Sigma Controls, Inc.
PROCESS CONTROLS AND INSTRUMENTATION

EZ-C PROCESS PANEL METER

Version 1.6

1/8 DIN 48 X 96MM Housing

THE EZ-C PANEL METER PROVIDES CONTINUOUS LEVEL MONITORING FROM ANALOG INPUTS

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TABLE OF CONTENTS

SPECIFICATIONS

Inputs (1 ea.)	Analog, 4/20MA, 0-5V, 1-5V, 0-10VDC, isolated, ±0.005% accuracy.
Inputs (1 ea.)	High-speed Digital 1-24VDC (May require external resistor)
Outputs (1 ea.)	Analog, 0-20MA, 0-10V
Outputs (4 ea.)	Relays 5A max. 2) Form A, 2) Form C
Display	LCD, 122 X 32 bitmapped graphical display
Loop Power	24VDC regulated output, 40MA max. Ex. Bussman S500-40-R
5 User Keys	Up, Down, Left, Right, Enter
Accuracy	0.005% of calibrated span
Lockout	User password
Input Impedance	Voltage 100K current 100 OHMS
Power	85-305VAC 50-60Hz. Fuse 1 AMP Slow Blow. Ex.AGC-1-R
Environmental	Operating 0-65°C, Storage –40° - 80°C, R.H., 0-90% non condensing
Enclosure	1/4 DIN, ABS plastic 48 X 96 X 150mm
Front Panel	Nema 1
Access	Dip switches & contrast adjust
Terminal Strip	(28) 'Pluggable' for ease of wiring 20 – 16AWG
Programming	Menu based, all parameters and setpoints are user configurable via menu prompt and the user keys using the preconfigured screens and 'pull down' sub menus with English prompts assures rapid setup and commissioning.
Warranty	1 Year Warranty
Options	RTD & Thermocouple add on (Future)
Data	Modbus® RTU RS 485 Slave

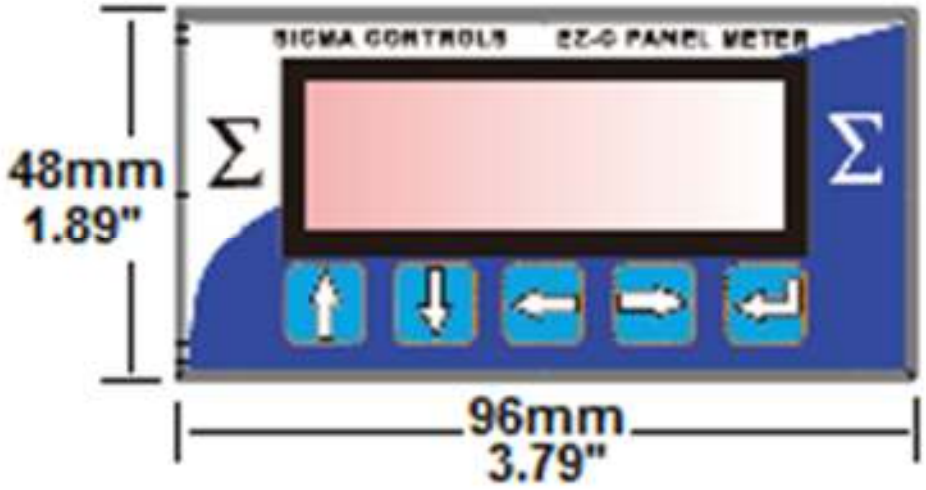
PRODUCT OVERVIEW

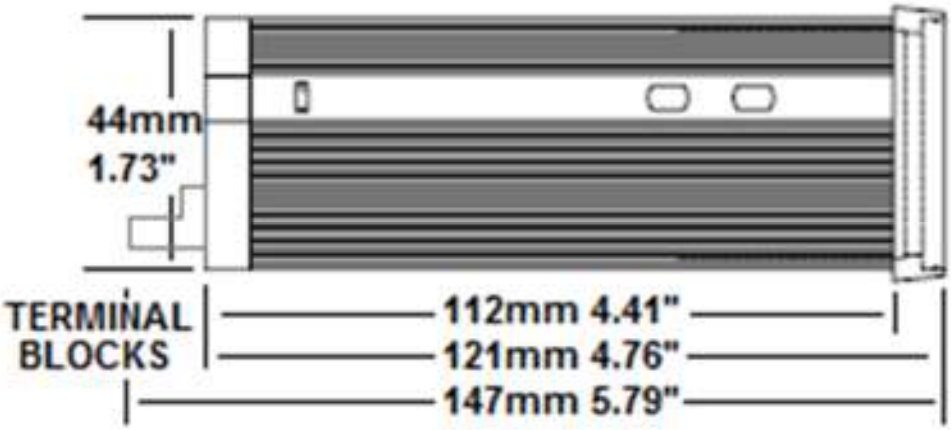
The EZ-C process meter gets its name from the large, easy to see, backlit display. Pushing the up key shows an even larger process reading that can be seen across a room.

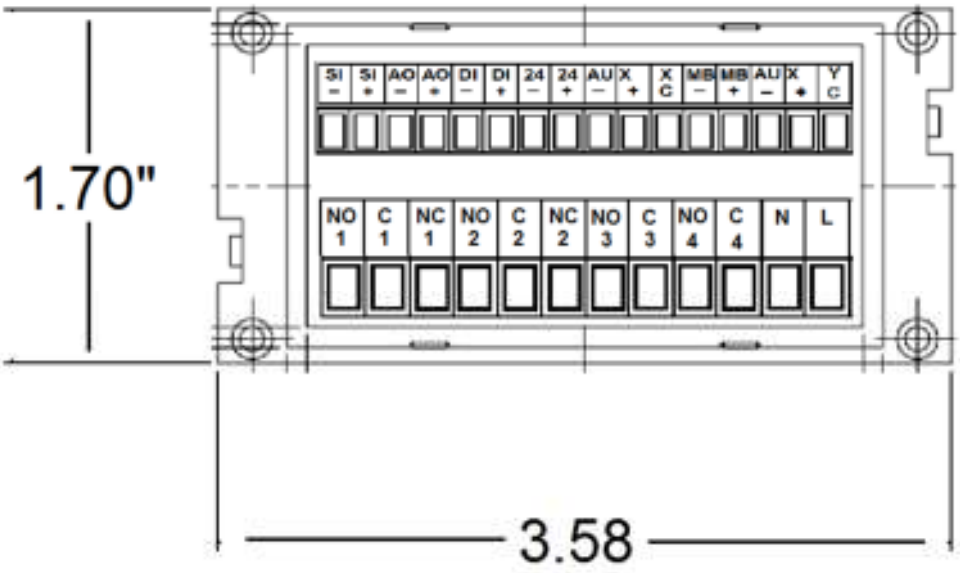
It is easy to understand too. Much like our controllers and level meters, all of the menus are in plain English. Unlike other process meters, setup is frustration free. In fact, an experienced controls person may not need this manual at all.

