DISP-PAXDP

1/8 DIN DUAL PROCESS INPUT PANEL METER

CE

Rev.	Date	Reason
1.	25/04/2014	Optional cards added and minor corrections

1. INTRODUCTION

- Accepts two 4-20mA or 0-10VDC input signals
- Programmable A/D conversion rate, 5 to 105 readings per second
- Optional custom units overlay w/ backlight
- 16 point scaling for non-linear correction
- 9 digit totalizer (integrator) with batching
- Programmable function keys/user inputs
- Four setpoint alarm outputs (w/plug-in card)
- Communication and bus capabilities (w/plug-in card)
- Analog output signal (w/plug-in card)
- Pc software available for meter configuration
- Nema 4x/IP65 sealed front bezel

2. GENERAL DESCRIPTION

The DISP-PAXDP Dual Process Input Meter offers many features and performance capabilities to suit a wide range of industrial applications. Available in two models, AC or DC power, the meter has the capability to accept two, 4 to 20 mA or 0 to 10 VDC input signals. Each input signal can be independently scaled and displayed. In addition, a math function can be performed on the two signals, C + A + B, C - A - B, C + A - B, AB / C, CA / B, or C (A / B - 1). Any of the three meter values can have Alarms, Comms, and/or a Retransmitted Analog Output capability by simply adding optional cards. The optional plug-in output cards allow the opportunity to configure the meter for current applications, while providing easy upgrades for future needs.

The update rate of the meter is user selectable. This will help in those applications where a quick response from the meter is of the utmost importance. The rate can be adjusted from eight selections with a minimum of 5 updates/second to a maximum of 105 updates/second.

The meter employs a bright 0.56" (14,2mm) LED display. The unit is available with a red sunlight readable LED. The intensity of display can be adjusted from dark room applications up to sunlight readable, making it ideal for viewing in bright light applications.

The meter provides a Max and Min reading memory with programmable capture time. The capture time is used to prevent detection of false max and min readings which may occur during burst testing or unusual process events.

The signal totalizer (integrator) can be used to compute a time-input product. This can be used to provide a readout of totalized flow, calculate service intervals of motors and pumps, etc. The totalizer can also accumulate batch weighing operations.

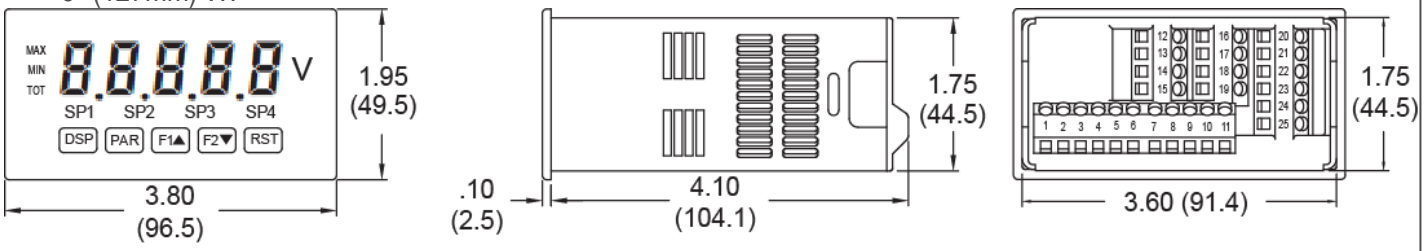
The meter has four setpoint outputs, implemented on Plug-in option cards. The Plug-in cards provide dual FORM-C relays (5A), quad FORM-A (3A), or either quad sinking or quad sourcing open collector logic outputs. The setpoint alarms can be configured to suit a variety of control and alarm requirements.

Communication and Bus Capabilities are also available as option cards. These include RS232, RS485, Modbus, DeviceNet, Profibus-DP and USB. Readout values and setpoint alarm values can be controlled through the bus. Additionally, the meter has a feature that allows a remote computer to directly control the

outputs of the meter. With an RS232, RS485 or USB card installed, it is possible to configure the meter using Windows.
A linear DC output signal is available as an optional Plug-in card. The card provides either 20 mA or 10 V signals. The output can be scaled independent of the input range and can track either the input, totalizer, max or min readings.
Once the meter has been initially configured, the parameter list may be locked out from further modification in its entirety or only the setpoint values can be made accessible.
The meters have been specifically designed for harsh industrial environments. With NEMA 4X/IP65 sealed bezel and extensive testing of noise effects to CE requirements, the meter provides a tough yet reliable application solution.

2.1. Dimensions in inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4mm) H x 5" (127mm) W.



CAUTION: Read complete instructions prior to installation and operation of the unit.
CAUTION: Risk of electric shock.

2.2. Safety Summary

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so can be potentially harmful to persons or equipment in the event of a fault to the unit.

3. SPECIFICATIONS

3.1. Display

5 digit, 0.56" (14.2 mm) red sunlight readable LEDs, (-19999 to 99999)

3.2. Power

AC Versions (DISP-PAXDP): AC Power: 85 to 250VAC, 50/60Hz, 21VA
Isolation: 2300 Vrms for 1 min. to all inputs and outputs.
DC Versions (DISP-PAXDP24): DC Power: 18 to 36VDC, 13W (Derate operating temperature to 40°C if operating <15VDC and three plug-in cards are installed)
AC Power: 24VAC, ±10%, 50/60Hz, 16VA
Isolation: 500Vrms for 1 min. to all inputs and outputs (50V working).
Must use a Class 2 or SELV rated power supply.

3.3. Annunciators

A - Programmable Display
B - Programmable Display
C - Programmable Display
SP1 - Setpoint alarm 1 is active
SP2 - Setpoint alarm 2 is active
SP3 - Setpoint alarm 3 is active
SP4 - Setpoint alarm 4 is active
Units Label - Optional units label backlight

3.4. Keypad

3 programmable multi-function keys, 5 keys total

3.5. A/d converter

16 bit resolution

3.6. Update rates

A/D conversion rate: Adjustable 5.3 to 105 readings/sec.
Step response: (to within 99% of final readout value with digital filter disabled)

Input update rate	Max. time (msec)
5.3	770
7.5	560
16.7	260
19.8	220
20	220
30	150
105	60

Display update rate: adjustable 1 to 20 readings/sec.
Setpoint output on/off delay time: 0 to 3275 sec.
Analog output update rate: 0 to 10 sec
Max./Min. capture delay time: 0 to 3275 sec.

3.7. Display messages

"OLOL" - Appears when measurement exceeds +signal range
"ULUL" - Appears when measurement exceeds - signal range
". . . ." - Appears when display values exceed + display range
"- . . ." - Appears when display values exceed - display range

3.8. Input ranges

Input Range	Accuracy [1] (18 to 28°C)	Accuracy[1] (0 to 50°C)	Impedance/ compliance	Max continuous overload	Resolution
±20mA (-26 to 26mA)	0.03% of reading +2µA	0.12% of reading +3µA	24.6Ω	90mA	1µA
±10VDC (-13 to 13VDC)	0.03% of reading +2mV	0.12% of reading +3mV	500kΩ	50V	1mV

3.9. Excitation power

Transmitter Power: 18VDC, ±20%, unregulated, 70mA max. per input channel.

3.10. Low frequency noise rejection

Normal Mode: (digital filter off)

Input update rate	50Hz ±1Hz	60Hz ±1Hz
5.3	>90dB	>65dB
7.5	>60dB	>55dB
16.7	>100dB	>50dB
19.8[2]	>60dB	>95dB
20	>55dB	>100dB
30	>20dB	>20dB
105	>20dB	>13dB

Common Mode: >100dB @50/60 ±1Hz (19.8 or 20 Input Rate)

3.11. User inputs (logic level)

Two programmable user inputs.
Max. Continuous Input: 30VDC
Isolation to Sensor Input A Common: 500Vrms for 1min; working voltage: 50V
Isolation to Sensor Input B Common: Not isolated.

Input state	Sinking inputs 22 kΩ pull-up to +5 V	Sourcing inputs 22 kΩ pull-down
Active	V_{IN} < 0.9 VDC	V_{IN} > 3.6 VDC
Inactive	V_{IN} > 3.6 VDC	V_{IN} < 0.9 VDC

Response Time: 20msec. max.
Logic State: Jumper selectable for sink/source logic

3.12. Totalizer

Time Base: second, minute, hour or day
Time Accuracy: 0.01% typical
Decimal Point: 0 to 0.0000
Scale Factor: 0.001 to 65.000
Low Signal Cut-out: -19,999 to 99,999
Total: 9 digits, display alternates between high order and low order readouts

3.13. Custom linearization

Data Point Pairs: Selectable from 2 to 16
Display Range: -19,999 to 99,999
Decimal Point: 0 to 0.0000

3.14. Memory

Nonvolatile EEPROM retains all programmable parameters and display values.

[1] After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 10 to 75% RH environment; and accuracy over a 0 to 50°C and 0 to 85%RH (non-condensing environment). Accuracy over the 0 to 50°C range includes the temperature coefficient effect of the meter.

[2] Note: 19.8 Hz Input Rate provides best rate performance and simultaneous 50/60 Hz rejection.

3.15. Certifications and compliances

UL Recognized Component, File #E179259, UL61010A-1, CSA C22.2 No. 61010-1

Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.

UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95

LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards

Type 4X Enclosure rating (Face only), UL50

IECEE CB Scheme Test Certificate #US/8843A/UL

CB Scheme Test Report #04ME11209-20041018 Issued by Underwriters Laboratories, Inc.

IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

IP65 Enclosure rating (Face only), IEC 529

IP20 Enclosure rating (Rear of unit), IEC 529

3.16. Electromagnetic compatibility

Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

Immunity to industrial locations

Electrostatic discharge	EN 61000-4-2	Criterion A 4kV contact discharge 8kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A 10V/m (80MHz to 1GHz)
Fast transients (burst)	EN 61000-4-4	Criterion A 2kV power 1kV signal
Surge	EN 61000-4-5	Criterion A 1kV L-L 2kV L&N-E power
Voltage dip/interruptions	EN61000-4-11	Criterion A 0.5 cycle
RF conducted interference	EN 61000-4-6	Criterion A 3Vrms

Emissions

AC powered	EN 55011	Class B
DC powered	EN 55011	Class A

Criterion A: Normal operation within specified limits.

Criterion B: Temporary loss of performance from which the unit self recovers.

Refer to EMC Installation Guidelines section of the bulletin for additional information.

3.17. Environmental conditions

Operating Temperature Range: 0 to 50°C (0 to 45°C with all three plug-in cards installed)

Storage Temperature Range: -40 to 60°C

Operating and Storage Humidity: 0 to 85% max. RH non-condensing

Altitude: Up to 2000 meters

3.18. Connections

High compression cage-clamp terminal block

Wire Strip Length: 0.3" (7.5mm)

Wire Gage: 30-14 AWG copper wire

Torque: 4.5 inch-lbs (0.51 N-m) max.

3.19. Construction

This unit is rated for NEMA 4X/IP65 outdoor use. IP20 Touch safe. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Synthetic rubber keypad. Panel gasket and mounting clip included.

