

The following tables provide memory mapping for all available Modbus commands for the Energy Calculator.

Function Code 04 (Read Input Registers)

ABSOLUTE ADDRESS	DESCRIPTION
30001	CHA Uncorrected Rate X 10
30002	CHA High Word of Uncorrected Total
30003	CHA Low Word of Uncorrected Total
30004	CHA High Word of Uncorrected Accum Total
30005	CHA Low Word of Uncorrected Accum Total
30006	CHA Corrected Rate X 10 (Mass or Volume)
30007	CHA High Word of Corrected Total
30008	CHA Low Word of Corrected Total
30009	CHA High Word of Corrected Accum Total
30010	CHA Low Word of Corrected Accum Total
30011	CHA Pressure
30012	CHA Density X 1000
30013	Temperature In (Kelvin)
30014	Temperature Out (Kelvin)
30015	Power X 10
30016	High Word of Heating
30017	Low Word of Heating
30018	High Word of Accum Heating
30019	Low Word of Accum Heating
30020	High Word of Cooling
30021	Low Word of Cooling
30022	High Word of Accum Cooling
30023	Low Word of Accum Cooling
30024	High Word of Energy
30025	Low Word of Energy
30026	High Word of Accum Energy
30027	Low Word of Accum Energy

Function Code 01 (Coil Status)

ABSOLUTE ADDRESS	DESCRIPTION
00002-00008	OPEN
00009	Clear all Totals for Ch A including all energy totals
00010	Clear Accum Totals for Ch A including all accumulated energy totals
00011	Clear Totals for Ch B
00012	Clear Accum Totals for Ch B
00013	Clear Totals for Ch C
00014	Clear Accum Totals for Ch C
00015	Clear Totals for Ch D
00016	Clear Accum Totals for Ch D

Installation

Notes:

1. The terminal marked with safety ground symbol must be connected to the earth ground, using a multi-stranded, braided wire.
2. To minimize susceptibility to electromagnetic noise, all sensor connections must be made using shielded twisted pair wires and shields must be connected to the designated shield or earth terminals on the Nova-Flow rear panel.
3. Signal cables must be separated from power line and relay cables to minimize possible interference problems.

Main Connector

Figure 1 indicates the location of the Main Connector on the Nova-Flow rear panel. This 18-pin connector provides connections for a flow meter input, an AC or DC power supply input, an auxiliary 24 Vdc output, and 8 digital I/O lines. The pages that follow, illustrate typical connections made to the main connector.

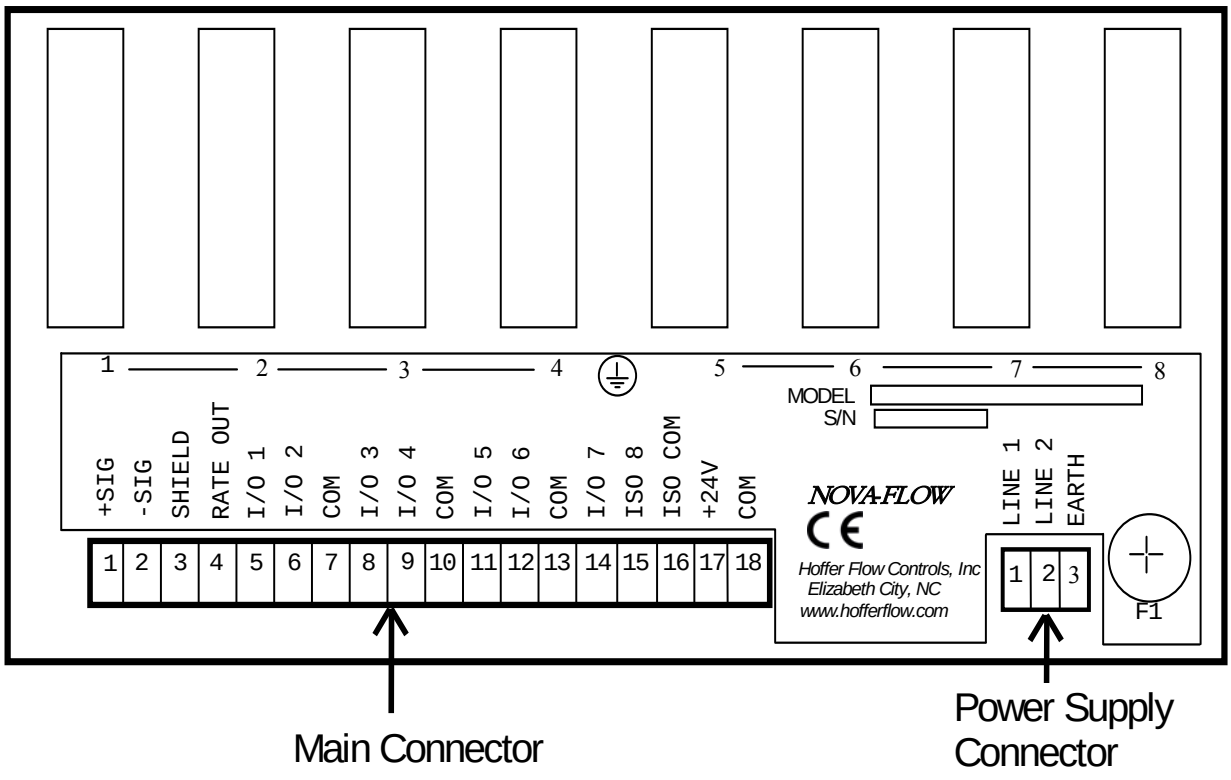


Figure 1. Main Connector on the Nova-Flow Rear Panel.

Power Supply Connections

Warning! Before connecting power supply lines, verify the power supply rating indicated on the Nova-Flow unit.

Note: The power input is protected by a fuse accessible from the back panel and is designated as F1. The specified fuse rating is AGC 2 Amp/250 V.

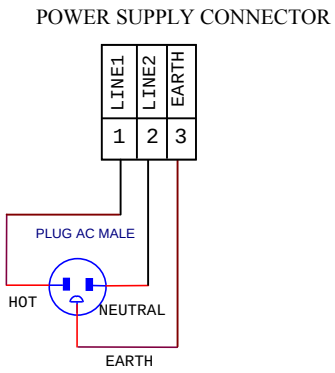


Figure 2. 120/240 VAC Power Line connection

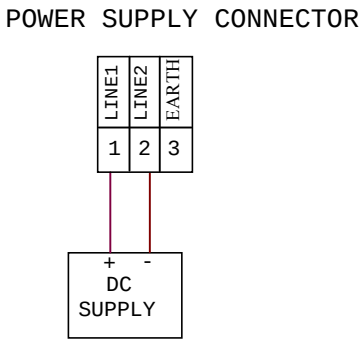


Figure 3. 10-30 VDC Power Line connection

Pickup Coil Connections

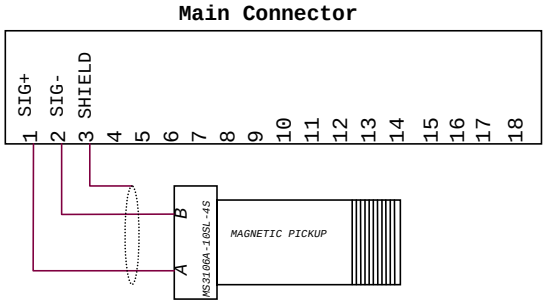


Figure 4. Magnetic Coil Connection

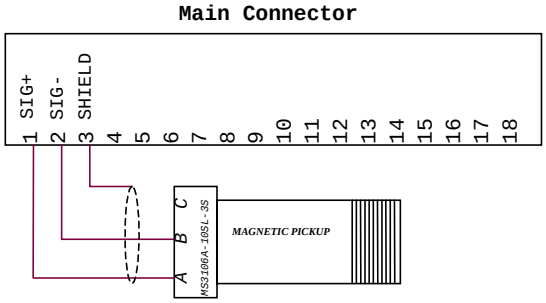


Figure 5. MCP Coil Connection

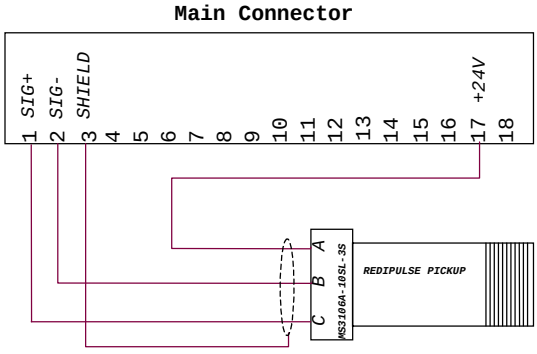


Figure 6. Redi-Pulse/Open Collector Coil Connection

I/O1 - I/O7 Connections

The following figures illustrate example input and output connections for I/O1 – I/O7. Please refer to the Hardware Configuration section of this manual for details on the proper hardware configuration of these options.