The EZ-C has expansion capabilities and can be customized for specific applications and OEM needs. Private labeling is available. Optional expansion PCBs and capabilities will be rolled out over time. Check in with us for updates or sign up for our newsletter from our website's front page at sigmacontrols.com

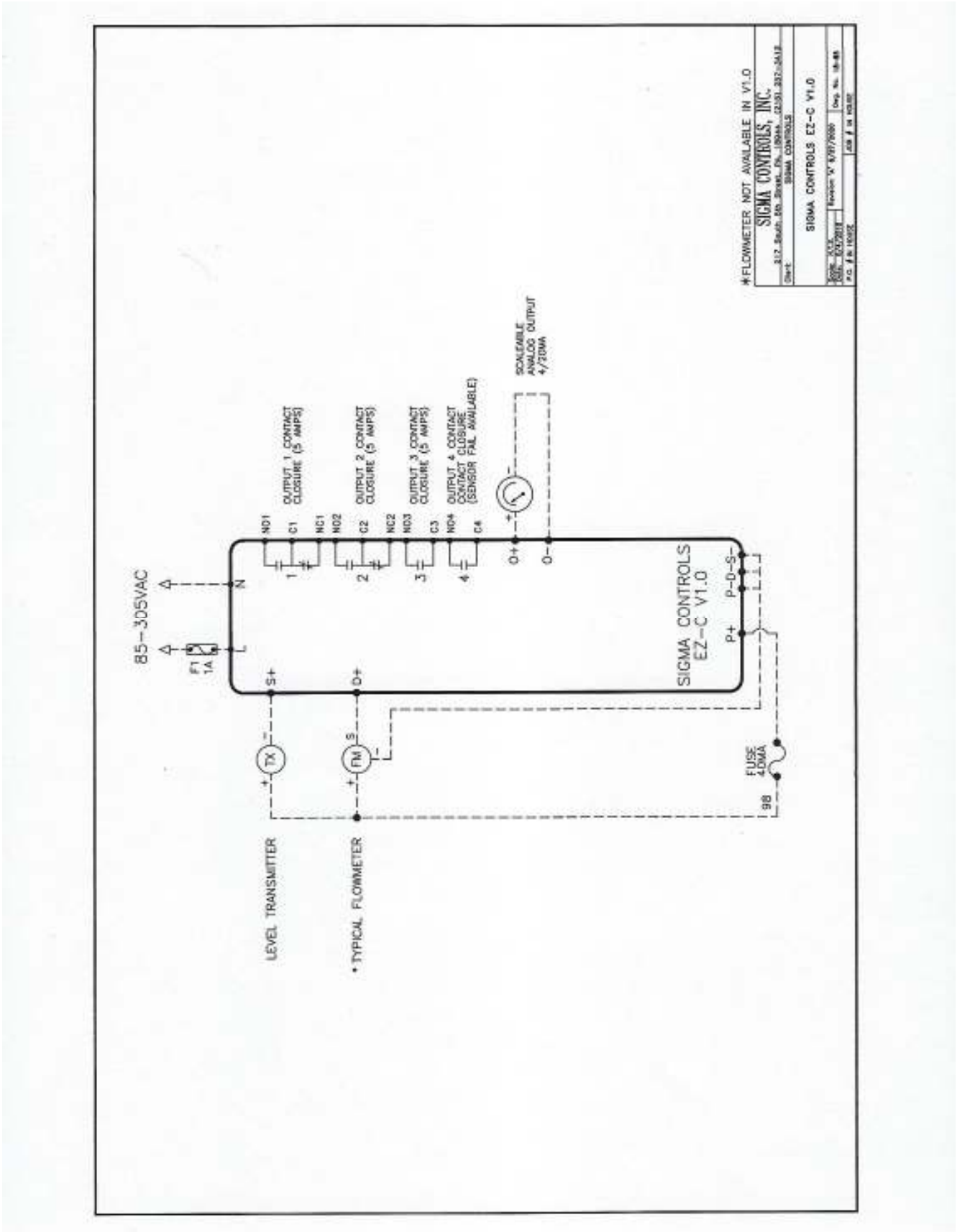
MECHANICAL


SIGMA CONTROLS
EZ-G PANEL METER
48mm
1.89"
96mm
3.79"

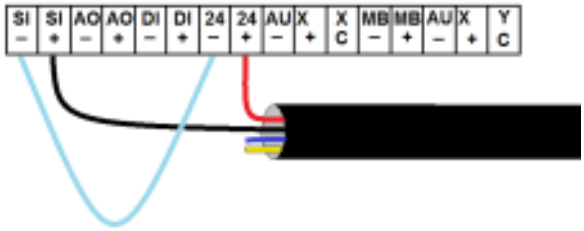

44mm
1.73"
TERMINAL BLOCKS
112mm 4.41"
121mm 4.76"
147mm 5.79"


1.70"
SI − SI + AO − AO + DI − DI + 24 − 24 + AU − X + X C MB − MB + AU − X + Y C
NO 1 C 1 NC 1 NO 2 C 2 NC 2 NO 3 C 3 NO 4 C 4 N L
3.58