3.20. Weight

10.4 oz. (295 g)

4. ORDERING INFORMATION

TYPE	MODEL NO.	DESCRIPTION	PART NUMBER
Meter	DISP-PAXDP	Universal DC Input Panel Meter, Upgradeable, 85…280VAC Powered	DISP-PAXDP
		Universal DC Input Panel Meter, Upgradeable, 10…30VDC/24VAC Powered	DISP-PAXDP24
Optional Plug-in Cards	CARD-CDS	Dual Setpoint Relay Output Card	CARD-CDS-10
		Quad Setpoint Relay Output Card	CARD-CDS-20
		Quad Setpoint Sinking Open Collector Output Card	CARD-CDS-30
		Quad Setpoint Sourcing Open Collector Output Card	CARD-CDS-40
	CARD-CDC	RS485 Serial Communications Card	CARD-CDC-10
		RS232 Serial Communications Card	CARD-CDC-20
		DeviceNet Communications Card	CARD-CDC-30
		MODBUS Communications Card	CARD-CDC-40
		Profibus-DP Communications Card	CARD-CDC-50
	CARD-PAX-USB	USB Communications Card	CARD-PAX-USB
	CARD-CDL	Analog Output Card	CARD-CDL-10

5. ADDING OPTION CARDS

The DISP-PAXDP meters can be fitted with up to three optional plugin cards. The details for each plug-in card can be reviewed in the specification section below. Only one card from each function type can be installed at one time.
The function types include Setpoint Alarms (CARD-CDS), Communications (CARD-CDC), and Analog Output (CARD-CDL). The plug-in cards can be installed initially or at a later date.

5.1. Communication cards (CARD-CDC)

A variety of communication protocols are available for the DISP-PAXDP. Only one of these cards can be installed at a time. When programming the unit the RS232, RS485, or USB Cards must be used.

CARD-CDC10 - RS485 Serial
CARD-CDC20 - RS232 Serial
CARD-CDC30 - DeviceNet
CARD-CDC40 - Modbus
CARD-CDC50 - Profibus-DP
CARD-PAX-USB - USB (Mini B)

5.1.1. Serial communications card

Type: RS485 or RS232
Data: 7/8 bits
Baud: 300 to 19,200
Parity: No, Odd or Even
Bus Address: Selectable 0 to 99, Max. 32 meters per line (RS485)
Transmit Delay: Selectable for 2 to 50msec or 50 to 100msec (RS485)

5.1.2. DeviceNet™ card

Compatibility: Group 2 Server Only, not UCMM capable
Baud rates: 125k, 250k, and 500k
Bus Interface: Phillips 82C250 or equivalent with MIS wiring protection per DeviceNet™ Volume I Section 10.2.2.
Node Isolation: Bus powered, isolated node

5.1.3. Modbus card

Type: RS485; RTU and ASCII MODBUS modes
Baud Rates: 300 to 38400.
Data: 7/8 bits
Parity: No, Odd, or Even
Addresses: 1 to 247.
Transmit Delay: Programmable; See Transmit Delay explanation.

5.1.4. Profibus-DP card

Fieldbus Type: Profibus-DP as per EN 50170, implemented with Siemens SPC3 ASIC
Conformance: PNO Certified Profibus-DP Slave Device
Baud Rates: Automatic baud rate detection in the range 9.6K to 12M
Station Address: 0 to 125, set by rotary switches.
Connection: 9-pin Female D-Sub connector

5.1.5. USB programming card

Type: USB Virtual Comms Port
Connection: Type mini B
Baud Rate: 300 to 19.2k
Unit Address: 0 to 99; only 1 meter can be configured at a time.

5.2. Setpoint cards (CARD-CDS)

The DISP-PAXDP has 4 available setpoint alarm output plug-in cards. Only one of these cards can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:

CARD-CDS10 - Dual Relay, FORM-C, Normally open & closed
CARD-CDS20 - Quad Relay, FORM-A, Normally open only
CARD-CDS30 - Isolated quad sinking NPN open collector
CARD-CDS40 - Isolated quad sourcing PNP open collector

5.2.1. Dual relay card

Type: Two FORM-C relays
Contact Rating:

- One Relay Energized: 5 amps @ 120/240VAC or 28VDC (resistive load), 1/8 HP @120VAC, inductive load.
- Total current with both relays energized not to exceed 5 amps

Life Expectancy: 100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads

5.2.2. Quad relay card

Type: Four FORM-A relays
Contact Rating:

- One Relay Energized: 3 amps @ 240VAC or 30VDC (resistive load), 1/10 HP @120VAC, inductive load.
- Total current with all four relays energized not to exceed 4 amps

Life Expectancy: 100K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads

5.2.3. Quad sinking open collector card

Type: Four isolated sinking NPN transistors.
Rating: 100mA max @VSAT = 0.7V max VMAX=30V

5.2.4. Quad sourcing open connector card

Type: Four isolated sourcing PNP transistors.
Rating: Internal supply: 24VDC ± 10%, 30mA max total
External supply: 30VDC max, 100mA max each output

5.2.5. All four setpoint card

Response Time:

- 200msec. max. to within 99% of final readout value (digital filter and internal zero correction disabled)
- 700msec. max. (digital filter disabled, internal zero correction enabled)

5.3. Linear DC output (CARD-CDL)

Either a 0(4)-20 mA or 0-10 V retransmitted linear DC output is available from the analog output plug-in card. The programmable output low and high scaling can be based on various display values. Reverse slope output is possible by reversing the scaling point positions.

CARD-CDL10 - Retransmitted Analog Output Card

5.3.1. Analog output card

Types: 0 to 20mA, 4 to 20mA or 0 to 10VDC
Accuracy: 0.17%FS (18 to 28°C); 0.4%FS (0 to 50 °C)
Resolution: 1/3500
Compliance:

- 10VDC: 10KΩ load min
- 20mA: 500Ω load max.

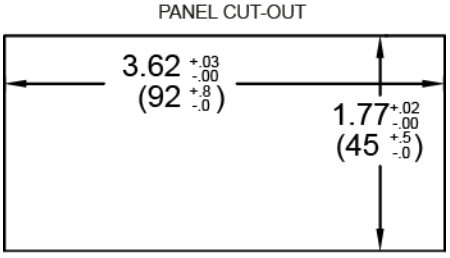
Update time:

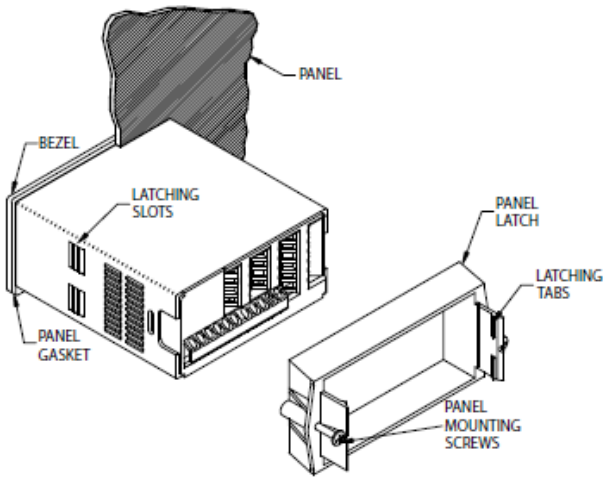
- 200msec. max to within 99% of final output value (digital filter and internal zero correction disabled)
- 700msec. max (digital filter disabled, internal zero correction enabled)

6. INSTALLING THE METER

6.1. Installation

The DISP-PAXDP meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.





While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel(Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

6.2. Installation Environment

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.
The bezel should be cleaned only with a soft cloth and neutral soap product. DO NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.
Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

7. SETTING THE JUMPERS

The meter has a jumper that must be set prior to applying power. The jumper is User Input Logic. The Jumper Selections Figure is an enlargement of the jumper area shown below. To access the jumper, remove the meter base from the meter case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start the other side latch.

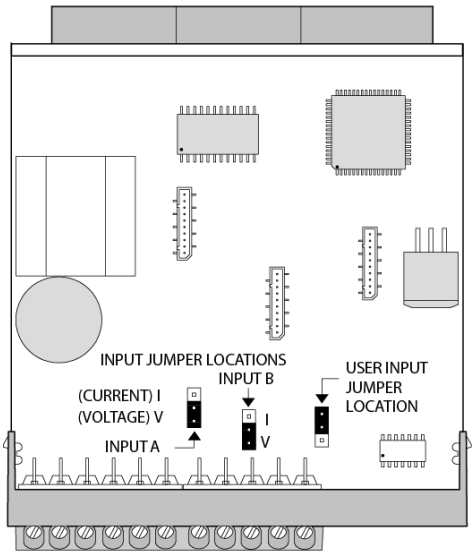
7.1. Input Jumpers

These jumpers are used to select the proper input types, Voltage (V) or Current (I). The input type selected in programming must match the jumper setting. See the Jumper Selection Figures for more details.

7.2. User Input Logic Jumper

One jumper is used for the logic state of all the user inputs. If the user inputs are not used, it is not necessary to check or move this jumper.

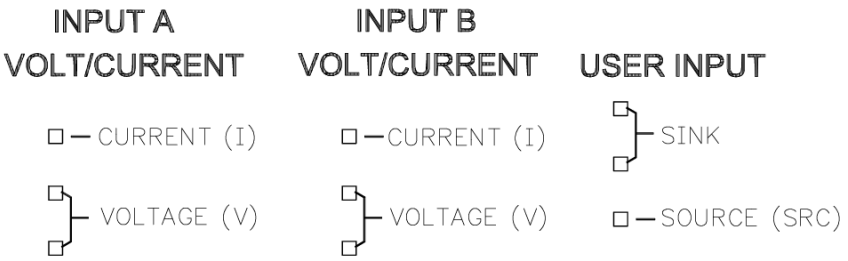
FRONT DISPLAY



REAR TERMINALS

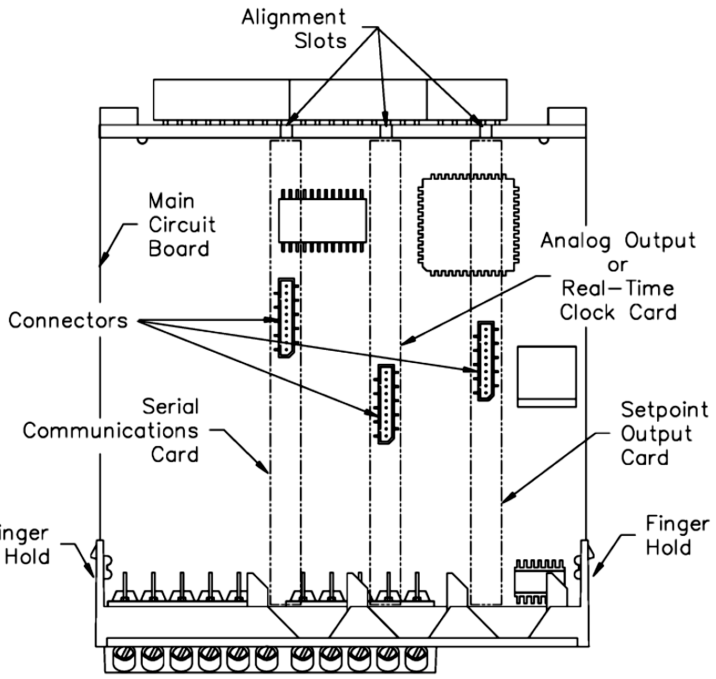
JUMPER SELECTIONS

The ⌒ indicates factory setting.



Note: In the figures above, the text shown in parenthesis is printed on the circuit board to help with proper jumper positioning.

8. INSTALLING AN OPTION CARD



Caution: The option and main circuit cards contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.

Warning: Exposed line voltage exists on the circuit boards. Remove all power to the meter AND load circuits before accessing the unit.

1. Remove the main assembly from the rear of the case. Squeeze the finger holds on the rear cover, or use a small screwdriver to depress the side latches to release it from the case. It is not necessary to separate the rear cover from the main circuit card.
2. Locate the option card connector for the serial communication card. Hold the unit by the rear cover, not the display board, when installing an option card.
3. Install the option card by aligning the option card with the slot in the rear cover. Be sure the connector is fully engaged and the tab on the option card rests in the alignment slot on the display board.
4. Slide the assembly back into the case. Be sure the rear cover latches fully into the case.