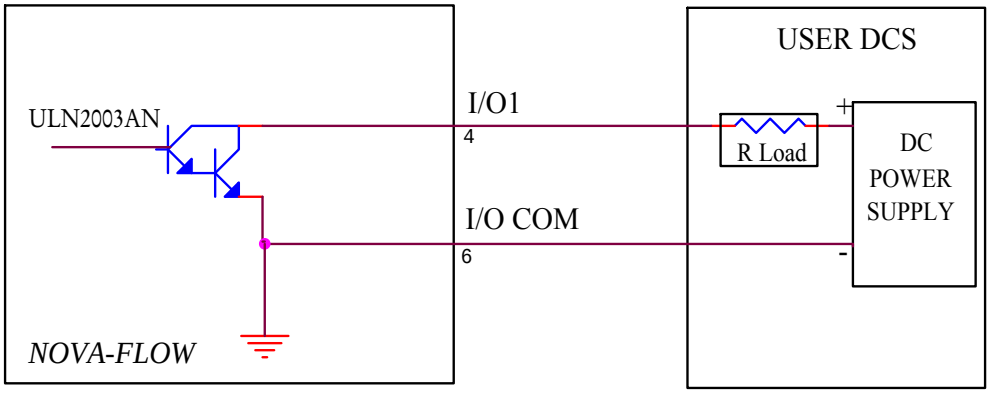


Figure 7. I/O1 Configured for Open Collector Output

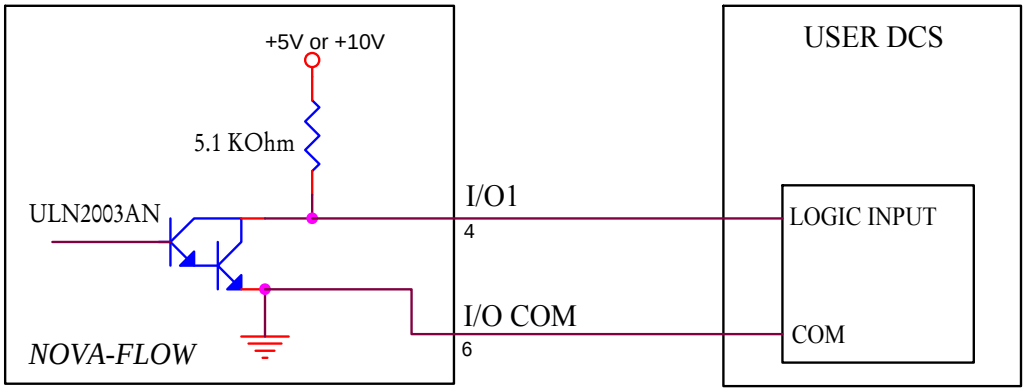


Figure 8. I/O1 Configured for 5V or 10V Output

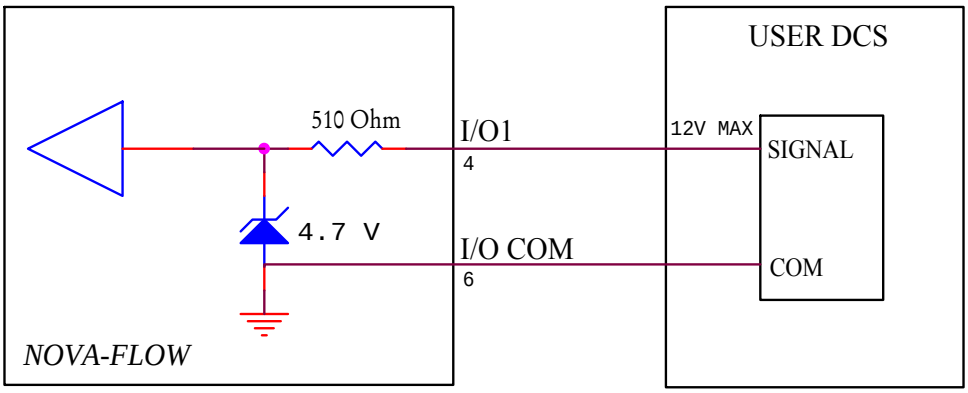


Figure 9. I/O1 Configured as an Input

I/O8

I/O8 is an output only. It can be configured for isolated output, open collector referenced to internal ground, or digital output at 5V or 10V level referenced to internal ground. Please refer to the Hardware Configuration section of this manual for details on the proper hardware configuration of these options.

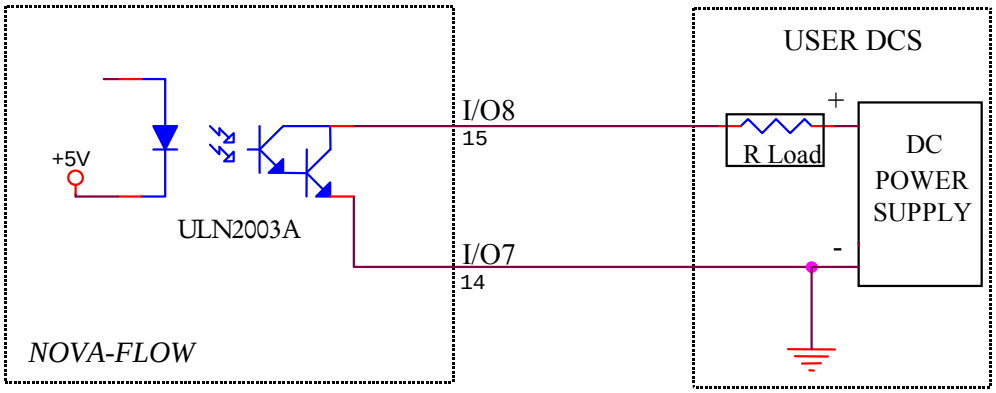


Figure 10. I/O8 Configured for Isolated Output

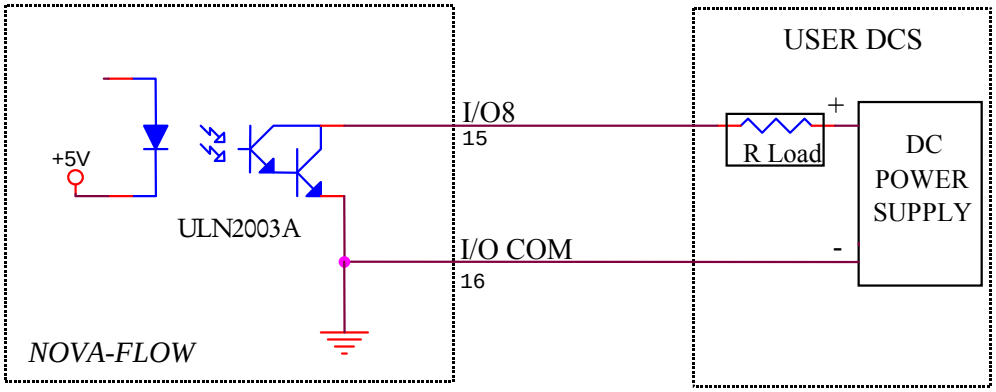


Figure 11. I/O8 Configured for Open Collector Output Referenced to Internal Ground.

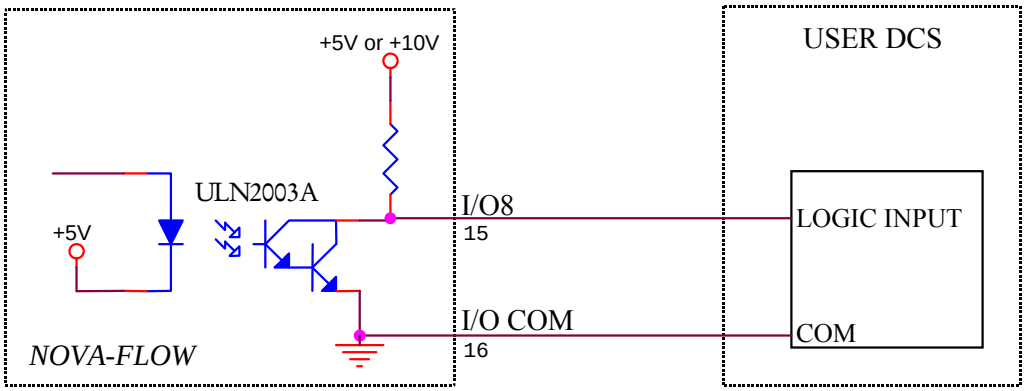


Figure 12. I/O8 Configured for 5V or 10V Outputs Internally Referenced.

Flow B Module Connections

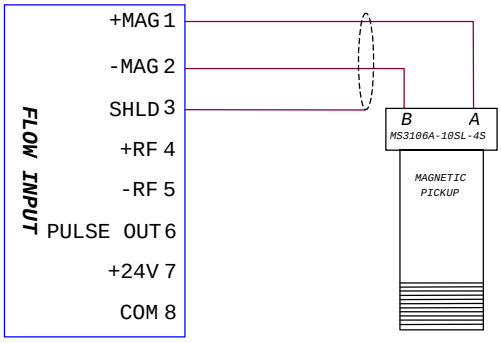


Figure 13. Magnetic Coil Connection

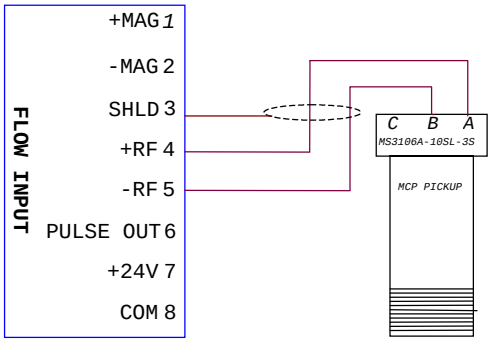


Figure 14. MCP Coil Connection

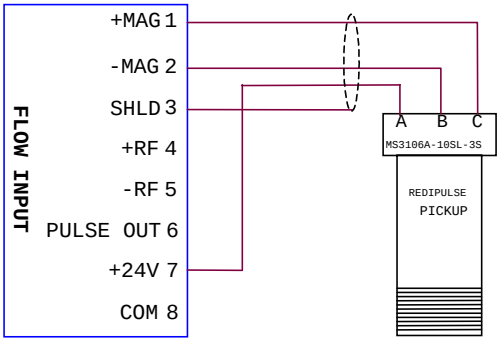


Figure 15. Redi-Pulse/Open Collector Coil Connection

RTD/Analog Input Module

NOTE: Loop powered devices cannot be connected when using true four-wire RTD configuration since pin 8 will be COM instead of +24V as selected by internal jumper. Refer to the Hardware Configuration section of this manual for details.