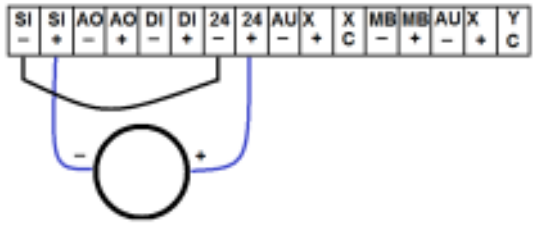
SIGMA DRAWING



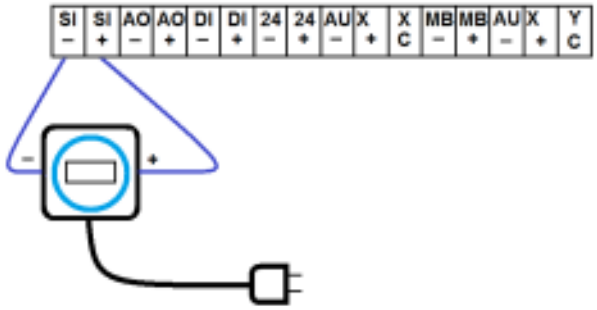
WIRING CONNECTIONS



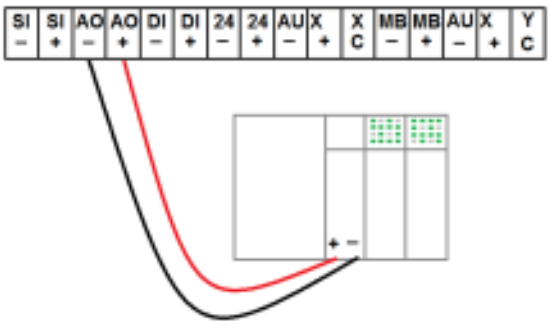
Connecting a Sigma Controls submersible sensor. The shield wire should be connected to earth ground. (Power should be fused)



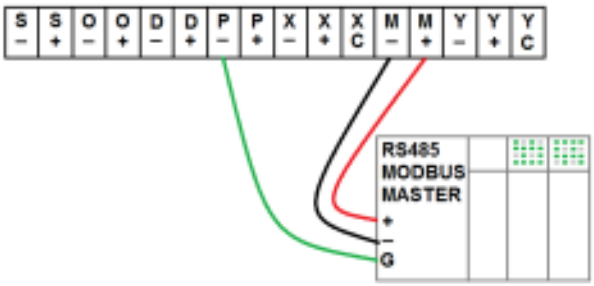
Connecting any 4-20mA, non-powered sensor.



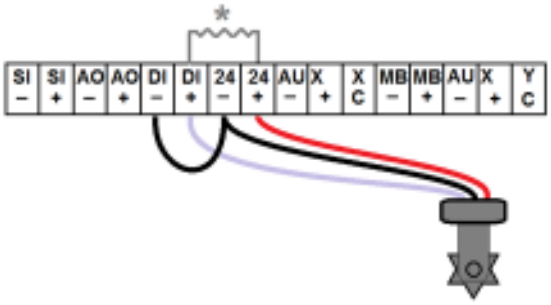
Connecting a powered 4-20mA or 0-10 volt signal.



Connecting the analog output.

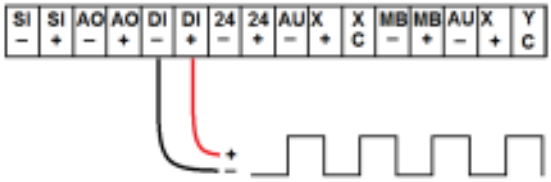


Connecting the RS485 Modbus® data. The ground is optional.

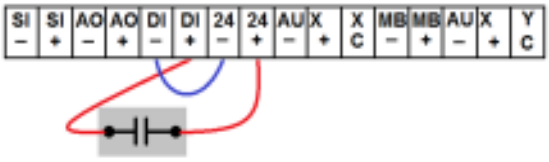


A pull up resistor may be needed on some paddle wheels, such as the Sigma FP-3000. A 1K ohm Resistor will pull DI+ up to about 12V. When the pulse is active, DI+ will be pulled down to about OV. (Power should be fused)

Typical 3 wire flow meter.

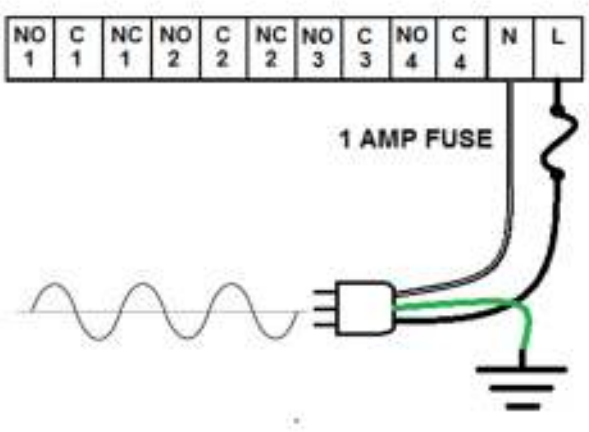


Any powered pulse signal. 5-24VDC.

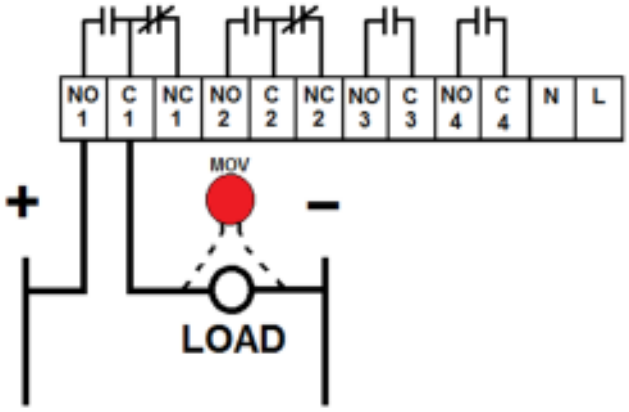


Pulsing dry contact. (Power should be fused)

POWER CONNECTIONS



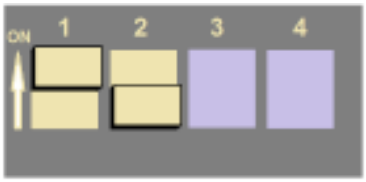
Supply power 85-305 VAC 50-60Hz.