9. WIRING THE METER

9.1. Wiring overview

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder). Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm) wire, two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm).

9.2. EMC installation guidelines

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, its source or the method of coupling into the unit may be different for various installations. Listed below are some EMC guidelines for successful installation in an industrial environment.

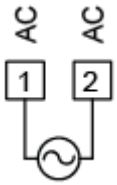
1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. With use of the lower input ranges or signal sources with high source impedance, the use of shielded cable may be necessary. This helps to guard against stray AC pick-up. Attach the shield to the input common of the meter.
3. To minimize potential noise problems, power the meter from the same power branch, or at least the same phase voltage as that of the signal source.
4. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
5. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
6. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   - Fair-Rite # 0443167251
   - Steward #28B2029-0A0
   - TDK # ZCAT3035-1330A

   Line Filters for input power cables:
   - Schaffner # FN610-1/07
   - Corcom #1VR3
   - Schaffner # FN670-1.8/07

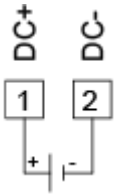
   Note: Reference manufacturer's instructions when installing a line filter.
7. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
8. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.

9.3. Power wiring

AC Power
Terminal 1 : VAC
Terminal 2 : VAC



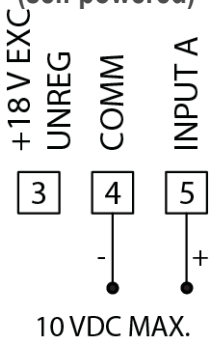
DC Power
Terminal 1 : +VDC
Terminal 2 : -VDC



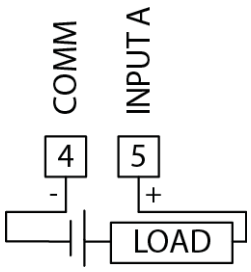
9.4. Input A signal wiring

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

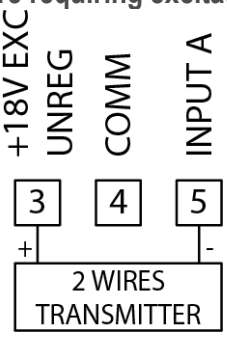
Voltage signal (self powered)



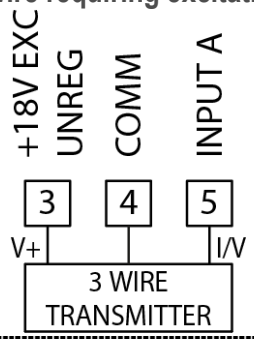
Current signal (self powered)



Current signal (2 wire requiring excitation)



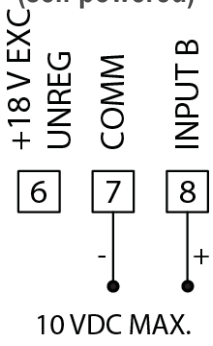
Current signal / Voltage signal (3 wire requiring excitation)



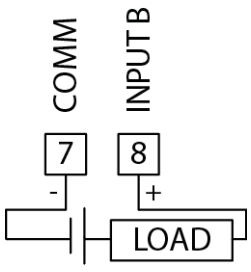
9.5. Input B signal wiring

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

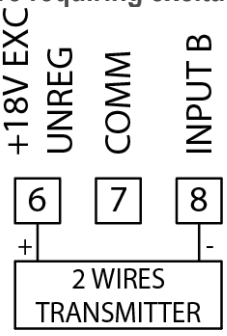
Voltage signal (self powered)



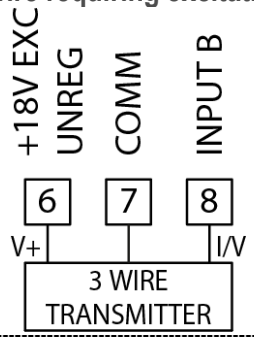
Current signal (self powered)



Current signal (2 wire requiring excitation)



Current signal / Voltage signal (3 wire requiring excitation)



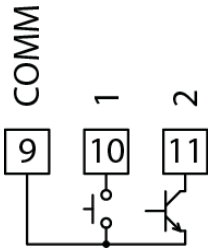
CAUTION: Sensor Input B common is NOT isolated from user input common. In order to preserve the safety of the meter application, the sensor input common must be suitably isolated from hazardous live earth referenced voltages; or input common must be at protective earth ground potential. If not, hazardous live voltage may be present at the User Inputs and User Input Common terminals. Appropriate considerations must then be given to the potential of the user input common with respect to earth common; and the common of the isolated plug-in cards with respect to input common.

9.6. User input wiring

Before connecting the wires, the User Input Logic Jumper should be verified for proper position. If not using User Inputs, then skip this section. Only the appropriate User Input terminal has to be wired.

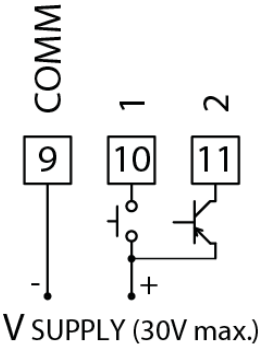
Sinking Logic

In this logic, the user inputs of the meter are internally pulled up to +5V with 22kΩ resistance.
The input is active when it is pulled low (<0.9V).

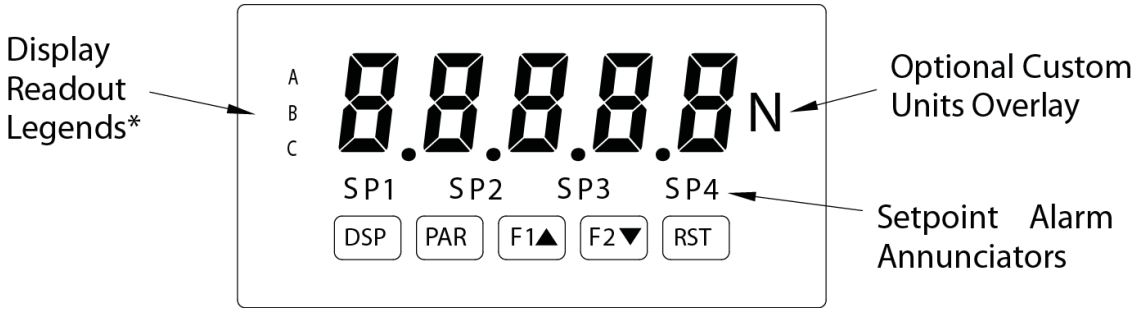


Sourcing Logic

In this logic, the user inputs of the meter are internally pulled down to 0V with 22kΩ resistance.
The input is active when a voltage greater than 3.6VDC is applied.



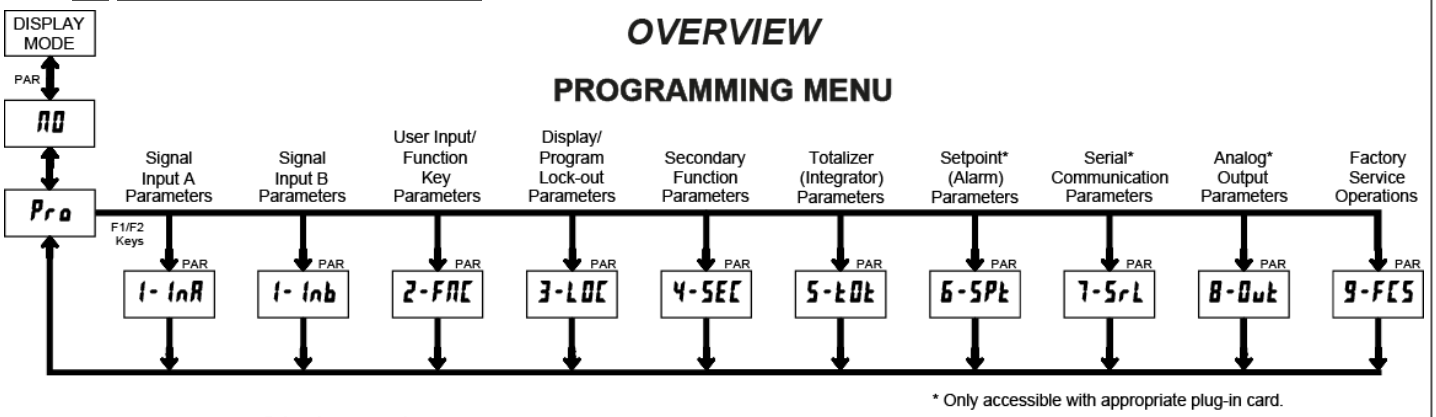
10. REVIEWING THE FRONT BUTTONS AND DISPLAY



KEY	DISPLAY MODE OPERATION	PROGRAMMING MODE OPERATION
DSP	Index display through main displays as programmed in 3-LOC	Quit programming and return to display mode
PAR	Access parameter list	Store selected parameter and index to next parameter
F1▲	Function key 1; hold for 3 seconds for Second Function 1**	Increment selected parameter value
F2▼	Function key 2; hold for 3 seconds for Second Function 2**	Decrement selected parameter value
RST	Reset (function key)**	Hold with F1▲ , F2▼ to scroll value by x1000

* Display Readout Legends may be locked out in Factory Settings.
** Factory setting for the F1, F2, and RST keys is NO mode.

11. PROGRAMMING THE METER



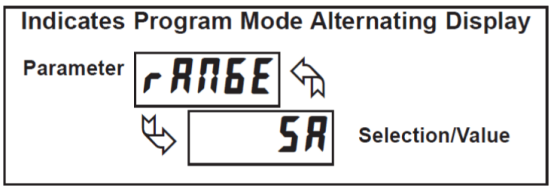
Display mode

The meter normally operates in the Display Mode. In this mode, the meter displays can be viewed consecutively by pressing the DSP key. The annunciators to the left of the display indicate which display is currently shown; A, B, or C. Each of these displays are programmable and can be locked from view through programming. (See Module 3.)

Programming tips

The Programming Menu is organized into nine modules (See above). These modules group together parameters that are related in function. It is recommended to begin programming with Module 1 and proceed through each module in sequence. Note that Modules 6 through 8 are only accessible when the appropriate plug-in option card is installed. If lost or confused while programming, press the DSP key to exit programming mode and start over. When programming is complete, it is recommended to record the meter settings on the Parameter Value Chart and lock-out parameter programming with a User Input or lock-out code. (See Modules 2 and 3 for lock-out details.)

Alternating selection display



In the module description sections which follow, the dual display with arrows appears for each programming parameter. This is used to illustrate the display alternating between the parameter (top display) and the parameter's Factory Setting (bottom display). In most cases, selections or value ranges for the parameter will be listed on the right.

Step by step programming instructions

Programming mode entry (PAR key)

The Programming Mode is entered by pressing the PAR key. If this mode is not accessible, then meter programming is locked by either a security code or a hardware lock. (See Modules 2 and 3 for programming lock-out details.)

Module entry (arrow & PAR keys)

Upon entering the Programming Mode, the display alternates between Pro and the present module (initially NO). The arrow keys (F1▲ and F2▼) are used to select the desired module, which is then entered by pressing the PAR key.

Parameter (module) menu (PAR key)

Each module has a separate parameter menu. These menus are shown at the start of each module description section which follows. The PAR key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters.

After completing a module, the display will return to Pro NO. From this point, programming may continue by selecting and entering additional modules. (See MODULE ENTRY above.)

Parameter selection entry (arrow & PAR keys)

For each parameter, the display alternates between the parameter and the present selection or value for that parameter. For parameters which have a list of selections, the arrow keys (F1▲ and F2▼) are used to sequence through the list until the desired selection is displayed. Pressing the PAR key stores and activates the displayed selection, and also advances the meter to the next parameter.