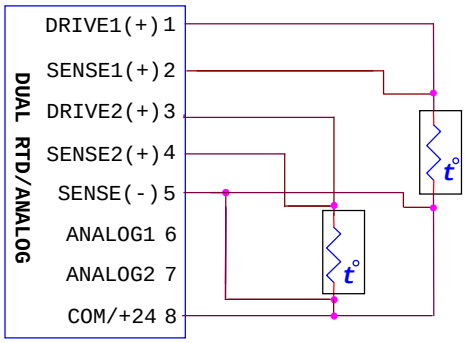


Figure 1. Four-Wire RTD Connection.

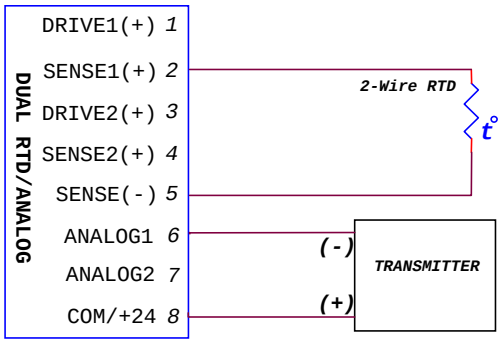


Figure 17. Two-Wire RTD and Transmitter Connection.

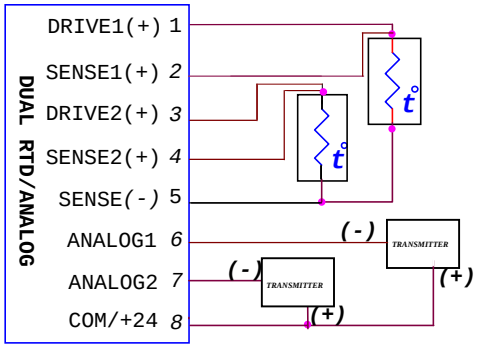


Figure 18. Three-Wire RTD and Transmitter Connection.

Analog Output Module

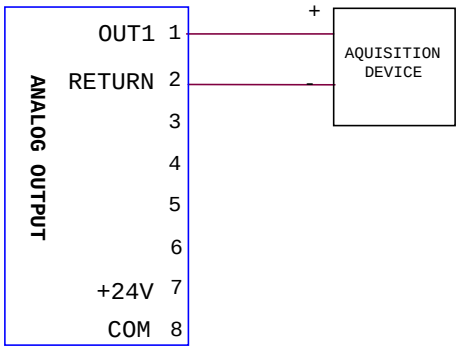


Figure 19. Analog Output Using Internal Power Supply (Sourcing).

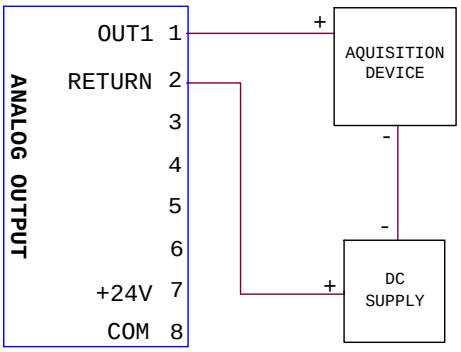


Figure 20. Analog Output Using External Power Supply (Sinking).

Dual Pulse Output Module

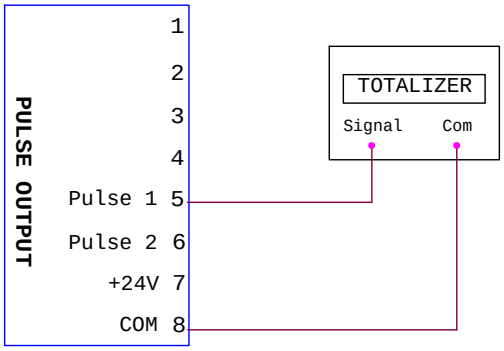


Figure 21. Pulse Output Connection.

Dual Relay Module

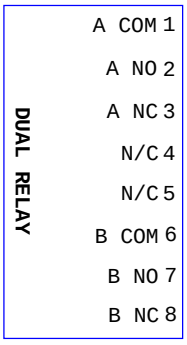


Figure 22. Dual Relay Connections.

Communications

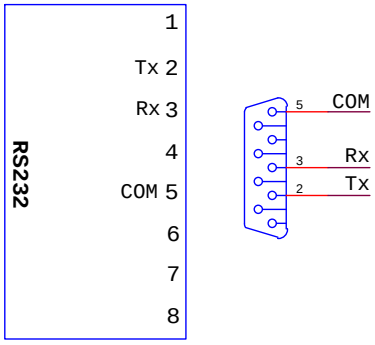


Figure 23. RS-232 Connections for Optional 8 Pin or DB-9 Connector.

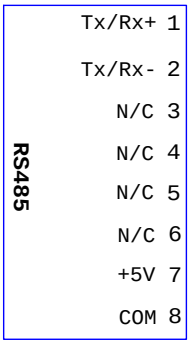


Figure 24. RS-485 Connections.

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Hardware Configuration

I/O Configuration

SW1, SW2, and SW3 are used for configuration of Main board I/O functions. The switches are located on the rear of the main board near the main connector.

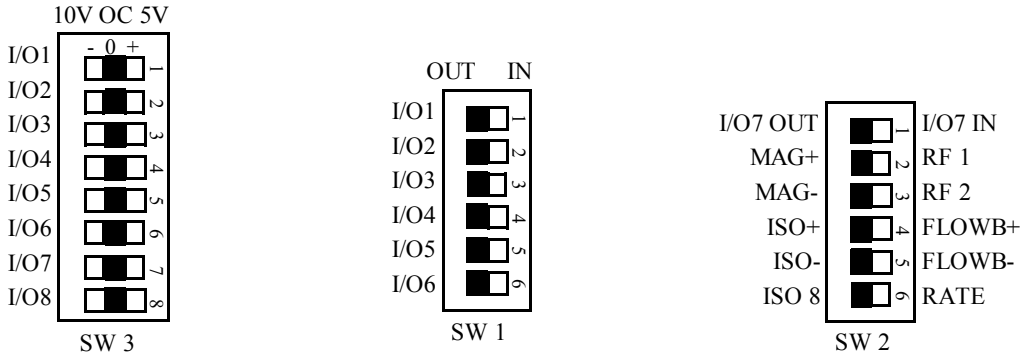


Figure 1. I/O Configuration Switches SW1, SW2, and SW 3.

Flow Input Selection

SW3 is used for selecting the type of flow input that will be used. The following figures illustrate the proper switch settings for a variety of flow sensors.

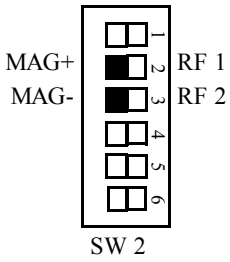


Figure 2. Magnetic Pickup Coil

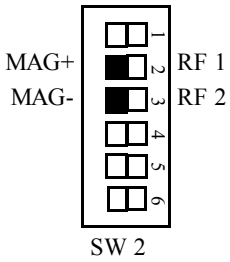


Figure 3. Redi-Pulse/Open Collector Coil Connection.

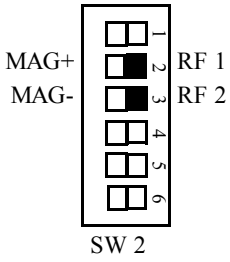


Figure 4. MCP Coil Connection

Digital I/O 1-7

I/O1 – I/O7 can be configured individually for input or output by setting SW1 and SW2-1. When configured as an output, SW1 is used to select whether the output is 5V, 10V, or Open Collector.

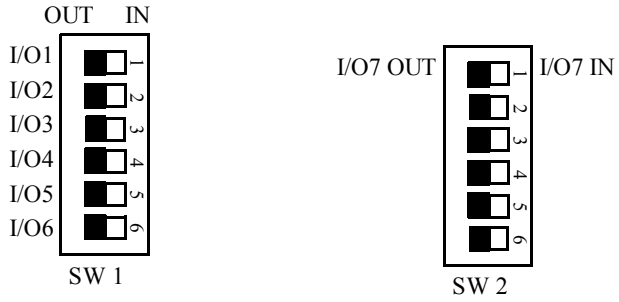


Figure 6. SW1 and SW2-1 for Selecting Digital Input or Output (Shown Configured as Output).

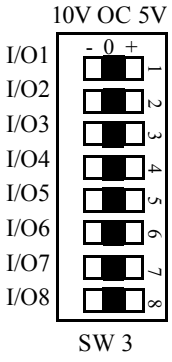


Figure 7. Selecting 5V, 10V, or Open Collector Output on SW3 (Shown Configured as Open Collector).

Digital I/O8

I/O8 is an output only. It can be configured for isolated output, open collector referenced to internal ground, or digital output at 5V or 10V level referenced to internal ground. The following figures illustrate settings for typical configurations.

NOTE: I/O7 is not available when I/O8 is configured as an Isolated Output.

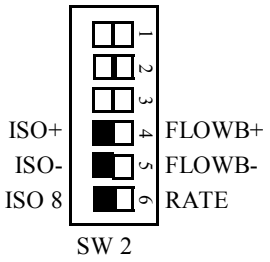


Figure 8. I/O8 Configured as an Isolated Output

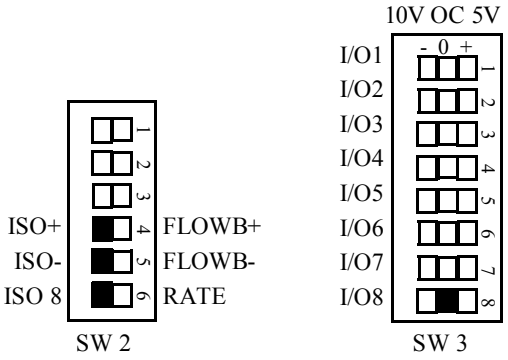


Figure 9. I/O8 Configured as an Open Collector Output Referenced to Internal Ground.