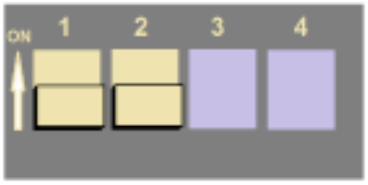
Connecting a load. 5 Amp maximum.

It is recommended to use a properly sized MOV. (Metal Oxide Varistor) When connecting to inductive loads such as relay coils or solenoid valve. Available upon request. Must specify coil voltage.

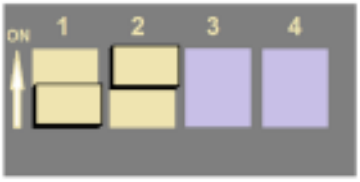
DIP SWITCHES



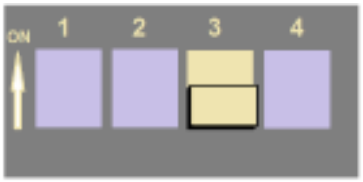
4-20mA input (Default)



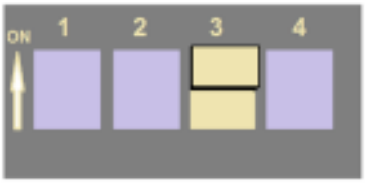
0-5 volt input



0-10 volt input



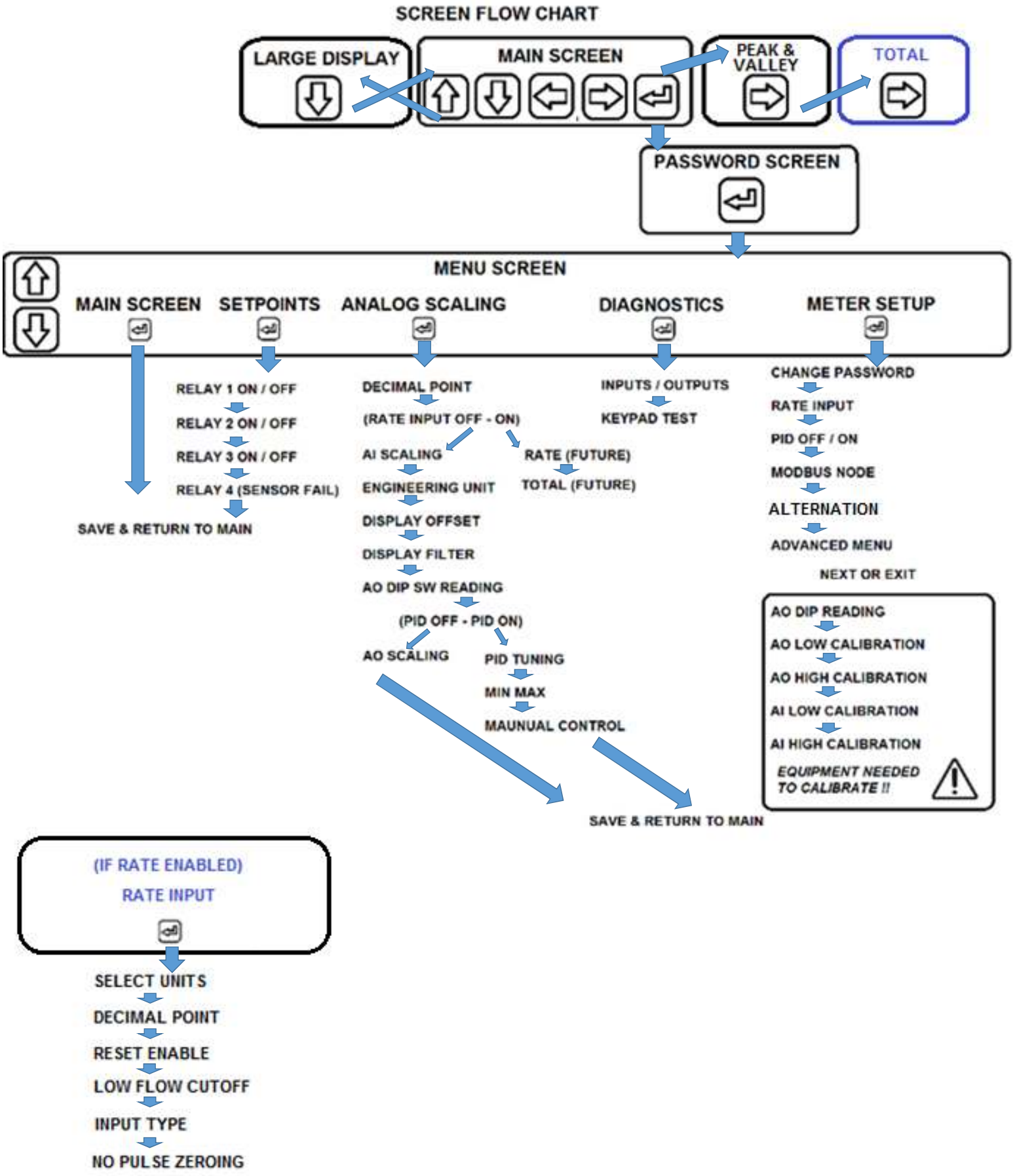
4-20mA output (Default)



0-10 volt output.

Dip Switch 4 is for future use.