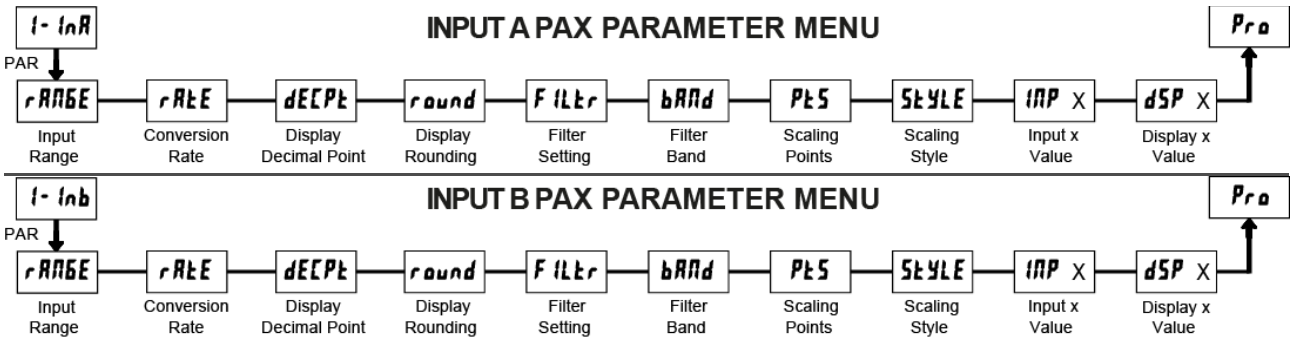
Numerical value entry (arrow, RST & PAR keys)

For parameters which require a numerical value entry, the arrow keys can be used to increment or decrement the display to the desired value. When an arrow key is pressed and held, the display automatically scrolls up or scrolls down. The longer the key is held, the faster the display scrolls. The RST key can be used in combination with the arrow keys to enter large numerical values. When the RST key is pressed along with an arrow key, the display scrolls by 1000's. Pressing the PAR key stores and activates the displayed value, and also advances the meter to the next parameter.

Programming mode exit (DSP or PAR Key at Pro NO)

The Programming Mode is exited by pressing the DSP key (from anywhere in the Programming Mode) or the PAR key (with Pro NO displayed). This will commit any stored parameter changes to memory and return the meter to the Display Mode. If a parameter was just changed, the PAR key should be pressed to store the change before pressing the DSP key. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

11.1. Module 1 – Signal input parameters (1-InX)



11.1.1. Input range

Selection	Range resolution
UoLt	10.000V
Curr	20.000mA
U-Sqr	±10.000V - Square Root Extraction
C-Sqr	±20.000mA - Square Root Extraction

Select the input range that corresponds to the external signal. Before applying signal configure input jumper to match setting desired.

11.1.2. ADC conversion rate

5.3 20 | 7.5 30 | 16.7 105 | 19.8

Select the ADC conversion rate (conversions per second). The selection does not affect the display update rate, however it does affect setpoint and analog output response time. The default factory setting of 19.8 is recommended for most applications. Selecting a fast update rate may cause the display to appear very unstable.

11.1.3. Display decimal point

0 0.0 0.00 0.000 0.0000

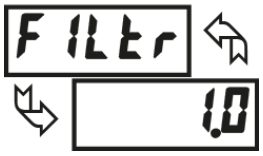
Select the decimal point location for the Input display. (The **TOT** display decimal point is a separate parameter.) This selection also affects round, dSP 1 and dSP2 parameters and setpoint values.

11.1.4. Display rounding

1 2 5
10 20 50 100

Rounding selections other than one, cause the Input Display to 'round' to the nearest rounding increment selected (ie. rounding of '5' causes 122 to round to 120 and 123 to round to 125). Rounding starts at the least significant digit of the Input Display. Remaining parameter entries (scaling point values, setpoint values, etc.) are not automatically adjusted to this display rounding selection.

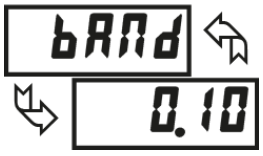
11.1.5. Filter setting



0.0 to 25.0 seconds

The input filter setting is a time constant expressed in tenths of a second. The filter settles to 99% of the final display value within approximately 3 time constants. This is an Adaptive Digital Filter which is designed to steady the Input Display reading. A value of '0' disables filtering.

11.1.6. Filter band



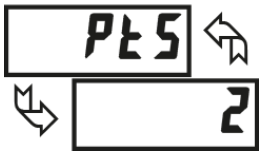
0 to 250 display units

The digital filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the digital filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units. A band setting of '0' keeps the digital filter permanently engaged.

11.1.7. Scaling points

2 to 16

Linear - Scaling Points (2)



For linear processes, only 2 scaling points are necessary. It is recommended that the 2 scaling points be at opposite ends of the input signal being applied. The points do not have to be the signal limits. Display scaling will be linear between and continue past the entered points up to the limits of the Input Signal Jumper position. Each scaling point has a coordinate-pair of Input Value (inP) and an associated desired Display Value (dSP).

Square Root Extraction Input Range - Scaling Points (2)

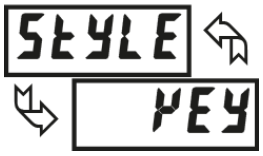
The DISP-PAXDP can apply the square root function directly to the sensor signal by selecting the Square Root Extraction Input Range (U-Sqr or C-Sqr)When configured for Square Root Extraction, piecewise multipoint linearization is not required and only the first 2 scaling points are used. For proper operation the Display 1 (dSP 1) value must be zero.

Nonlinear - Scaling Points (Greater than 2)

For non-linear processes, up to 16 scaling points may be used to provide a piece-wise linear approximation. (The greater the number of scaling points used, the greater the conformity accuracy.) The Input Display will be linear between scaling points that are sequential in program order. Each scaling point has a coordinate-pair of Input Value (INP) and an associated desired Display Value (dSP). Data from tables or equations, or empirical data could be used to derive the required number of segments and data values for the coordinate pairs.

11.1.8. Scaling style

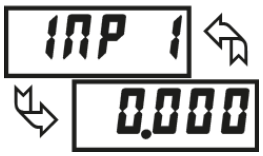
KEY Key-in data
APLY Apply signal



If Input Values and corresponding Display Values are known, the Key-in (KEY) scaling style can be used. This allows scaling without the presence or changing of the input signal. If Input Values have to be derived from the actual input signal source or simulator, the Apply (APLY) scaling style must be used. After using the Apply (APLY) scaling style, this parameter will default back to KEY but the scaling values will be shown from the previous applied method.

11.1.9. Input value for scaling point 1

-19999 to 99999



For Key-in (KEY), enter the known first Input Value by using the arrow keys. (The Input Range selection sets up the decimal location for the Input Value.) For Apply (APLY), apply the input signal to the meter, adjust the signal source externally until the desired Input Value appears. In either method, press the **PAR** key to enter the value being displayed. In the APLY style, the **RST** key can be pressed to advance the display past the INP 1 value or other input value without storing it. This is useful for application scaling of the second scaling point (i.e. when the tank is full), or some other point in multipoint applications.

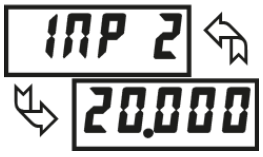
11.1.10. Display value for scaling point 1

-19999 to 99999

Enter the first coordinating Display Value by using the arrow keys. This is the same for KEY and APLY scaling styles. The decimal point follows the dECPt selection. For Square Root Extraction Input Range, the Display 1 value must be zero.

11.1.11. Input value for scaling point 2

-19999 to 99999



For Key-in (KEY), enter the known second Input Value by using the arrow keys. For Apply (APLY), adjust the signal source externally until the next desired Input Value appears. (Follow the same procedure if using more than 2 scaling points.)

11.1.12. Display value for scaling point 2

-19999 to 99999

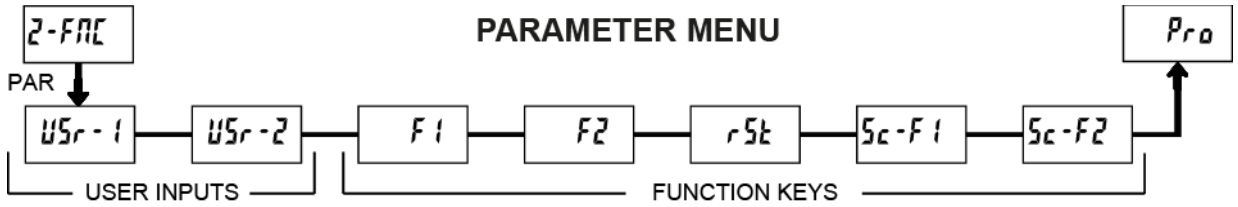
Enter the second coordinating Display Value by using the arrow keys. This is the same for KEY and APLY scaling styles. (Follow the same procedure if using more than 2 scaling points.)

General notes on scaling

1. Input Values for scaling points should be confined to the limits of the Input Range Jumper position.
2. The same Input Value should not correspond to more than one Display Value. (Example: 20mA can not equal 0 and 10.) This is referred to as read out jumps (vertical scaled segments).

3. The same Display Value can correspond to more than one Input Value. (Example: 0mA and 20mA can equal 10.) This is referred to as readout dead zones (horizontal scaled segments).
4. The maximum scaled Display Value spread between range maximum and minimum is limited to 65535. For example using +20mA range the maximum +20mA can be scaled to is 32767 with 0mA being 0 and Display Rounding of 1. (Decimal points are ignored.) The other half of 65535 is for the lower half of the range 0 to -20mA even if it is not used. With Display Rounding of 2, +20mA can be scaled for 65535 (32767 x 2) but with even Input Display values shown.
5. For input levels beyond the first programmed Input Value, the meter extends the Display Value by calculating the slope from the first two coordinate pairs (INP 1/dSP 1 & INP2/dSP2). If INP 1=4mA and dSP 1=0, then 0mA would be some negative Display Value. This could be prevented by making INP 1=0mA/dSP 1=0, INP2=4mA/dSP2=0, with INP3=20mA/dSP3 = the desired high Display Value. The calculations stop at the limits of the Input Range Jumper position.
6. For input levels beyond the last programmed Input Value, the meter extends the Display Value by calculating the slope from the last two sequential coordinate pairs. If three coordinate pair scaling points were entered, then the Display Value calculation would be between INP2/dSP2 & INP3/dSP3. The calculations stop at the limits of the Input Range Jumper position.

11.2. Module 2 – User input and front panel function key parameters (2-fnc)



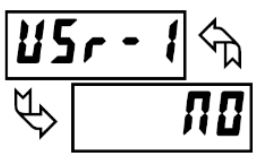
The two user inputs are individually programmable to perform specific meter control functions. While in the Display Mode or Program Mode, the function is executed the instant the user input transitions to the active state.

The front panel function keys are also individually programmable to perform specific meter control functions. While in the Display Mode or when viewing meter values in Quick Programming mode, the primary function is executed the instant the key is pressed. Holding the function key for three seconds executes a secondary function. It is possible to program a secondary function without a primary function.

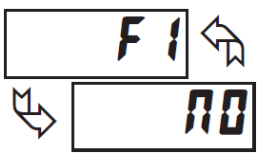
In most cases, if more than one user input and/or function key is programmed for the same function, the maintained (level trigger) actions will be performed while at least one of those user inputs or function keys are activated. The momentary (edge trigger) actions will be performed every time any of those user inputs or function keys transition to the active state.

Note: In the following explanations, not all selections are available for both user inputs and front panel function keys. Alternating displays are shown with each selection. Those selections showing both displays are available for both. If a display is not shown, it is not available for that selection. USr - 1 will represent all the user inputs. F 1 will represent all five function keys.