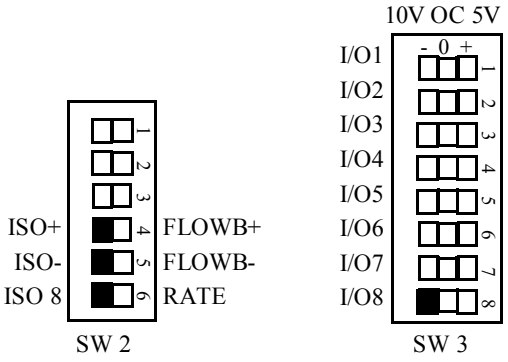


Figure 10. I/O8 Configured as a 10V Output Referenced to Internal Ground.

RTD/Analog Input Module

	2 -Wire RTD	3-Wire RTD	4 -Wire RTD
SW1-1	ON	X	OFF
SW1-2	ON	OFF	OFF
SW1-3	ON	OFF	OFF
SW1-4	ON	ON	OFF

Table 2. SW1 Settings for RTD Input.

RTD Resistance	R1, R2	R4, R5, R9, R10	R3, R8
RTD 100	2 k	1 k	Not installed
RTD 1000	20 k	1 k	Not installed
RTD 2500	50 k	1 k	Not installed

Table 3. Resistor Values for Optional RTD Input Configurations.

Note: All resistors are factory installed. Values listed are for reference only.

Input Signal	Resistor A	Resistor B	Resistor C
4-20 mA	10	10	200
1-5 V	1k	1.5k	8.45k

Table 4. Resistor Values for Optional Analog Input Configurations.

Note: All resistors are factory installed. Values listed are for reference only

Pin 8: Auxiliary 24V / COM

There is an auxiliary 24V supply provided for loop-powered devices on pin 8. This option must be selected by equipping JP2 on the module. Pin 8 may also be used as a reference Ground for 4-wire RTD applications by equipping JP1.

Note: JP1 and JP2 should never be equipped simultaneously, as this will cause a power supply short. Loop powered devices cannot be used on a module that requires true 4-wire RTD connections.

Analog Output Module

Analog Output may be configured for 4-20 mA or 1-5 V output, and may be powered internally or externally using removable jumpers JP1-JP4 and Pins 1 and 2 of the eight-pin connector.

	JP1	JP2	JP3	JP4	Pins1&2 on P1 connector
Externally Powered 4-20 mA		Installed			
Internally Powered 4-20 mA	Installed		Installed		
1-5 V	Installed			Installed	Installed

Table 5. Jumper Settings for Power and Output Options.

Pulse Output Module

The Pulse Output signal level can be configured for open collector, 5V, or 12V using removable jumpers JP1-JP4. Do not install jumpers for open collector output.

Output level	Pulse 1	Pulse 2
5 V Output	JP2	JP4
12 V Output	JP1	JP3
Open Collector	NONE	NONE

Table 6. Jumper Settings for Optional 5V or 12V Output Level.

Windows Configuration

The Nova-Flow WinConfig Program allows for quick, easy configuration of the Nova-Flow using a personal computer. Any programmable field available locally on the flow computer is also accessible through WinConfig. This chapter provides guidelines for basic operations available through WinConfig.

Installation

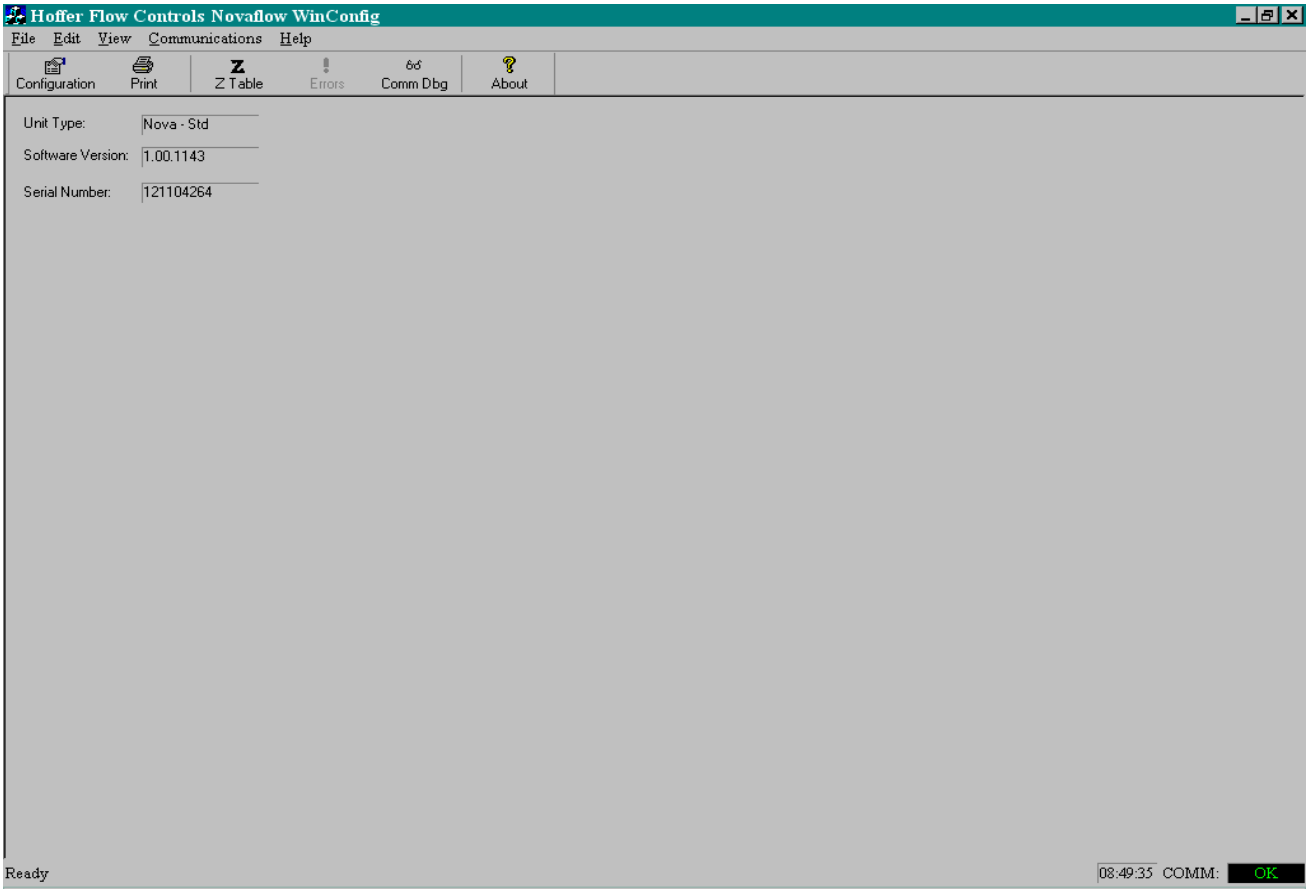
Minimum system requirements: 486 Processor running Windows 95/NT and a Communications Port.

Insert the provided disk into the computer.
Click on the "Start" menu on the Windows desktop taskbar and select "Run".
Click on "Browse" and search for the drive in which the disk is located.
Select "Setup", and let the Setup Wizard guide the installation process.

Startup

Below is an illustration of the "Startup" screen that will appear when the WinConfig program is invoked. Make certain that Nova-Flow is powered up before attempting to establish communications. Connection may be made to the Nova-Flow via cable or the infrared interface. Click on "Communications" then on "Initialize" and select the appropriate Com port designation and Com port type. After making the appropriate selections, click on "OK" and verify that the COMM Window in the bottom right corner of the screen displays "OK".

After establishing Communications, the Startup screen will display the detected Unit Type, software version, and the electronic serial number assigned to the flow computer.



COMM Window in the bottom right corner of the screen displays "OK". After establishing communications, the Startup screen will display the detected Unit Type, software version, and the electronic serial number assigned to the flow computer.

Print

Clicking on "Print" in the Startup screen will print a copy of the programmed configuration parameters to a printer connected to the personal computer. A preview of the printout can be displayed by selecting "File" and then "Print Preview".

Configuration

After communications have been established, clicking on "Configuration" uploads program information from Nova-Flow. Once the upload is complete, the I/O menu will be displayed. Other available menu items may be selected by clicking on the appropriate tabs at the top of the screen.

I/O Configuration Menu

The I/O Configuration Menu is used to configure Main board I/O options as well as assigning, configuring and calibrating optional I/O modules. Diagnostic functions for specific I/O options are also available in the I/O Menu.