PROGRAMING


SCREEN FLOW CHART
LARGE DISPLAY
MAIN SCREEN
PEAK & VALLEY
TOTAL
PASSWORD SCREEN
MENU SCREEN
MAIN SCREEN
SETPOINTS
ANALOG SCALING
DIAGNOSTICS
METER SETUP
RELAY 1 ON / OFF
RELAY 2 ON / OFF
RELAY 3 ON / OFF
RELAY 4 (SENSOR FAIL)
SAVE & RETURN TO MAIN
DECIMAL POINT
(RATE INPUT OFF - ON)
AI SCALING
RATE (FUTURE)
ENGINEERING UNIT
TOTAL (FUTURE)
DISPLAY OFFSET
DISPLAY FILTER
AO DIP SW READING
(PID OFF - PID ON)
AO SCALING
PID TUNING
MIN MAX
MAUNUAL CONTROL
INPUTS / OUTPUTS
KEYPAD TEST
CHANGE PASSWORD
RATE INPUT
PID OFF / ON
MODBUS NODE
ALTERNATION
ADVANCED MENU
NEXT OR EXIT
AO DIP READING
AO LOW CALIBRATION
AO HIGH CALIBRATION
AI LOW CALIBRATION
AI HIGH CALIBRATION
EQUIPMENT NEEDED TO CALIBRATE !!
SAVE & RETURN TO MAIN
(IF RATE ENABLED)
RATE INPUT
SELECT UNITS
DECIMAL POINT
RESET ENABLE
LOW FLOW CUTOFF
INPUT TYPE
NO PULSE ZEROING

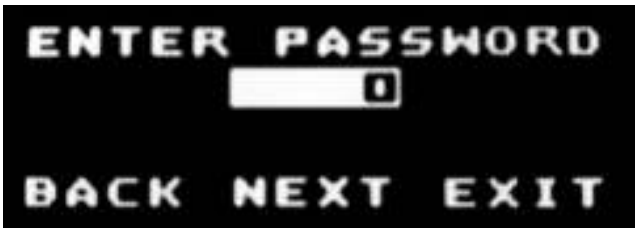
MAIN SCREEN AND NAVIGATION

This is the screen that is displayed at the end of the power up sequence. The main process value is displayed with large numerals in the center of the screen. The engineering unit is displayed below the main process. On the far right a bar graph representing the range of the analog input. A heart symbol is shown beating, indicating a healthy processor.
The relays are represented next to the bar graph they are highlighted when the relay is energized.

KEYS
The up and down keys are used to increase or decrease in value. To speed up the increase or decrease of a value, push the left key while holding up or down. Each push will increase the rate of change by a factor of 10. The up key might switch an off/on value to on while the down key will switch it to off. These keys are also used to scroll a menu list up and down. The right and left keys are used to move the cursor around the screen. Letting you select Back -Next - Exit
The enter key executes the cursor selection. Usually navigating to another screen.

Pressing the Up key from the main screen will display the process value only. This large display allows the value to be seen from a distance.
Press the down key to return to the main screen.
Pressing the enter key from the main menu brings you to the password screen.

Password Screen and Navigation (BACK-NEXT-EXIT)



The default password is zero. Usually one would push enter at this point to go to the menu screen.

BACK
Use the right and left keys to move the cursor. Selecting back and pushing enter will navigate you to the previous screen.

NEXT
Use the right and left keys to move the cursor. Selecting next and pushing enter will navigate you to the next screen.

EXIT
Selecting exit and pushing enter will navigate you to the main screen. Whenever this is done, all of the settings are stored in memory.

Main menu
This menu scrolls up and down with the up-and-down keys. Much like the wheel on the TV show The Price is Right you can spin through the menu selections. The center highlighted item is the selected cursor item. Pushing enter will navigate you to your selection.

Analog scaling
This branch of the menu tree allows you to scale the analog input, assign a decimal point position, engineering unit, and analog output. If the PID option is selected its parameters can be adjusted here also.

Meter setup
Optional and advanced functions can be selected here.

Diagnostics
Various inputs and outputs are displayed to aid in troubleshooting. It is often helpful to confirm that an input is being read by the processor to troubleshoot a connection problem.

Main screen
Returns you to the main screen.

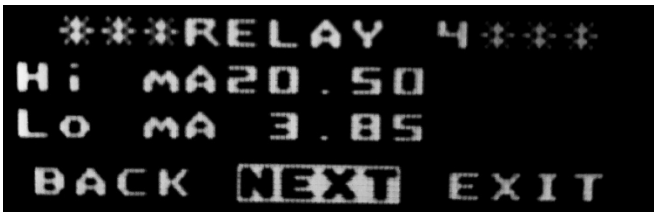
Setpoints screen
Sets Relay on and off points.

Whenever returning to the main screen, all of the settings will be saved.

Setpoints screen

Set - The point at which the relay energizes.
Reset - The point at which the relay D energizes.
The set and reset points are compared to each other to assign whether the action is a rising or falling type of function.

When the set is greater than the reset, it is used as a high alarm or a pump down application.
When the set is less than the reset, it is used as a low alarm or a pump up application.



Relay 4 can be assigned in the meter set up screen to be used as a sensor failure alarm. The point at which the alarm will call can be set in place of the set and reset functions.
When the analog input is outside of these boundaries the relay will energize and the screen will flash off and on to indicate that the meter is no longer getting a useful signal.

When rate mode is enabled relays 1 & 2 are for rate, 3 & 4 are for total. (Version 1.4 and above)

ANALOG SCALING

The first screen of the analog scaling menu tree gives you an indication of the DIP switch settings. This negates the need to open the unit to check the dip switches. You cannot change the dip settings from the screen, however if you were to change them you would see your new selection indicated here.
The linearizer can be selected for use here also. See linearizer section for details.
Select next and press enter.

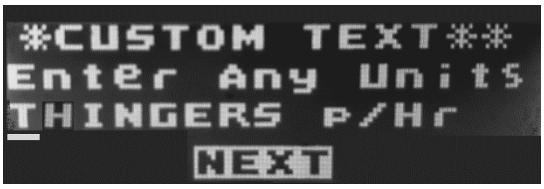
The decimal point selected here will be assigned to many of the values used subsequently.
4.1 indicates that there are five numerals to the left of the setpoint and one number to the right. It is not a value of 4.1.

Move the cursor to the numeral to the right of the decimal point and use the up-and-down keys to select the decimal point position. A zero will result in a whole number
Move cursor to next and push enter.