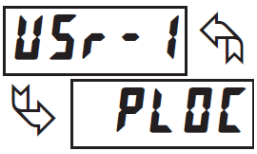
11.2.1. No function



No function is performed if activated. This is the factory setting for all user inputs and function keys. No function can be selected without affecting basic start-up.



11.2.2. Programming Lock-Out



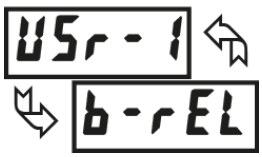
Programming Mode is locked-out, as long as activated (maintained action). A security code can be configured to allow programming access during lock-out.

11.2.3. Input A zero (tare) display

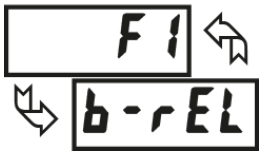
The Zero (Tare) Display provides a way to zero the Input A value at various input levels, causing future Display readings to be offset. This function is useful in weighing applications where the container or material on the scale should not be included in the next measurement value.

When activated (momentary action), rESEt flashes and the Input A value is set to zero. At the same time, the Input A value (that was on the display before the Zero Display) is subtracted from the Input A Display Offset Value and is automatically stored as the new Display Offset Value (OFS-A) If another Zero (tare) Display is performed, the display will again change to zero and the Input A reading will shift accordingly.

11.2.4. Input B zero (tare) display



The Zero (Tare) Display provides a way to zero the Input B value at various input levels, causing future Display readings to be offset. This function is useful in weighing applications where the container or material on the scale should not be included in the next measurement value. When activated (momentary action), rESEt flashes and the Input B value is set to zero.



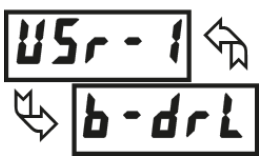
At the same time, the Input B value (that was on the display before the Zero Display) is subtracted from the Input B Display Offset Value and is automatically stored as the new Display Offset Value (OFS-b). If another Zero (tare) Display is performed, the display will again change to zero and the Input B reading will shift accordingly.

11.2.5. Input A relative/absolute display

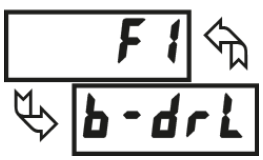
This function will switch the Input A Display between Relative and Absolute. The Relative is a net value that includes the Display Offset Value. The Input A Display will normally show the Relative unless switched by this function. The Absolute is a gross value (based on Module 1 **DSP** and **INP** entries)

without the Display Offset Value. The Absolute display is selected as long as the user input is activated (maintained action) or at the transition of the function key (momentary action). When the user input is released, or the function key is pressed again, the input A display switches back to Relative display. Abs-A (absolute) or rEL-A (relative) is momentarily displayed at transition to indicate which display is active.

11.2.6. Input B relative/absolute display



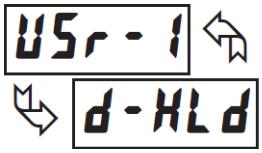
This function will switch the Input B Display between Relative and Absolute. The Relative is a net value that includes the Display Offset Value. The Input B Display will normally show the Relative unless switched by this function. The Absolute is a gross value (based on Module 1 **DSP** and **INP** entries)



without the Display Offset Value.

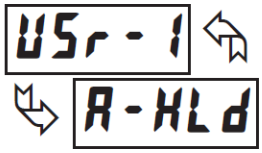
The Absolute display is selected as long as the user input is activated (maintained action) or at the transition of the function key (momentary action). When the user input is released, or the function key is pressed again, the input B display switches back to Relative display. Abs-b (absolute) or rEL-b (relative) is momentarily displayed at transition to indicate which display is active.

11.2.7. Hold display



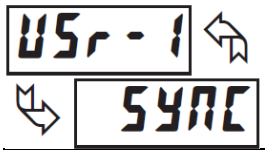
The shown display is held but all other meter functions continue as long as activated (maintained action).

11.2.8. Hold all functions



The meter disables processing the inputs, holds all display contents, and locks the state of all outputs as long as activated (maintained action). The serial port continues data transfer.

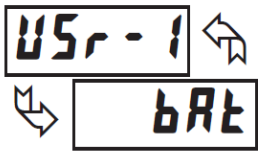
11.2.9. Synchronize meter reading



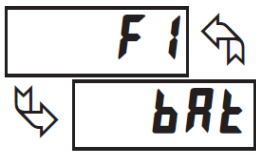
The meter suspends all functions as long as activated (maintained action). When the user input is released, the meter synchronizes the restart of the A/D with other processes or timing events.

Input assignment for the totalizer is programmed in Module 5, Totalizer (Integrator) Parameters. Only the assigned input or calculation will be active for the following Totalizer User Functions.

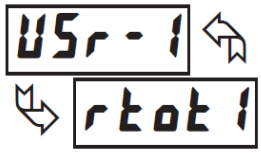
11.2.10. Store batch reading in totalizer



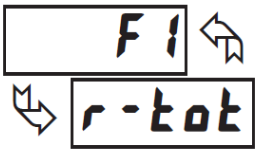
The Input Display value is one time added (batched) to the Totalizer at transition to activate (momentary action). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. When this function is selected, the normal operation of the Totalizer is overridden.



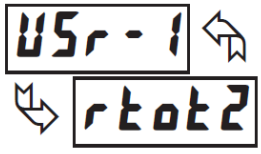
11.2.11. Reset totalizer



When activated (momentary action), rESEt flashes and the Totalizer resets to zero. The Totalizer then continues to operate as it is configured. This selection functions independent of the selected display.

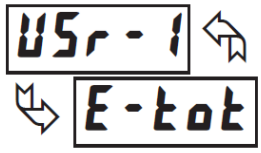


11.2.12. Reset and enable totalizer



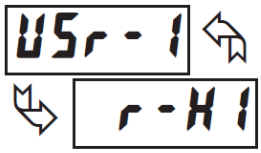
When activated (momentary action), rESEt flashes and the Totalizer resets to zero. The Totalizer continues to operate while active (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

11.2.13. Enable totalizer

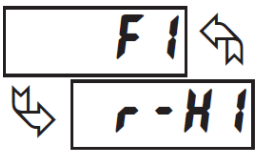


The Totalizer continues to operate as long as activated (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

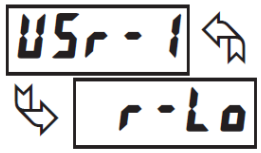
11.2.14. Reset maximum



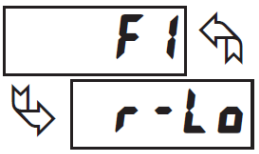
When activated (momentary action), rESEt flashes and the Maximum resets to the present Input Display value. The Maximum function then continues from that value. This selection functions independent of the selected display.



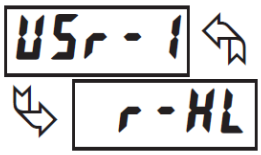
11.2.15. Reset minimum



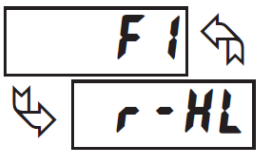
When activated (momentary action), rESEt flashes and the Minimum reading is set to the present Input Display value. The Minimum function then continues from that value. This selection functions independent of the selected display.



11.2.16. Reset maximum and minimum



When activated (momentary action), rESEt flashes and the Maximum and Minimum readings are set to the present Input Display value. The Maximum and Minimum function then continues from that value. This selection functions independent of the selected display.



Note: Following display functions are only available on User Input.

11.2.17. Advance display

When activated (momentary action), the display advances to the next display that is not locked out from the Display Mode.

11.2.18. Select display A

When activated (momentary action), the display advances to Display A, if enabled.

11.2.19. Select display B

When activated (momentary action), the display advances to Display B, if enabled.

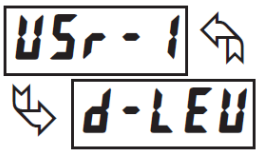
11.2.20. Select display C

When activated (momentary action), the display advances to Display C, if enabled.

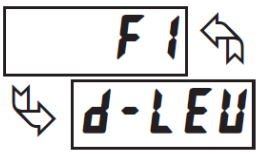
11.2.21. Select display _

When activated (momentary action), the display advances to the Display _ (no annunciator), if enabled.

11.2.22. Change display intensity level



When activated (momentary action), the display intensity changes to the next intensity level (of 4). The four levels correspond to Display Intensity Level (d-LEu) settings of 0, 3, 8, and 15.

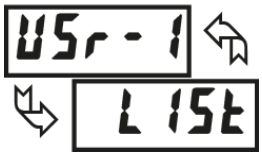


11.2.23. Setpoint selections

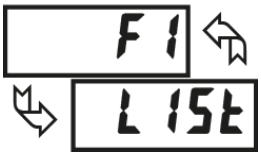
The following selections are accessible only with the Setpoint plug-in card installed. Refer to the card's manual for an explanation of their operation.

Setpoint card only	L 15t	Select main or alternate setpoints
	r-1	Reset Setpoint 1 (Alarm 1)
	r-2	Reset Setpoint 2 (Alarm 2)
	r-3	Reset Setpoint 3 (Alarm 3)
	r-4	Reset Setpoint 4 (Alarm 4)
	r-34	Reset Setpoint 3 & 4 (Alarm 3 & 4)
	r-234	Reset Setpoint 2, 3 & 4 (Alarm 2, 3 & 4)
	r-ALL	Reset Setpoint All (Alarm All)

11.2.24. Select setpoint list

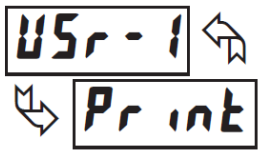


Two lists of values are available for SP-1, SP-2, SP-3, SP-4. The two lists are named L5t-A and L5t-b. If a user input is used to select the list then L5t-A is selected when the user input is not active and L5t-b is selected when the user input is active (maintained action). If a front panel key is used to select the list then the list will toggle for each key press (momentary action). The display will only indicate which list is active when the list is changed.

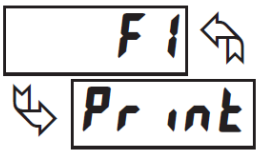


To program the values for L5t-A and L5t-b, first complete the programming of all the parameters. Exit programming and switch to the other list. Re-enter programming and enter the values for SP-1, SP-2, SP-3, SP-4. If any other parameters are changed then the other list values must be reprogrammed.

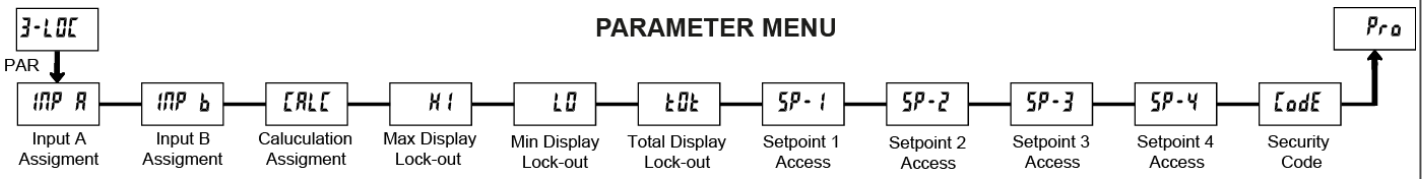
11.2.25. Print request



The meter issues a block print through the serial port when activated. The data transmitted during a print request is programmed in Module 7. If the user input is still active after the transmission is complete (about 100msec), an additional transmission occurs. As long as the user input is held active, continuous transmissions occur.