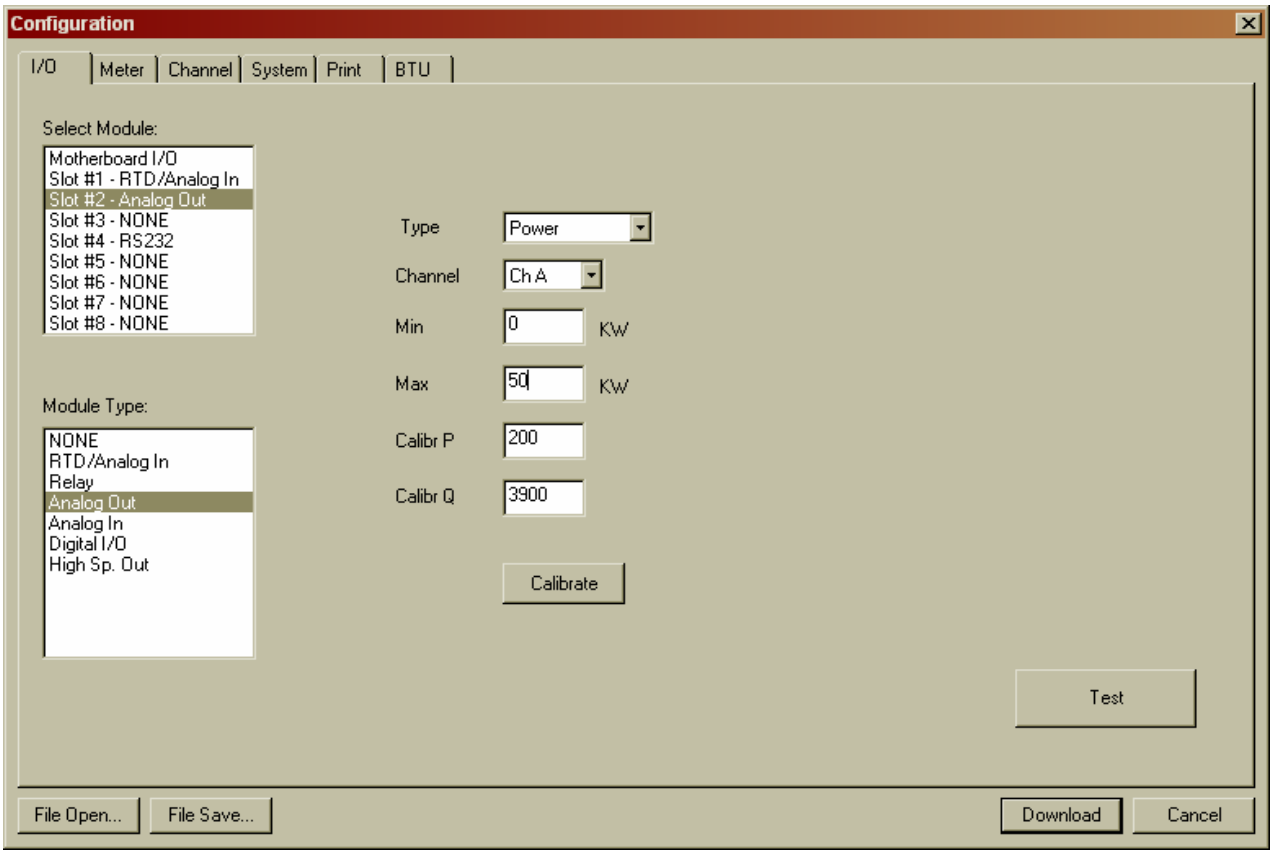


Figure 2. I/O Configuration Menu.

Meter Configuration Menu

The Meter Configuration Menu is used to configure all parameters associated with connected flow meter(s). The A, B, C, and D buttons on the left side of the screen represent the channel designations. Selecting one of these buttons will display the Meter options for the associated channel.

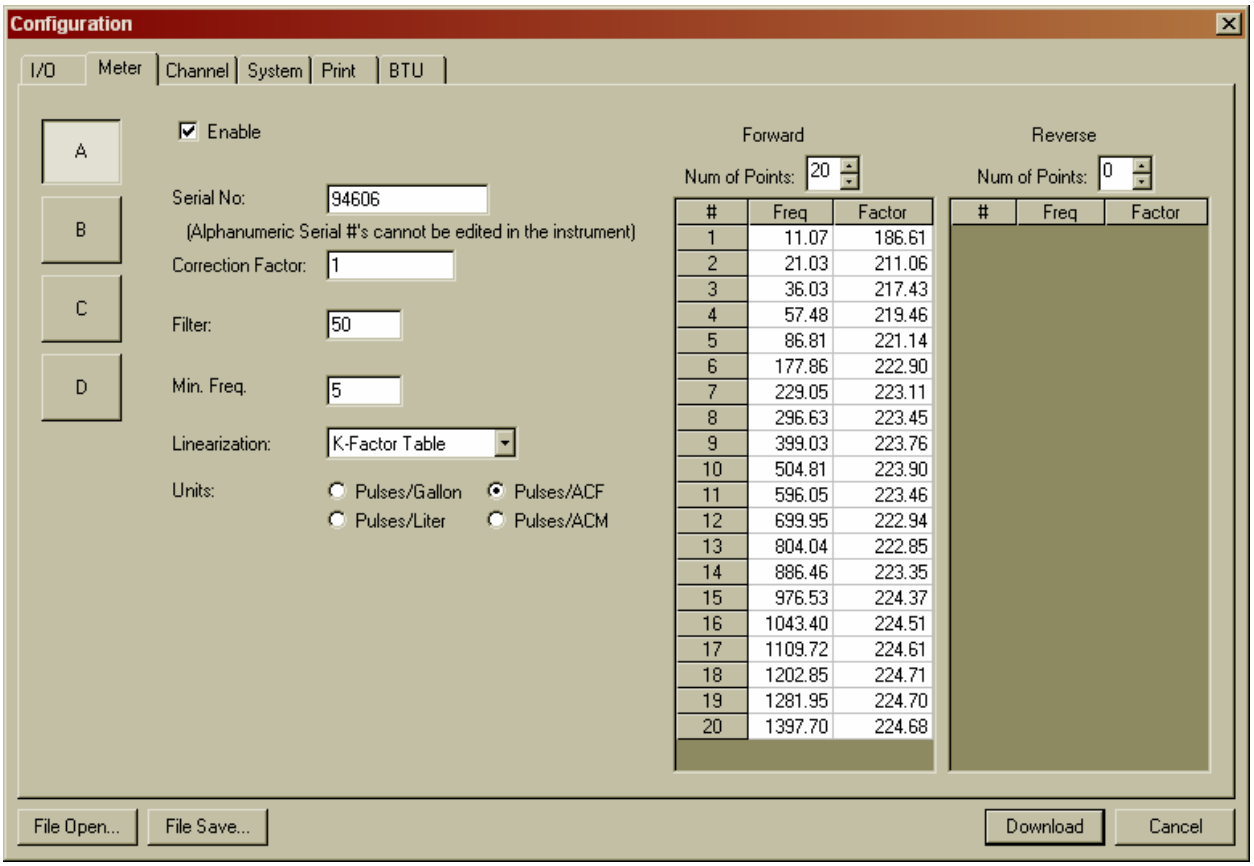


Figure 3. Meter Configuration Menu.

Channel Configuration Menu

The Channel Configuration Menu is used to configure metrological specifics such as the calculation and compensation methods, default conditions, and unit selections for each channel. The A, B, C, and D buttons on the left side of the screen represent the channel designations. Selecting one of these buttons will display the options for the associated channel.

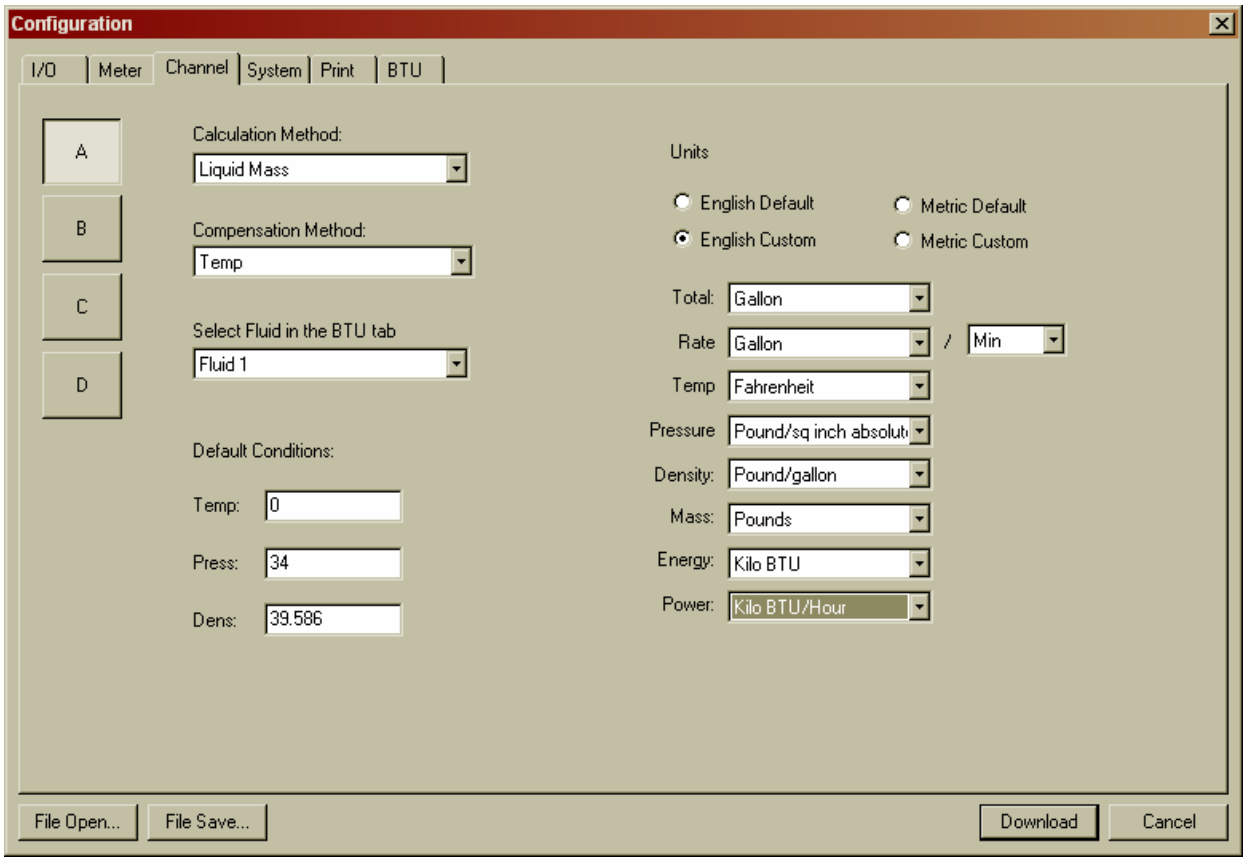


Figure 4. Channel Configuration Menu.