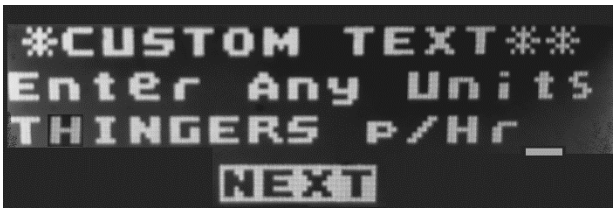
The input scale screen molds the milliamp or voltage analog input into a desired display value. The four points needed to scale are displayed at the same time to show the linear relationship. All four values can be adjusted by moving the cursor to select.

Use the up and down keys to scroll through a list of pre-defined engineering units. One of the selections is called user defined. To create your own custom display text, push enter while user defined is displayed.

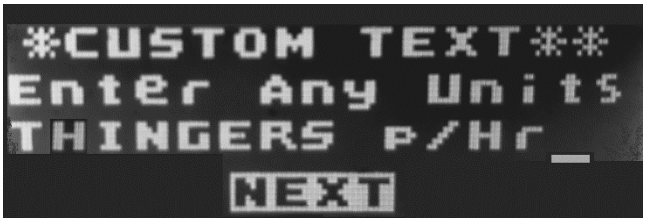
Custom text screen



On the screen the cursor is indicated as an underline below the character to be changed. Using the E will allow you to move through the alphabet towards the letter a. Using the down key will move you towards the letter Z.
Use the right and left keys to move the cursor to the next character.
A blank character is selectable that will erase all of the characters to the right of it.



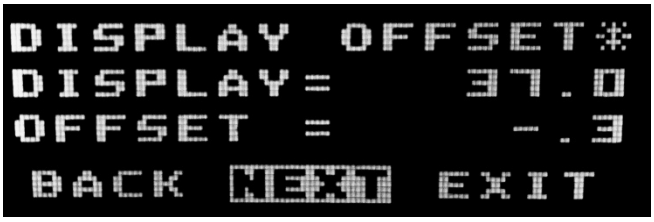
When satisfied with your custom text, move the cursor all the way to the right.



Eventually a next cursor will appear allowing you to exit to the next screen.

Display offset

This adjustment allows you to tweak the displayed value to compensate for any reason. Sometimes it is desired to show and offset because of a raise the tank, or a sensor that is not at the bottom of the tank.
The upper value is what will be displayed on the main screen. The lower value is the offset. This can be positive or negative.



For instance, maybe we want the displayed value to be an even 37.0.

Move the cursor to the offset value. Entering a value of -.3, evens the display out at 37.0.

Display filter

Display filter
This can be described as a change limiter. It will only allow the value to change by a unit of one, at a timed interval.
A setting of zero has no effect on the displayed value. A setting of 10 will severely slow the rate of change after the analog input has changed.

Analog output scaling

The analog output can be a linear relationship between the display value and the analog output or it can be a PID Control, this is selected in the meter setup screen.
The default is for a linear analog output.
The first screen shows the position of the DIP switch selecting voltage or current output.
Move the cursor to next and press enter.

Four values are used to create the linear relationship between the display value and the analog output. These can be selected by moving the cursor and adjusting the value.

PID control screens

PID tuning screen
The screen is intended to be very busy. It shows many values on the same screen to allow for PID tuning in real time.
When the screen first appears the top line indicates that the display value is on the left and it is compared to the set point value on the right.

A display value of 55.9 is compared to a set period of 50. The difference between them equals the error shown in percentage.

That difference is multiplied by the gain value.

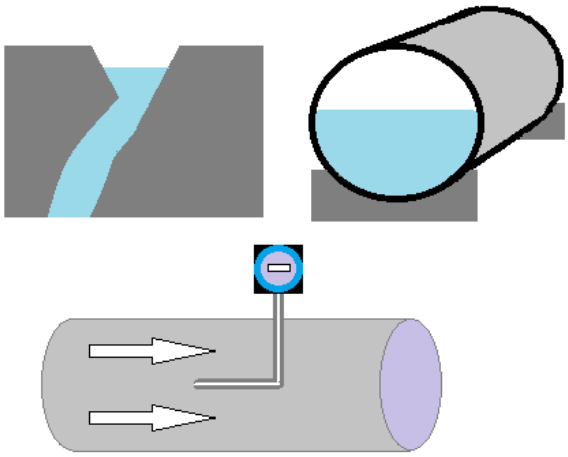
The product of that multiplication is applied in a percentage value to the analog output in a timed fashion. The integral setting is a time out parameter. Setting a longer time out slows the application of change to the analog output.

PID manual control screen
To put the PID control into manual, move the cursor to auto and push the down key. Then move the cursor to the percentage value. Use the up-and-down keys to change the output.

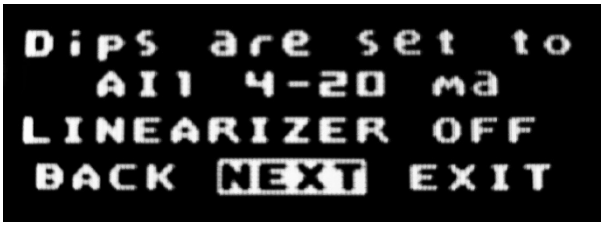
PID Min and Max screen
Sets the floor and ceiling of the PID analog output. A minimum setting maybe used to set the slowest speed of a motor.

The maximum setting might be used to limit how far a valve can open.

Linearizer

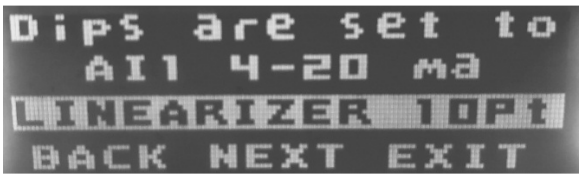


The linearizer is useful in applications where the analog signal needs to represent a round wall tank, weir or square root flow signal from a pitot tube.
Calculations must be made before entering the values. We must know the milliamp value of the sensor compared to the desired display value at different points throughout the 4 to 20 mA range. The linearizer will draw a linear line in between each of these points so many points are needed to create a rounded line. Move the cursor and use the up key to turn the linear riser on. Move the cursor to next and push enter.