11.3. Module 3 - Display and program lock-out parameter (3-Loc)

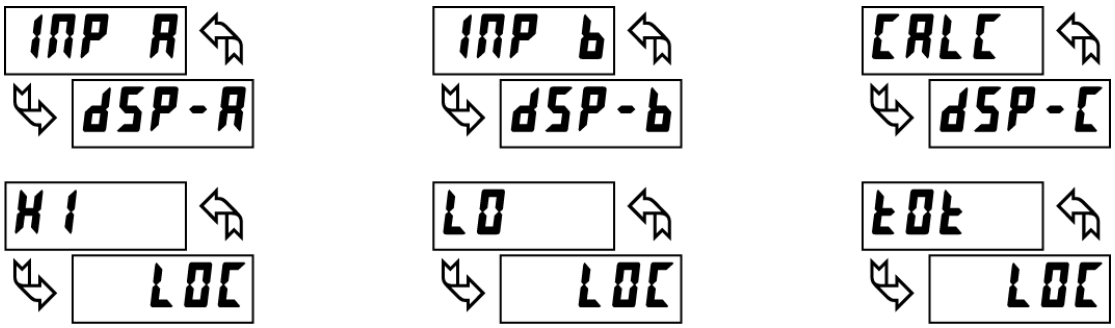


Module 3 is the programming for the Display, Display assignments, Display lock-out and "Full" and "Quick" Program lock-out.

When in the main Display Mode, the available displays (A, B, C, _) can be read consecutively by repeatedly pressing the **DSP** key. An annunciator indicates the display being shown (_ = No annunciator).

A meter display value can be programmed to one of the displays, to the quick programming mode or be locked from being visible. It is recommended that the meter display value be set **LOC** when it is not being used in the application. "Full" Programming Mode permits all parameters to be viewed and modified. This Programming Mode can be locked with a security code and/or user input. When locked and the **PAR** key is pressed, the meter enters a "Quick" Programming Mode. In this mode, the setpoint values can still be read and/or changed per the selections below. The display Intensity Level (**d-LEV**) parameter also appears whenever Quick Programming Mode is enabled and the security code greater than zero.

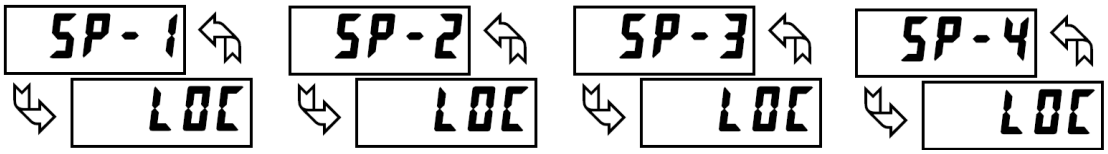
11.3.1. Display assignment



There are six meter values that can be individually programmed for one of the main displays (A,B,C or _), or programmed to be viewable in Quick Programming mode (**rEd**), or programmed to be locked out from display (**LOC**) (see the following table). If two or more values are assigned to the same display the last value assigned will be the one that is displayed.

SELECTION	DESCRIPTION
LOC	Not visible in Quick Programming Mode
rEd	Visible in Quick Programming Mode
dSP-	Assign to Display _ (No annunciator)
dSP-A	Assign to Display A
dSP-b	Assign to Display B
dSP-C	Assign to Display C

11.3.2. SP-1 SP-2 SP-3 SP-4 setpoint access

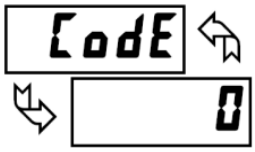


The setpoint displays can be programmed for **LOC**, **rEd** or **ENt** (See the following table). Accessible only with the Setpoint plug-in card installed.

SELECTION	DESCRIPTION
LOC	Not visible in Quick Programming Mode
rEd	Visible but not changeable in Quick Programming Mode
ENt	Visible and changeable in Quick Programming Mode

11.3.3. Program mode security code

2 to **250**



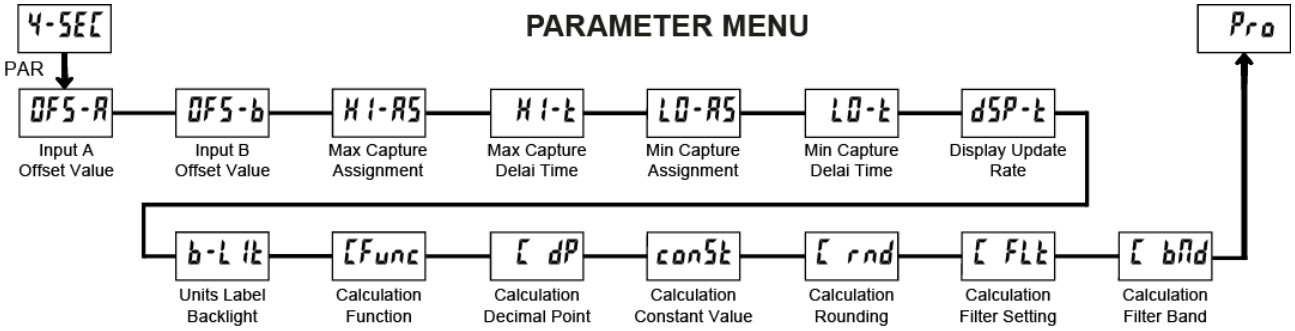
By entering any non-zero value, the prompt **CodE 0** will appear when trying to access the Program Mode. Access will only be allowed after entering a matching security code or universal code of **222**. With this lock-out, a user input would not have to be configured for Program Lock-out. However, this lock-out is overridden by an inactive user input configured for Program Lock-out.

11.3.4. Programming mode access

SECURITY CODE	USER INPUT CONFIGURED	USER INPUT STATE	WHEN PAR KEY IS PRESSED	"FULL" PROGRAMMING MODE ACCESS
0	not PLOC	-	"Full" Programming	Immediate access.
>0	not PLOC	-	Quick Programming w/Display Intensity	After Quick Programming with correct code # at CodE prompt.
>0	PLOC	Active		
>0	PLOC	Not active	"Full" Programming	Immediate access.
0	PLOC	Active	Quick Programming	No access
0	PLOC	Not Active	"Full" Programming	Immediate access.

Throughout this document, Programming Mode (without Quick in front) always refers to "Full" Programming (all meter parameters are accessible).

11.4. Module 4 – secondary function parameters (4-SEC)



11.4.1. Input A offset value

-19999 to **99999**

Unless a Zero Display was performed or an offset from Module 1 scaling is desired for Input A, this parameter can be skipped. The Display Offset Value is the difference between the Absolute (gross) Display value and the Relative (net) Display value for the same input level. The meter will automatically update this Display Offset Value after each Zero Display. The Display Offset Value can be directly keyed-in to intentionally add or remove display offset. See Relative/Absolute Display and Zero Display explanations in Module 2.

11.4.2. Input B offset value

-19999 to **99999**

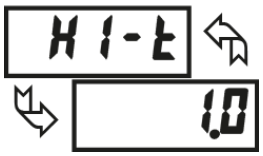
Unless a Zero Display was performed or an offset from Module 1 scaling is desired for Input B, this parameter can be skipped. The Display Offset Value is the difference between the Absolute (gross) Display value and the Relative (net) Display value for the same input level. The meter will automatically update this Display Offset Value after each Zero Display. The Display Offset Value can be directly keyed-in to intentionally add or remove display offset. See Relative/Absolute Display and Zero Display explanations in Module 2.

11.4.3. Max capture assignment

A-rEL **A-AbS** **b-rEL** **b-AbS** **CALC**

Select the desired parameter that will be assigned to the Max Capture.

11.4.4. Max capture delay time



0.0 to 3275.0 sec.

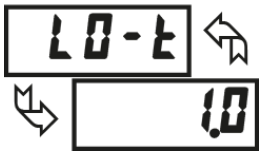
When the Input Display is above the present MAX value for the entered delay time, the meter will capture that display value as the new MAX reading. A delay time helps to avoid false captures of sudden short spikes.

11.4.5. Min capture assignment

A-rEL A-Abs b-rEL b-Abs CALC

Select the desired parameter that will be assigned to the Min Capture.

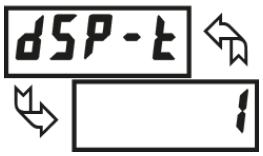
11.4.6. Min capture delay time



0.0 to 3275.0 sec.

When the Input Display is below the present MIN value for the entered delay time, the meter will capture that display value as the new MIN reading. A delay time helps to avoid false captures of sudden short spikes.

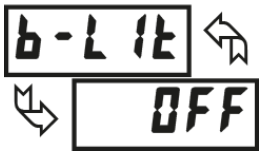
11.4.7. Display update rate



1 2 5 10 20 Updates/sec

This parameter determines the rate of display update.

11.4.8. Units label backlight



ON OFF

The Units Label Kit Accessory contains a sheet of custom unit overlays which can be installed in to the meter's bezel display assembly. The backlight for these custom units is activated by this parameter.

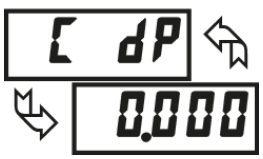
11.4.9. Calculation function

c1A1b c-A-b C1A-b AbrC cArb c Arb-1

This parameter determines the math calculation that will be performed on Input A and Input B and shown on the calculation display. The above formulas represent the available calculations; A = Input A relative value, b = Input B relative value, and c = Calculation Constant Value (conSt). For the average between A and B inputs, scale the display (Input A & Input B dSP x) values in half and then use C 1 A 1 b.

Note: 1 = add, - = subtract, r = division, c(Arb-1) is displayed in the DISP-PAXDP as Arb-1 and the function performs with A divided B then 1 is subtracted and the result is multiply by C.

11.4.10. Calculation decimal point

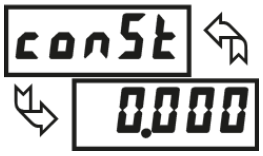


0 0.0 0.00 0.000 0.0000

This parameter determines the decimal point location for the Calculation Display. For the c1A1b, c-A-b and c1A-b calculation functions, Input A "Display Decimal Point", Input B "Display Decimal Point" and "Calculation Decimal Point" must all be in the same position.

11.4.11. Calculation constant value

-9999 to 99999

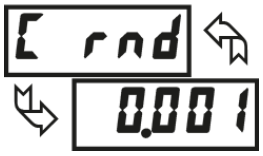


The constant value is used in the Calculation Function formulas to provide offsetting or scaling capabilities. For the c1A1b, c-A-b and c1A-b calculation functions, the Constant decimal point matches that Calculation Decimal point position. For these functions, the "Constant Value" must be lowered to a value of 0 for no offset.

For the AbrC, cArb and c(Arb-1) calculation functions, there is no "Constant Value" decimal point shown. However, when Input A "Display Decimal Point", Input B "Display Decimal Point" and "Calculation Decimal Point" are in the same position, then the "Constant Value" decimal point will be assumed to be at the same location as the "Calculation Decimal Point". For the Calculation Display to have the same resolution as Inputs A & B, the "Constant Value" must be a value of 1 with trailing 0's for each assumed decimal point location. Example: With Input A, Input B and the Calculation decimal points entered as 0.00, then the "Constant Value" would be entered as 100 for no gain.

11.4.12. Calculation rounding

1 2 5
10 20 50 100

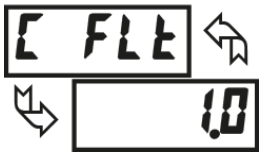


Rounding selections other than one, cause the Calculation Display to "round" to the nearest rounding increment selected (i.e. rounding of "0.005" causes 0.121 to round to 0.120 and 0.124 to round to 125).

Rounding starts at the least significant digit of the "Calculation Display" Remaining parameter entries (scaling point values, setpoint values, etc.) are not automatically adjusted to this display rounding selection. The displayed decimal point reflects that programmed in C dP.