System Configuration Menu

The System Configuration Menu provides four lower level menus as follows:

Utility Functions: Program the Menu timeout feature, Enable/Disable the keypad, Configure Math Functions.
Password/Pin: Program two levels of password protection for up to ten users.
Fluid Properties: Provides configuration parameters for up to four different fluids.
Base Conditions: Select the appropriate operating conditions.

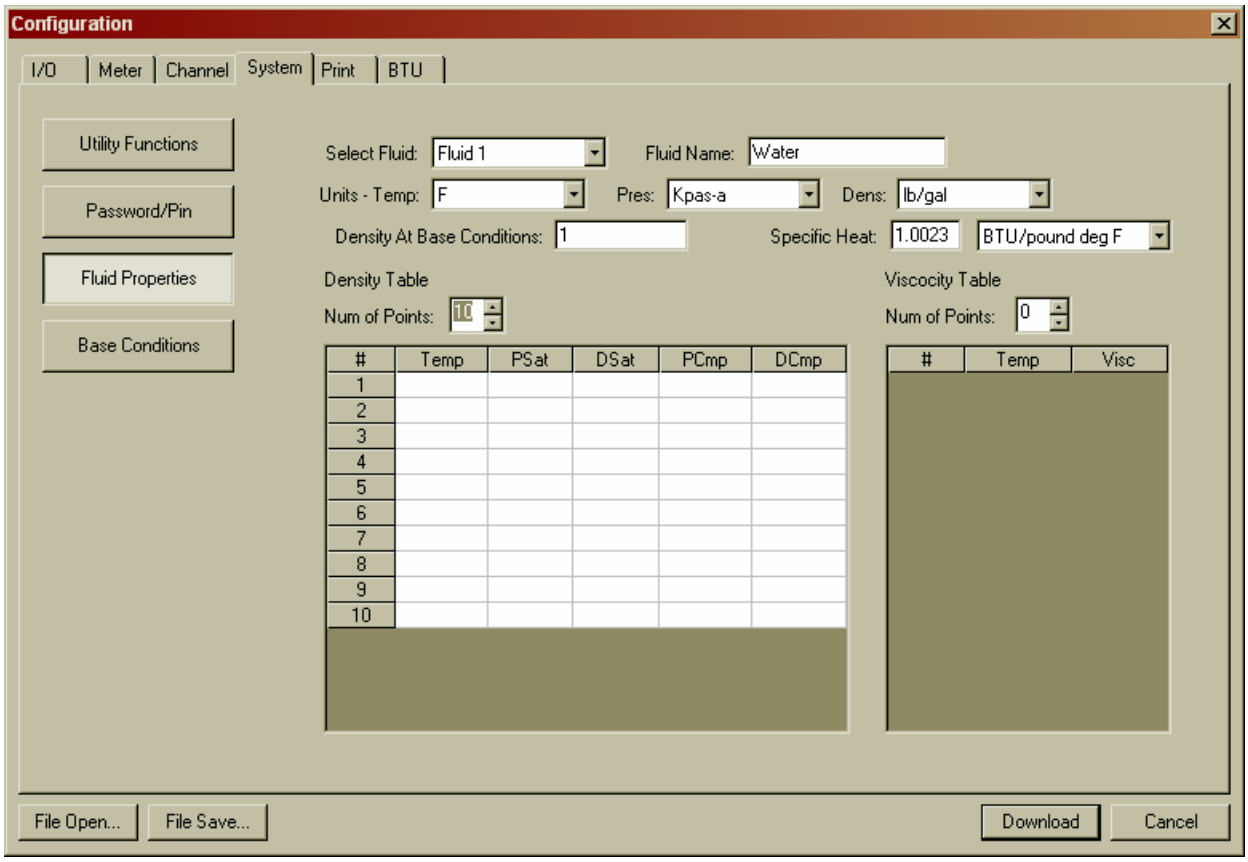


Figure 5. System Configuration Menu (Fluid Properties Shown).

Print Menu

The Print Menu is used to select the printer that is connected to the Nova-Flow and define the associated column width. A list of variables is also provided to select specific process parameters for printing when Print Variables is selected on the Nova-Flow. The selected variables may be printed automatically at programmed intervals by entering a value corresponding to the print interval in minutes in the Print Frequency field.

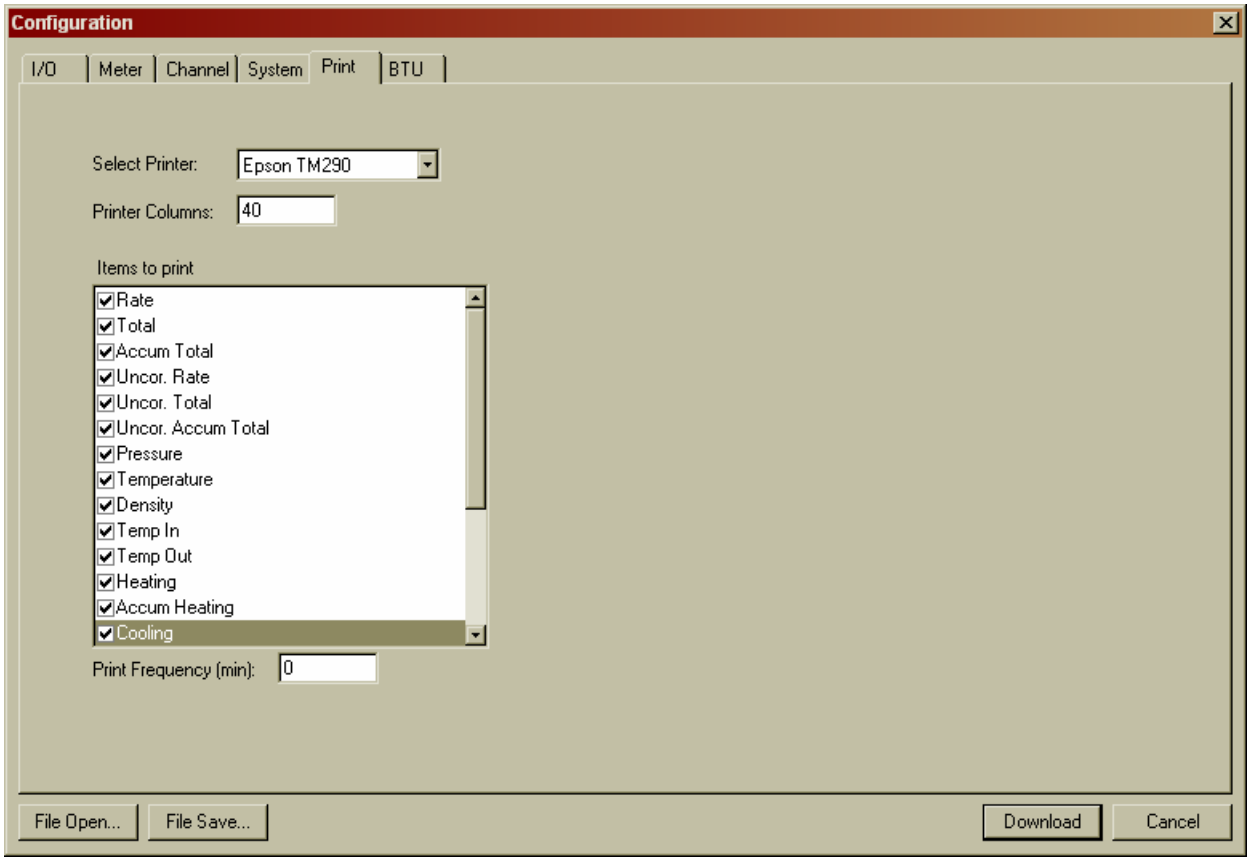


Figure 6. Print Menu.

BTU Menu

The BTU Menu is used to configure the specifics for energy applications. The fluid, mode of operation, and peak times may be configured from the BTU Menu. Refer to the Operation section of this manual for details on energy applications.