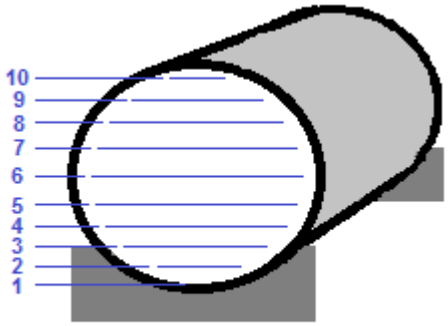
When the linearizer is selected to off, we are actually using a two point Linearizer. Up to 20 points can be used to mold the analog input to a non-linear display value.

Hint: Scale the input to the range of the sensor before turning the linearizer on. This will automatically distribute the display values and minimize setup time.



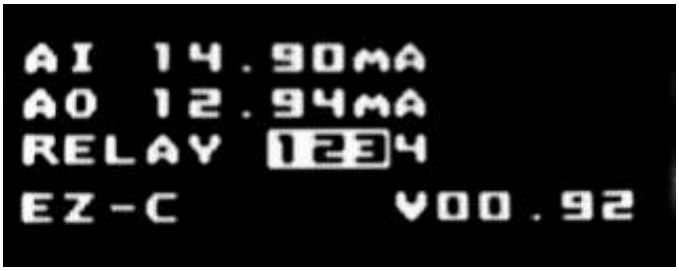
Select how many points are to be used.

The points or comparators are displayed one screen at a time. Each comparator consists of an analog value on the left and the display value on the right.



In this example, we are using 10 points.
The Comparator 1 screen would be set to 4.00mA = 0.0 gallons.
The Comparator 2 screen might be set to 4.90mA = 4.3 gallons.
The Comparator 3 screen might be set to 6.20mA = 12.2 gallons.
And so on.
The Comparator 10 screen must be set to 20.00mA = XXX.X to give the table an upper limit.

DIAGNOSTICS



The diagnostic screen is helpful for troubleshooting connection issues. Knowing what the processor is seeing and doing helps narrow down the cause of the problem. The analog input and output are displayed in their scaled milliamp or voltage reading. A block appears over the relay number to indicate which relays are being called by the processor. Relays 1, 2, and 3 are on in the pic above. Model and version number are shown at the bottom.

The next diagnostic screen shows the pushbuttons to troubleshoot the keypad. The DIP switches are read and shown. A block on the number indicates an ON state.

METER SETUP

The default password is 0. The password can be changed to a number 0-9999. MAKE NOTE OF THE NEW PASSWORD.

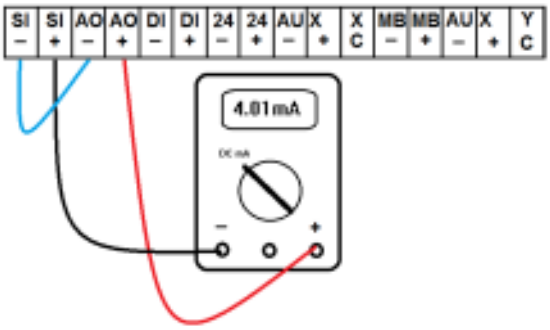
The analog output is a linear representation of the display value when disabled. When enabled, the output will act as a setpoint driven control.

If more than one slave device is on a Modbus® network, they must be given unique ID or node numbers. After changing the node, select exit to save, then cycle the power to adopt the new address.

Note: Not adjustable in V1.0 fixed at 5

The advanced configuration is for qualified personnel with the proper equipment. It is strongly advised to avoid these screens. Simply viewing these screens could render the meter inoperable, without the proper equipment. Therefor the user is encouraged to exit. Select next if you have read the following and are prepared with the proper equipment.

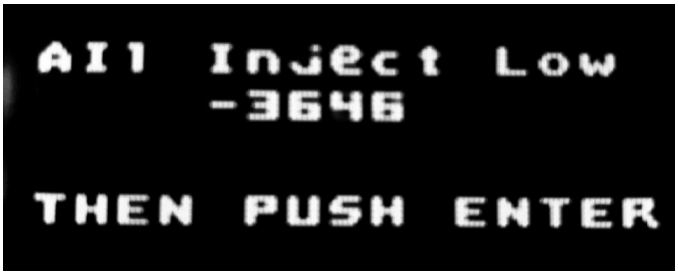
Again the user is encouraged to exit. The DIP settings are shown to ensure the proper calibration is performed. If you must change the factory set calibration, move the cursor to CALIBRATE and push enter.



If you are using the default settings of 4-20mA input and output, the EZ-C can be calibrated without a milliamp simulator. A simple digital volt meter (DVM) can be used. The wiring above shows the analog output being routed through a DVM set to read DC milliamps. The output is calibrated first, then used as a milliamp source, to calibrate the input.

Adjust the up and down keys until the DVM reads 4.00mA then push enter.

Adjust the up and down keys until the DVM reads 20.00mA then push enter.



A milliamp source must be used to calibrate the input. Failure to do so will render the unit inoperable. If you wish to exit without making changes. Power down the EZ-C.
Using a simulator or the analog output as shown in the diagram, inject 4.00mA into the input (S+ & S-) (The up & down keys control the analog output to negate the need for a simulator) Pushing enter will load this reading and move to the next screen.

Inject 20.00mA. Push enter to save the new calibration.
If there were any errors or doubt in calibration, the unit can be powered down before saving.

Note: The values on the calibration screens are for internal factory use. They can be ignored. They are not in any voltage or amperage units.

RATE INPUT (V 1.4 and above)

The rate input is used primarily for water flow applications. The input can be from the 4-20ma input or from a pulse generated on the digital input.