11.4.13. Calculation filter setting

0.0 to 25.0 seconds



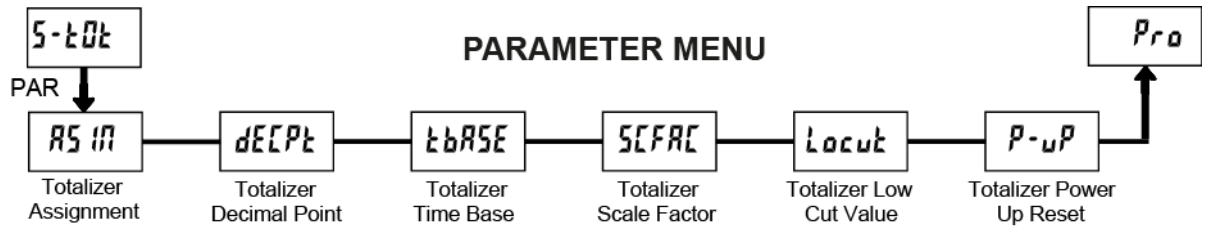
The calculation filter setting is a time constant expressed in tenths of a second. The filter settles to 99% of the final display value within approximately 3 time constants. This is an Adaptive Digital Filter which is designed to steady the Calculation Display reading. A value of "0" disables filtering.

11.4.14. Calculation filter band

0 to 250 display units.

The digital filter will adapt to variations in the calculation filter. When the variation exceeds the calculation filter band value, the digital filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units, independent of the Display Decimal Point position. A band setting of "0" keeps the digital filter permanently engaged.

11.5. Module 5 – Totalizer (integrator) parameters (5-tot)



The totalizer accumulates (integrates) the Input Display value using one of two modes. The first is using a time base. This can be used to compute a time temperature product. The second is through a user input or function key programmed for Batch (one time add on demand). This can be used to provide a readout of temperature integration, useful in curing and sterilization applications. If the Totalizer is not needed, its display can be locked-out and this module can be skipped during programming.

11.5.1. Totalizer assignment

A-rEL b-rEL CALC

This parameter determines which value is to be totalized.

11.5.2. Totalizer decimal point

0 0.0 0.00 0.000 0.0000

For most applications, this should match the decimal point position of the meter value selected in the totalizer assignment. If a different location is desired, refer to Totalizer Scale Factor

11.5.3. Totalizer time base

SEC seconds (÷1) hour hours (÷3600)
MIN minutes (÷60) dAY days (÷86400)

This is the time base used in Totalizer accumulations. If the Totalizer is being accumulated through a user input programmed for Batch, then this parameter does not apply.

11.5.4. Totalizer scale factor

0.001 to 65.000

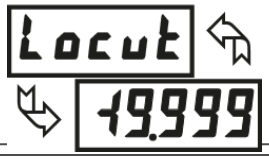
For most applications, the Totalizer reflects the same decimal point location and engineering units as the Input Display. In these cases, the Totalizer Scale Factor is 1.000. The Totalizer Scale Factor can be used to scale the Totalizer to a different value than the Input Display. Common possibilities are:

1. Changing decimal point location (example tenths to whole)
2. Average over a controlled time frame.

Details on calculating the scale factors are shown later.

If the Totalizer is being accumulated through a user input programmed for Batch, then this parameter does not apply.

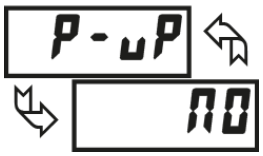
11.5.5. Totalizer low cut value



-19999 to 99999

A low cut value disables Totalizer when the Input Display value falls below the value programmed.

11.5.6. Totalizer power up reset



no Do not reset buffer
rSt Reset buffer

The Totalizer can be reset to zero on each meter power-up by setting this parameter to reset.

11.5.7. Totalizer high order display

When the total exceeds 5 digits, the front panel annunciator flashes (if assigned to A, B, or C display). In this case, the meter continues to totalize up to a 9 digit value. The high order 4 digits and the low order 5 digits of the total are displayed alternately. The letter "h" denotes the high order display.

11.5.8. Totalizer batching

The Totalizer Time Base and scale factor are overridden when a user input or function key is programmed for store batch (bAtt). In this mode, when the user input or function key is activated, the Input Display reading is one time added to the Totalizer (batch). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. This is useful in weighing operations, when the value to be added is not based on time but after a filling event.

11.5.9. Totalizer using time table

Totalizer accumulates as defined by:

$$\frac{Input\ Display * Totalizer\ scale\ factor}{Totalizer\ time\ base}$$

Where:

Input Display - the present input reading
Totalizer Scale Factor - 0.001 to 65.000
Totalizer Time Base - (the division factor of tbASE)

Example: The input reading is at a constant rate of 10.0 gallons per minute. The Totalizer is used to determine how many gallons in tenths has flowed. Because the Input Display and Totalizer are both in tenths of gallons, the Totalizer Scale Factor is 1. With gallons per minute, the Totalizer Time Base is minutes (60). By placing these values in the equation, the Totalizer will accumulate every second as follows:

$$\frac{10.0 * 1.000}{60} = 0.1667\ gallon\ accumulated\ each\ second$$

This results in:

10.0 gallons accumulates each minute
600.0 gallons accumulates each hour

11.5.10. Totalizer scale factor calculation examples

1. When changing the Totalizer Decimal Point (dECPt) location from the Input Display Decimal Point (dECPt), the required Totalizer Scale Factor is multiplied by a power of ten.

Example:

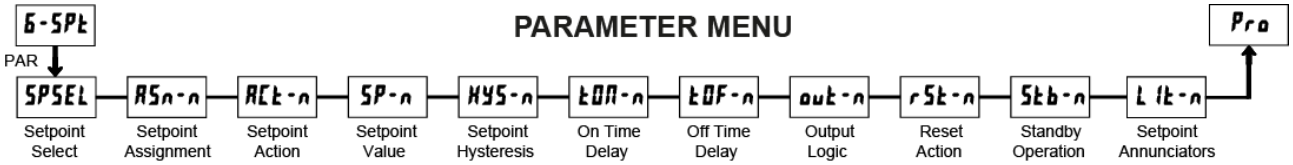
Input (dECPt) = 0,0		Input (dECPt)=0.00	
TOTALIZER dECPt	SCALE FACTOR	TOTALIZER dECPt	SCALE FACTOR
0.00	10	0.000	10
0.0	1	0.00	1
0	0.1	0.0	0.1
x10	0.01	0	0.01
x100	0.001	x10	0.001

(x = Totalizer display is round by tens or hundreds)

2. To obtain an average reading within a controlled time frame, the selected Totalizer Time Base is divided by the given time period expressed in the same timing units.

Example: Average temperature per hour in a 4 hour period, the scale factor would be 0.250. To achieve a controlled time frame, connect an external timer to a user input programmed for **rtot2**. The timer will control the start (reset) and the stopping (hold) of the totalizer.

11.6. Module 6 – Setpoint (Alarm) parameters (6-SPt)



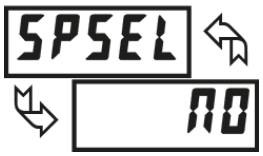
A setpoint card must be installed in order to access this module.

Depending on the card installed, there will be two or four setpoint outputs available. For maximum input frequency, unused Setpoints should be configured for **OFF** action.

The setpoint assignment and the setpoint action determine certain setpoint feature availability.

11.6.1. Setpoint select

no **SP-1** **SP-2** **SP-3** **SP-4**



Select a setpoint (alarm output) to open the remaining module menu. (The "**n**" in the following parameters will reflect the chosen setpoint number.) After the chosen setpoint is programmed, the display will default to **SPSEL no**. Select the next setpoint to be programmed and continue the sequence for each setpoint. Pressing **PAR** at **SPSEL no** will exit Module 6.

11.6.2. Setpoint assignment

none **A-rEL** **A-Abs** **b-rEL** **b-Abs** **CALC** **tot**

Selects the meter value that is used to trigger the Setpoint Alarm. The **-rEL** settings cause the setpoint to trigger off of the relative (net) input value. The relative input value is the absolute input value that includes the Display Offset Value. The **-Abs** settings cause the setpoint to trigger off of the absolute (gross) input value. The absolute input value is based on Module 1 **dSP** and **inP** entries.

11.6.3. Setpoint action

no **Ab-H1** **Ab-LO** **AU-H1** **AU-LO** **dE-H1** **dE-LO** **bAnd** **bnd in** **totLo** **totH1**

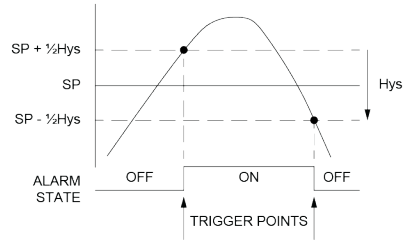
Enter the action for the selected setpoint (alarm output). See the Setpoint Alarm Figures in the Setpoint Card Bulletin for a visual detail of each action.

no	=	No Setpoint Action
Ab-H1	=	Absolute high, with balanced hysteresis
Ab-LO	=	Absolute low, with balanced hysteresis
AU-H1	=	Absolute high, with unbalanced hysteresis
AU-LO	=	Absolute low, with unbalanced hysteresis
dE-H1	=	Deviation high, with unbalanced hysteresis *
dE-LO	=	Deviation low, with unbalanced hysteresis *
bAnd	=	Outside band, with unbalanced hysteresis *
bnd in	=	Inside band, with unbalanced hysteresis *
totLo	=	Lower Totalizer absolute high, unbalance hysteresis**
totH1	=	Upper Totalizer absolute high, unbalance hysteresis**

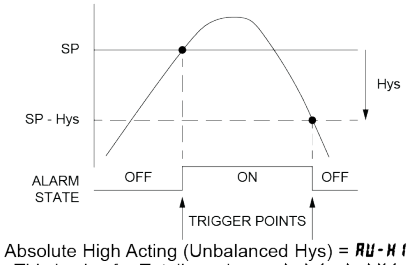
* Setpoint 2 or Setpoint 4 deviation and band action setpoints are relative to the value of setpoint 1 or Setpoint 3 respectively. It is not possible to configure setpoint 1 or 3 as deviation or band actions. It is possible to use setpoint 1 or 3 for an absolute action, while its value is being used for deviation or band.
** These modes only appear, and are the only modes that appear, when the setpoint assignment **ASn-n** is set to **tot**. The lower Totalizer action, **totLo**, allows setpoints to function off of the lower 5 digits of the Totalizer. The upper Totalizer action, **totHI**, allows setpoints to function off of the upper 4 digits of the Totalizer. To obtain absolute low alarms for the Totalizer, program the **totLo** or **totHI** output logic as reverse.

11.6.3.1. Setpoint Alarm Figures

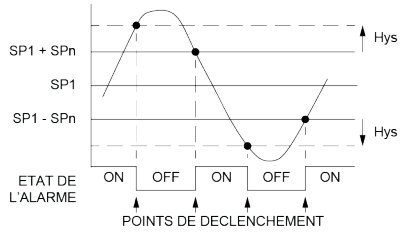
With reverse output logic **rEu**, the below alarm states are opposite.