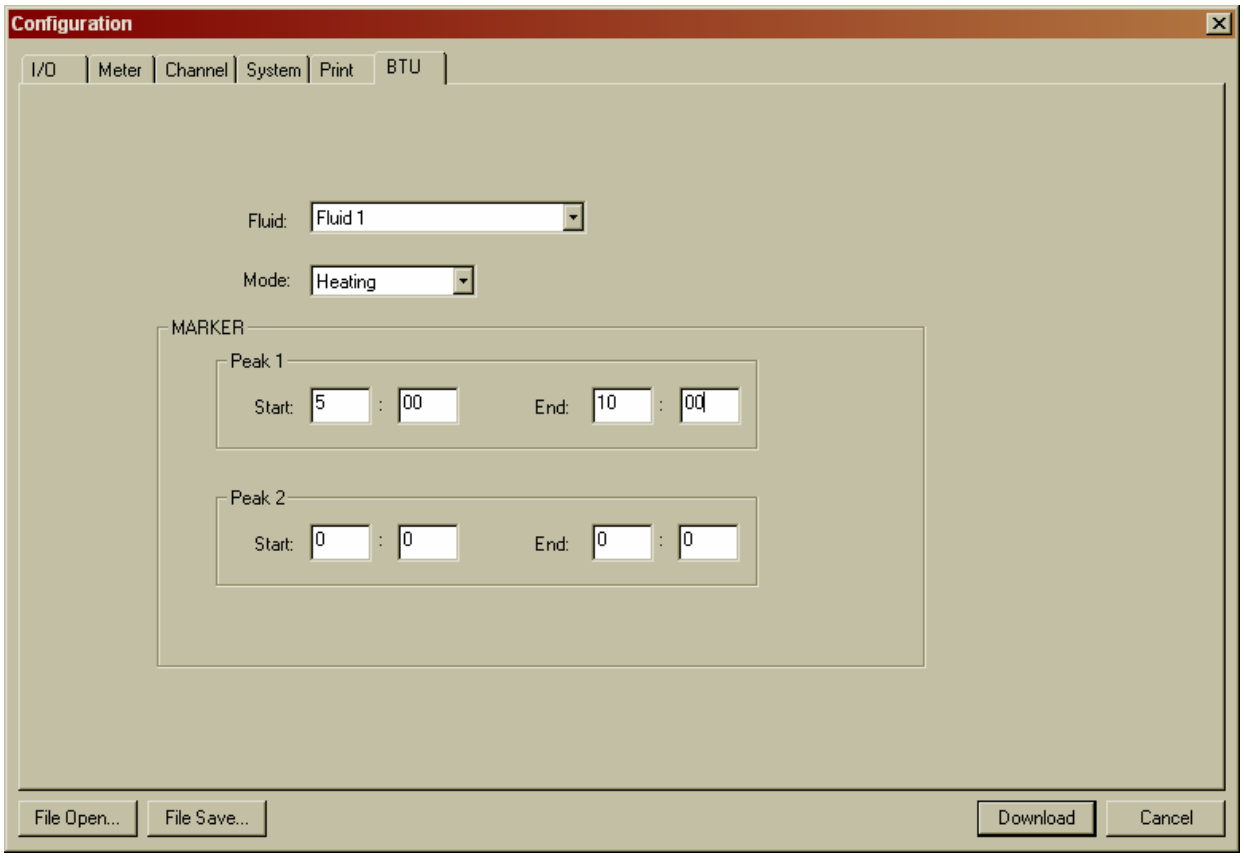


Figure 7. BTU Menu.

Downloading the Configuration

When all required parameters have been programmed, the configuration may be downloaded to the Nova-Flow by clicking on the "Download" button located in the bottom right corner of the configuration screens. After the configuration has been downloaded, a software reset is required on the Nova-Flow for the new configuration to take affect.

Configuration Files

WinConfig allows configurations to be saved as a file for future use. The two available file functions are File Open and File Save which are described on the following page.

Downloading the Configuration

When all required parameters have been programmed, the configuration may be downloaded to the Nova-Flow by clicking on the "Download" button located in the bottom right corner of the configuration screens. After the configuration has been downloaded, a software reset is required on the Nova-Flow for the new configuration to take affect.

Configuration Files

WinConfig allows configurations to be saved as a file for future use. The two available file functions are File Open and File Save which are described below.

Saving Configuration Files

After all required parameters have been programmed, click on the "File Save" button located in the bottom left corner of the configuration screens. When the "Save As" window appears, select the destination drive and directory, provide a name for the file and click on "Save". All configuration files are given an .HFC extension.

Opening Configuration Files

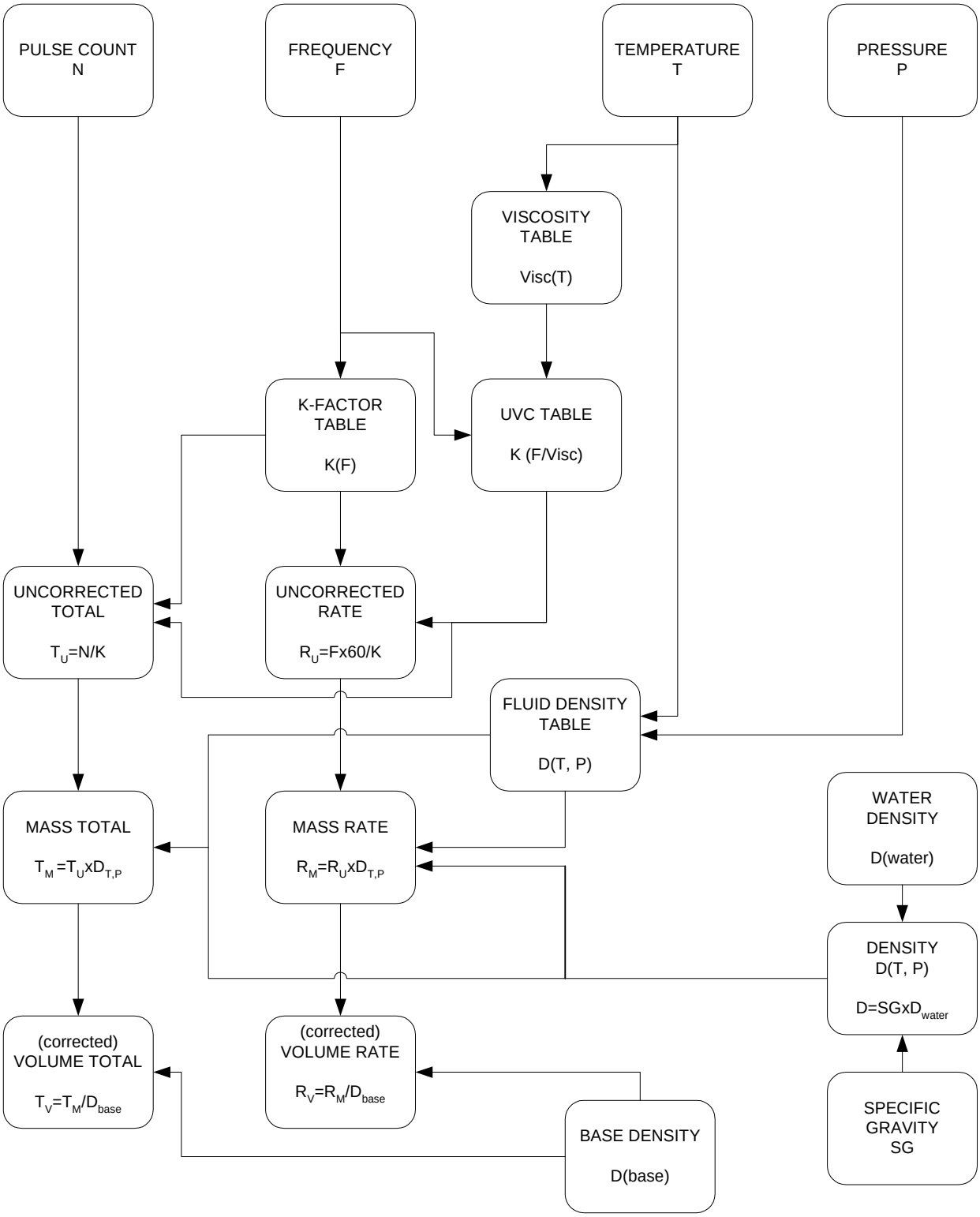
To recall previous configurations, click on the "File Open" button located in the bottom left corner of the configuration screens. When the "Open" window appears, select the proper drive and directory, select the desired .HFC file, then click on "Open".

Offline Editing

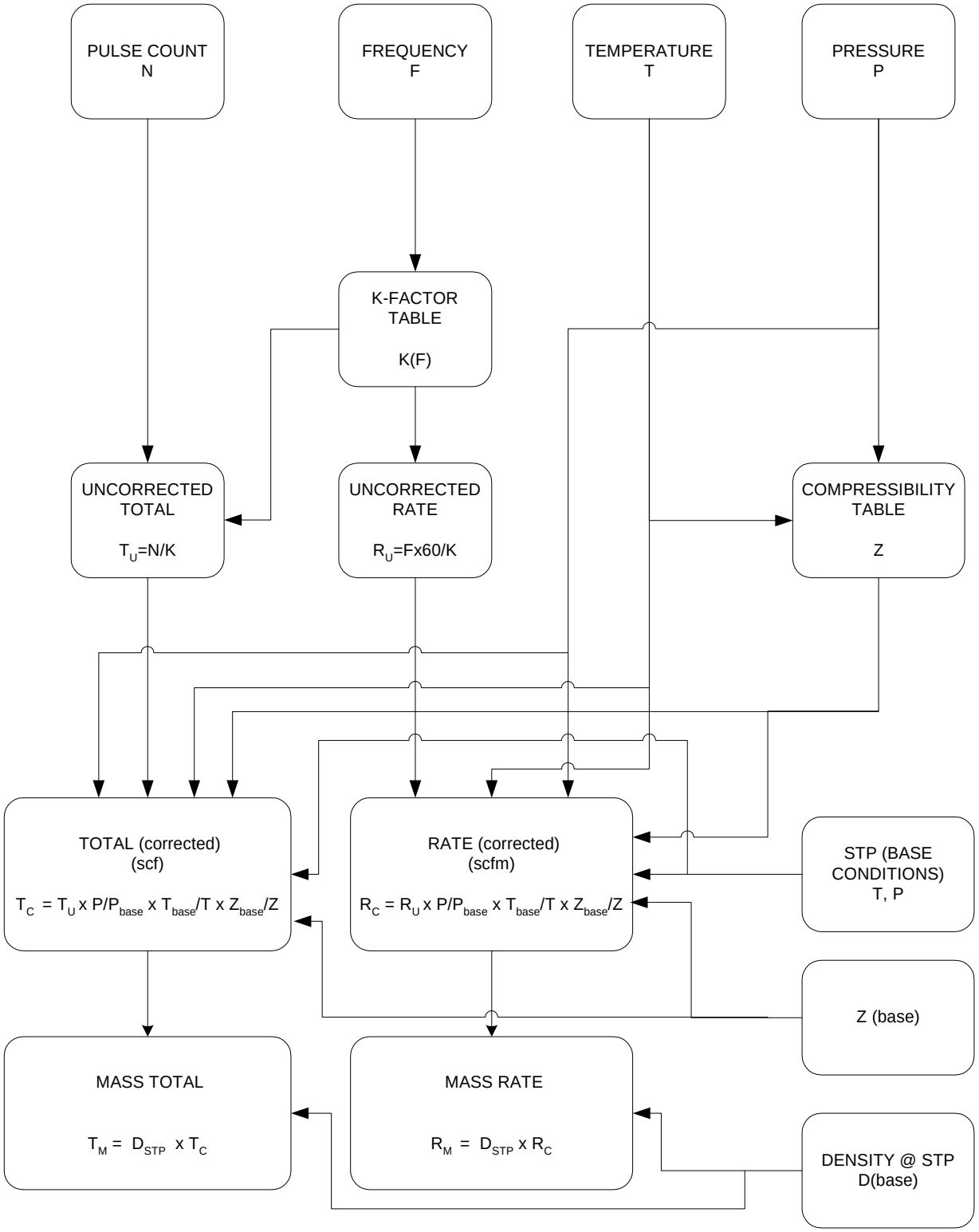
Configuration files may be created offline for future downloads. Click on "Configuration" in the Startup screen and a "Device Offline" message box will appear. Select the device type from the provided list and click on "OK". WinConfig will then enter the configuration mode. Configure all necessary parameters and then save the configuration as a file using the previously described method.