Pulse rate input can be from any voltage between 1 - 24VDC. The rate is generated by measuring the time between pulses. Pulses as fast as 100 per second or as slow as one every ten seconds, can be used to generate a flow rate. Since we have such a wide range, a zeroing timer can be used to set the rate to zero instead of waiting for the next pulse.

A totalizer is also invoked when rate is enabled. It is viewable by using the right key from the main screen, then selecting next from the peak and valley screen. It can be zeroed out by pushing the down button from the totalizer screen. This reset function must be enabled in the rate menu.

When rate mode is enabled relays 1 & 2 are for rate, 3 & 4 are for total.

Note: The linearizer and the pulse rate functions cannot be used simultaneously. 4-20ma rate and the linearizer can be active at the same time for flume applications.

MAIN SCREEN

If Pulse Rate is enabled, a circle with a blinking center will be on the main screen. It is filled when the digital input is energized. Refer to previous description or the flow chart to navigate to the totalizer screen.

Use the up and down keys to select Gallons or Liters to be displayed on the main screen.

Move the cursor to the numeral to the right of the decimal point and use the up-and-down keys to select the decimal point position. A zero will result in a whole number

Move cursor to next and push enter.

The totalized value can be set to zero if this is enabled. Go to the Totalizer screen and push the down key to do so.

The rate value must be greater than this value otherwise the rate will be set to zero. This is helpful when a flow meter is out of calibration and you do not want to totalize a .1GPM flow when there is no flow.

Choose Pulse or 4-20ma flow sensor input.

(Pulse mode only) Each pulse represents some amount of liquid, either in gallons or liters. This is not the same as a K factor. If you only know the K factor of your pulse flow sensor use this formula; 1 divided by KF = units per pulse.

(Pulse mode only) We measure the gap between pulses. We have no way to tell which pulse was the last pulse, so we hold the last rate. If no pulse is received in X seconds, the rate value will be set to zero.
If you have a sensor that normally gives 10 pulses per second, you might set this value to 1 second.
If you have a sensor that normally gives 1 pulse per 7 seconds, you might set this value to 14 seconds.

Relays 1 and 2 can alternate when both relays are off. When the Relay 1 setpoint is reached, Relay 2 will come on. When the Relay 2 setpoint is reached Relay 1 will come on. When both are off again, it will alternate back to normal.
Selections include:
OFF = No Alternation
AUTO = Functions as described above
FORCE RELAY 1 = Force Normal Operation 1 First
FORCE RELAY 2 = Force Relay 2 to Lead Position

REVISION HISTORY

V1.0 – (06/07/2018) Launch, No expansion PCB capabilities. mA and volt input and output.
V1.1 – (06/18/2018) Modbus Node Adjustment.
V1.2 – Not Released
V1.3 – (09/16/2018) Linearizer
V1.4 – (12/01/2018) Rate / Totalizer
V1.41 – (1/24/19) Fix custom text.
V1.50- Watchdog Reset
V1.55 – Decimal Point in V mode
V1.60 - Alternation

MODBUS®

The EZ-C uses a high resolution analog input. The resolution is greater than the typical limits of a single Modbus word. Double words are used for the most used values. Depending on the master, these words may need to be reversed for a correct reading.

WARNING: SETTING VALUES OUT OF LIMITS OR WRITING TO ADDRESSES NOT MENTIONED HERE CAN CAUSE ERRATIC OPERATION. WRITING TO THESE VALUES SHOULD ONLY BE DONE BY QUALIFIED PERSONNEL, WITH CAUTION. IT IS RECOMMENDED TO POLL THESE PARAMETERS IN READ ONLY MODE.

LONG WORDS

40001-40002 MAIN PROCESS DISPLAY
40003-40004 RELAY 1 SETPOINT
40005-40006 RELAY 1 RE-SETPOINT
40007-40008 RELAY 2 SETPOINT
40009-40010 RELAY 2 RE-SETPOINT
40011-40012 RELAY 3 SETPOINT
40013-40014 RELAY 3 RE-SETPOINT
40015-40016 RELAY 4 SETPOINT
40017-40018 RELAY 4 RE-SETPOINT
40041-40042 PID OUTPUT % XXX.XX
40077-40078 PID SETPOINT

BITS (COILS)

00001 RELAY 1
00002 RELAY 2
00003 RELAY 3
00004 RELAY 4
00005 SENSOR FAIL

COMMUNICATION SETTINGS

SLAVE ONLY
19200 BAUD [FIXED]
8 DATA BITS [FIXED]
1 STOP BIT [FIXED]
NO PARITY [FIXED]
MODBUS ID (NODE) IS SET TO 4 AT THE FACTORY. IT IS SELECTABLE FROM THE SETUP MENU

Sigma Controls, Inc.
PROCESS CONTROLS AND INSTRUMENTATION

WARRANTY

All Sigma Controls, Inc. products are warranted to be free from defective materials and workmanship for one (1) year from date of shipment. Sigma reserves the right to repair or replace at its option any product found to be defective. In no event shall Sigma Controls, Inc. be liable for any consequential, incidental, or special damages and the limit of its liability shall not exceed the purchase price of the supplied equipment.

*******IMPORTANT*******

SENSORS AND CABLE THAT HAVE BEEN USED IN WASTE WATER OR HAZARDOUS LIQUIDS MUST BE THOROUGHLY CLEANED BEFORE RETURNING. UNITS RETURNED UNCLEANED WILL BE CONSIDERED UNREPAIRABLE AND RETURNED TO SENDER OR DISCARDED. NOTE: DO NOT SUBMERGE UNITS FOR CLEANING WITH CABLE CUT OR REMOVED. THIS WILL ALLOW CLEANING FLUID TO ENTER HOUSING, DAMAGING ELECTRONICS AND VOIDING THE WARRANTY.

RETURN FOR REPAIR POLICY (WARRANTY/NON-WARRANTY REPAIR)

Return status can be determined upon factory inspection of returned equipment.

A completed Return Authorization form must accompany all items returned for repair.

Repairs will be evaluated as quickly as possible. Cost for non-warranty repairs will be provided before repairs are initiated and repairs will be completed only after approval by customer.

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