NOTE: When editing offline, attempts to download will result in the configuration being lost. Be sure to save the configuration as a file.

Appendix A: Liquid Calculation Flow Chart



Appendix B: Gas Calculation Flow Chart



Appendix C: Units of Measure

Liquid Volume

Full Name	Abbr. Name	Multiplier
Gallons	GAL	1
Liter	L	3.785411784
Milliliter	ML	3785.411784
Cubic feet	FT3	0.133680556
Pint	PT	8
Fluid once	FLOZ	128
Barrel (oil)	BBL	.02380952381
Cubic meter	M3	0.003785412
Cubic centimeter	CC	3785.411784
Quart	QT	4
Imperial gallon	IGAL	0.832674

Gas Volume

Full Name	Abbr. Name	Multiplier
Actual cubic feet	ACF	0.133680556
Actual liters	AL	3.785411784
Actual cubic centimeters	ACC	3785.411784
Actual cubic meters	ACM	0.003785412
Million cubic feet	MCF	133680.5556

Gas Mass

Full Name	Abbr. Name	Multiplier
Kilograms	KG	0.45359237
Pounds	LB	1
Gram	G	453.59237

Liquid Mass

Full Name	Abbr. Name	Multiplier
Pounds	LB	1
Kilograms	KG	0.45359237
Once	OZ	16
Ton	TON	0.0005
Metric ton	MTON	.00045
Gram	G	453.59237

Appendix C: Units of Measure

Temperature

Full Name	Abbr. Name	Multiplier	Offset
Fahrenheit	F	1	0
Celsius	C	0.555555556	-32.00
Kelvin	K	0.555555556	+459.67
Rankine	R	1	+459.67

Pressure

Full Name	Abbr. Name	Multiplier	Offset
Pound/sq inch absolute	PSIA	1	0
Atmosphere	ATM	0.068045964	0
Pound/sq inch gauge	PSIG	1	-14.69595
Bar gauge	BAR-G	0.068947573	-0.944302
Bar absolute	BAR-A	0.068947573	0
Kilo Pascal gauge	KPA-G	6.894757293	-94.43024
Kilo Pascal absolute	KPA-A	6.894757293	0
Mega Pascal gauge	MPA-G	0.006894757	-0.09443
Mega Pascal absolute	MPA-A	0.006894757	0
kG/cm2-g	KG/CM2-G	0.070306958	-0.96292
kG/cm2-a	KG/CM2-A	0.070306958	0
Millimeter of water column	MM W.C.		
Inch of water column	IN W.C.	27.7075924	0
Millimeter of mercury	MM HG	51.71493257	0
Inch of mercury	IN HG	2.036020967	0

Density

Full Name	Abbr. Name	Multiplier
Pound/gallon	LB/GAL	1
Kilogram/liter	KG/L	0.119826427
Pound/cubic feet	LB/FT3	7.480519481
Kilogram/cubic meter	KG/M3	119.8264273

K-factor

Full Name	Abbr. Name	Multiplier
Pulse/gallon	PULSE/GALLON	1
Pulse/liter	PULSE/LITER	0.264172052
Pulse/ft3	PULSE/FT3	7.480519481
Pulse/m3	PULSE/M3	264.1720524

Meter Factor

Full Name	Abbr. Name	Multiplier
Gallon/pulse	GAL/PULS	1
Cubic meter/pulse	M3/PULS	0.003785412

Energy

Full Name	Abbr. Name	Multiplier
Kilo BTU	KBTU	1
Kilowatt-hour	KWH	0.293071111
Megawatt hour	MWH	0.000293071
Mega Joule	MJ	1.055056
Giga Joule	GJ	0.001055056
Horsepower hour US	HP US	0.393014834
Calorie		251995.7963

Power

Full Name	Abbr. Name	Multiplier
Energy unit/hour	KBTU/HR	1
	KW	0.293071111

Time

Full Name	Abbr. Name	Multiplier
Second	SEC	1
Minute	MIN	
Hour	HR	
Day	DAY	

Corrected Volume (Gas and Liquid)

Full Name	Abbr. Name	Multiplier
Standard cubic feet	SCF	equation
Normal cubic meter	NCM	equation
Standard cubic meter	SCM	equation

Appendix D: Error Messages

	MESSAGE	*DESCRIPTION*
1	CHX HIGH FLOW ALARM	Flow Rate has exceeded the limit defined for the High Flow Alarm parameter of the Digital I/O or Relay Flow Alarm output.
2	CHX LOW FLOW ALARM	Flow Rate has fallen below the limit defined for the Low Flow Alarm parameter of the Digital I/O or Relay Flow Alarm output
3	CHX HIGH FLOW WARNING	Flow Rate has exceeded the limit defined in the High Warning parameter of the Digital I/O or Relay Flow Alarm output
4	CHX LOW FLOW WARNING	Flow Rate has fallen below the limit defined in the Low Warning parameter of the Digital I/O or Relay Flow Alarm output
5	CHX HIGH TEMP ALARM	Temperature has exceeded the limit defined for the High Alarm parameter of the Digital I/O or Relay Temp Alarm output.
6	CHX LOW TEMP ALARM	Temperature has fallen below the limit defined for the Low Alarm parameter of the Digital I/O or Relay Temp Alarm output.
7	CHX HIGH TEMP WARNING	Temperature has exceeded the limit defined for the High Warning parameter of the Digital I/O or Relay Temp Alarm output
8	CHX LOW TEMP WARNING	Temperature has fallen below the limit defined for the Low Warning parameter of the Digital I/O or Relay Flow Alarm output.
9	CHX HIGH PRES ALARM	Pressure has exceeded the limit defined for the High Alarm parameter of the Digital I/O or Relay Pres Alarm output
10	CHX LOW PRES ALARM	Pressure has fallen below the limit defined for the Low Alarm parameter of the Digital I/O or Relay Pressure Alarm output.

	MESSAGE	*DESCRIPTION*
11	CHX HIGH PRES WARNING	Pressure has exceeded the limit defined for the High Warning parameter of the Digital I/O or Relay Pressure Alarm output.
12	CHX LOW PRES WARNING	Pressure has fallen below the limit defined for the Low Warning parameter of the Digital I/O or Relay Pressure Alarm output.
13	CHX HIGH DENSITY ALARM	Density has exceeded the limit defined for the High Alarm parameter of the Digital I/O or Relay Density Alarm output
14	CHX LOW DENSITY ALARM	Density has fallen below the limit defined for the Low Alarm parameter of the Digital I/O or Relay Density Alarm output
15	CHX HIGH DENSITY WARNING	Density has exceeded the limit defined for the High Warning parameter of the Digital I/O or Relay Density Alarm output
16	CHX LOW DENSITY WARNING	Density has fallen below the limit defined for the Low Warning parameter of the Digital I/O or Relay Density Alarm output.
17	CHX HIGH SPECIFIC GRAVITY ALARM	Specific Gravity has exceeded the limit defined for the High Alarm parameter of the Digital I/O or Relay Sp. Gravity Alarm output.
18	CHX LOW SPECIFIC GRAVITY ALARM	Specific Gravity has fallen below the limit defined for the Low Alarm parameter of the Digital I/O or Relay Sp. Gravity Alarm output.
19	CHX HIGH SPECIFIC GRAVITY WARNING	Specific Gravity has exceeded the limit defined for the High Warning parameter of the Digital I/O or Relay Sp. Gravity Alarm output
20	CHX LOW SPECIFIC GRAVITY WARNING	Specific Gravity has fallen below the limit defined for the Low Warning parameter of the Digital I/O or Relay Sp. Gravity Alarm output.
21	CHX RTD PROBE SHORT	Temperature probe resistance input is less then 5 OHMS.
22	CHX RTD PROBE OPEN	Temperature probe resistance input is more then 15K OHMS resistance
23	CHX PRESS FAIL	Pressure Analog signal input is not detected. The computed value of the analog input value of the selected channel is equal to zero volts.

	MESSAGE	*DESCRIPTION*
24	CHX TEMP FAIL	Temperature signal analog input is not detected. The computed value of the analog input value of the selected channel is equal to zero volts.
25	CHX TEMP COMP	Temperature of the selected channel is out of range specified for analog input
26	CHX PRES COMP	Pressure of the selected channel is out of range specified for analog input
27	PULSE FAILURE	Flow circuits detect a pulse failure in a dual coil application.
28	TWO PHASE WARNING	Pressure is between saturated pressure and 5 psia above the saturated pressure
29	GAS INHIBIT ON	Pressure is equal or below the saturated pressure.
30	FLOWMETER RUNNING	Displayed if the operator attempts to clear totals or make configuration changes while flow is present.