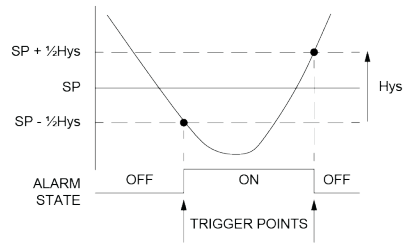
Absolute High Acting (Balanced Hys) = **Ab-HI**



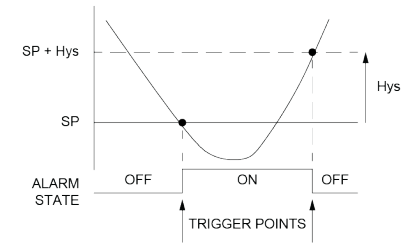
Absolute High Acting (Unbalanced Hys) = **AU-HI**
This is also for Totalizer alarms: **tot Io**, **totHI**



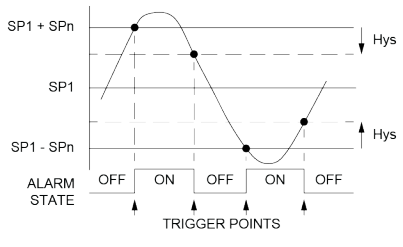
Action Interne Bande (Hys. non balancée) = **bAd In**



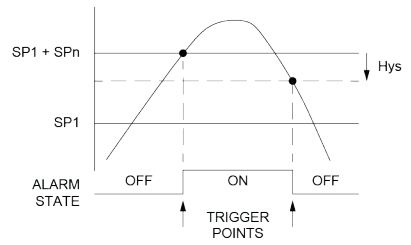
Absolute Low Acting (Balanced Hys) = **Ab-Lo**



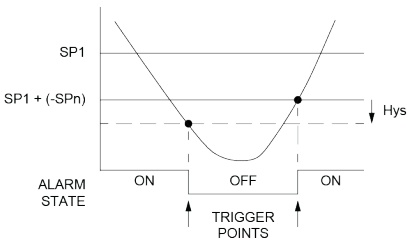
Absolute Low Acting (Unbalanced Hys) = **AU-Lo**



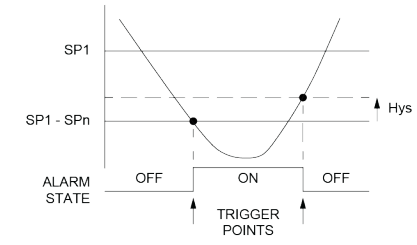
Band Outside Acting = **bAnd**



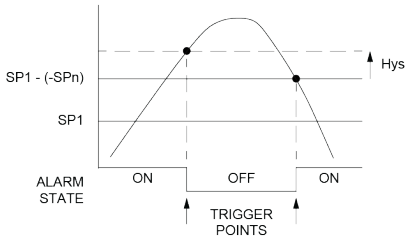
Deviation High Acting (SP > 0) = **dE-HI**



Deviation High Acting (SP < 0) = **dE-HI**



Deviation Low Acting (SP > 0) = **dE-Lo**



Deviation Low Acting (SP < 0) = **dE-Lo**

11.6.4. Setpoint value

-19999 to **99999**

Enter desired setpoint alarm value. These setpoint values can also be entered in the Display Mode during Program Lock-out when the setpoint is programmed as **Ent** in Parameter Module 3. When a setpoint is programmed as deviation or band acting, the associated output tracks **SP 1** as it is changed. The value entered is the offset, or difference from **SP 1**.

11.6.5. Hysteresis value

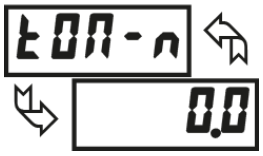
1 to **65000**

Enter desired hysteresis value. See Setpoint Alarm Figures for visual explanation of how setpoint alarm actions (balance and unbalance) are affected by the hysteresis. When the setpoint is a control output, usually balance hysteresis is used. For alarm applications, usually unbalanced hysteresis is used. For unbalanced hysteresis modes, the hysteresis functions on the low side for high acting setpoints and functions on the high side for low acting setpoints.

Note: Hysteresis eliminates output chatter at the switch point, while time delay can be used to prevent false triggering during process transient events.

11.6.6. On time delay

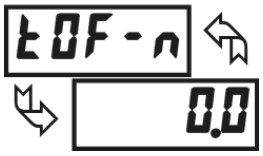
0.0 to **3275.0** sec



Enter the time value in seconds that the alarm is delayed from turning on after the trigger point is reached. A value of 0.0 allows the meter to update the alarm status per the response time listed in the Specifications. When the output logic is **rEu**, this becomes off time delay. Any time accumulated at power-off resets during power-up.

11.6.7. Off time delay

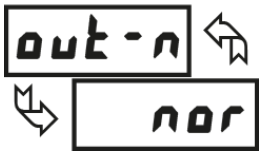
0.0 to **3275.0** sec



Enter the time value in seconds that the alarm is delayed from turning off after the trigger point is reached. A value of 0.0 allows the meter to update the alarm status per the response time listed in the Specifications. When the output logic is **rEu**, this becomes on time delay. Any time accumulated at power-off resets during power-up.

11.6.8. Output logic

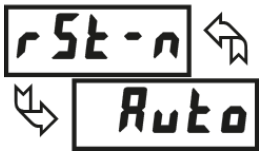
nor **rEu**



Enter the output logic of the alarm output. The **nor** logic leaves the output operation as normal. The **rEu** logic reverses the output logic. In **rEu**, the alarm states in the Setpoint Alarm Figures are reversed.

11.6.9. Reset action

Auto **LAtC 1** **LAtC2**



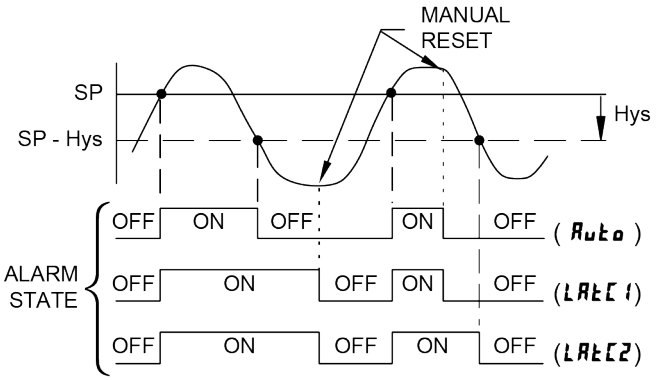
Enter the reset action of the alarm output

Auto = Automatic action; This action allows the alarm output to automatically reset off at the trigger points per the Setpoint Action shown in Setpoint Alarm Figures. The "on" alarm may be manually reset (off) immediately by a front panel function key or user input. The alarm remains reset off until the trigger point is crossed again.

LAtC 1 = Latch with immediate reset action; This action latches the alarm output on at the trigger point per the Setpoint Action shown in Setpoint Alarm Figures. Latch means that the alarm output can only be turned off by front panel function key or user input manual reset, serial reset command or meter power cycle. When the user input or function key is activated (momentary or maintained), the corresponding "on" alarm output is reset

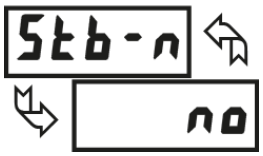
immediately and remains off until the trigger point is crossed again. (Previously latched alarms will be off if power up Display Value is lower than setpoint value.)

LAtC2 = Latch with delay reset action; This action latches the alarm output on at the trigger point per the Setpoint Action shown in Setpoint Alarm Figures. Latch means that the alarm output can only be turned off by front panel function key or user input manual reset, serial reset command or meter power cycle. When the user input or function key is activated (momentary or maintained), the meter delays the event until the corresponding "on" alarm output crosses the trigger off point. (Previously latched alarms are off if power up Display Value is lower than setpoint value. During a power cycle, the meter erases a previous Latch 2 reset if it is not activated at power up.)



Setpoint Alarm Reset Actions

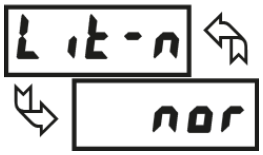
11.6.10. Standby operation



no YES

When YES, the alarm is disabled (after a power up) until the trigger point is crossed. Once the alarm is on, the alarm operates normally per the Setpoint Action and Reset Mode.

11.6.11. Setpoint annunciators



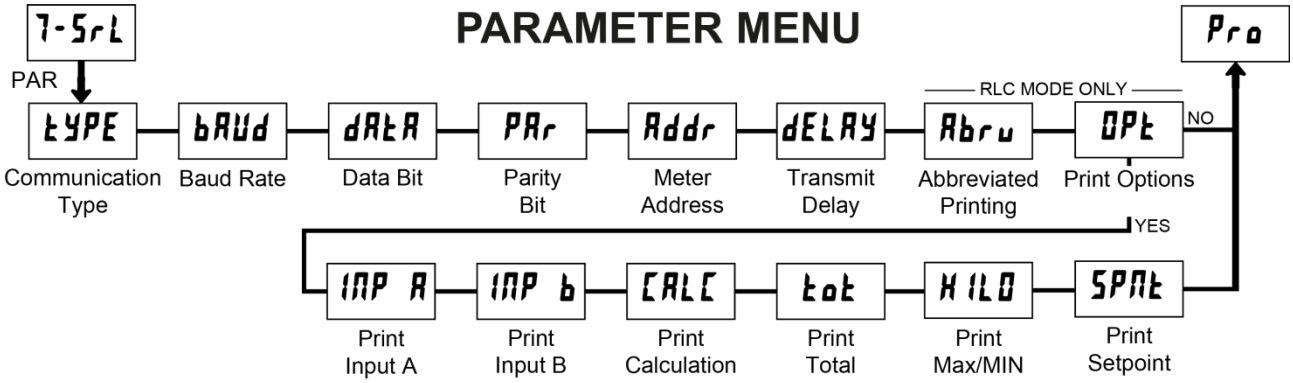
OFF nor rEu FLASH

The OFF mode disables display setpoint annunciators. The nor mode displays the corresponding setpoint annunciators of "on" alarm outputs. The rEu mode displays the corresponding setpoint annunciators of "off" alarms outputs. The FLASH mode flashes the corresponding setpoint annunciators of "on" alarm outputs.

11.6.12. Alternate Setpoints

An Alternate list of setpoint values can be stored and recalled as needed. The Alternate list allows an additional set of setpoint values. (The setpoint numbers nor rear terminal numbers will change in the Alternate list.) The Alternate list can only be activated through a function key or user input programmed for L ISt in Module 2. When the Alternate list is selected, the Main list is stored and becomes inactive. When changing between Main and Alternate, the alarm state of Auto Reset Action alarms will always follow their new value. Latched "on" alarms will always stay latched during the transition and can only be reset with a user input or function key. Only during the function key or user input transition does the display indicate which list is being used.

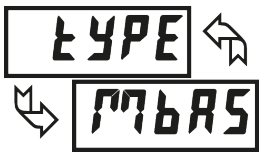
11.7. Module 7 – Serial communications parameters (7-SrL)



A communication card must be installed in order to access this module.

11.7.1. Communication type

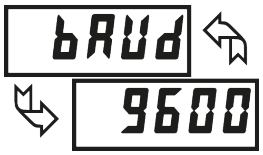
rLC	ASCII Protocol
Mbt	Modbus RTU
MbAS	Modbus ASCII



Select the desired communications protocol. Modbus is preferred as it provides access to all meter values and parameters. Since the Modbus protocol is included within the INDI-PAXDP, the INDI-PAX Modbus option card, CARD-CDC-40, should not be used. The CARD-CDC-10 (RS485) or CARD-CDC-20 (RS232) card should be used instead.

11.7.2. Baud rate

300	1200	4800	19200
600	2400	9600	38400



Set the baud rate to match the other serial communications equipment on the serial link. Normally, the baud rate is set to the highest value that all the serial equipment are capable of transmitting and receiving.

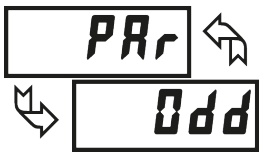
11.7.3. Data bit

7	8

Select either 7 or 8 bit data word lengths. Set the word length to match the other serial communications equipment on the serial link.

11.7.4. Parity bit

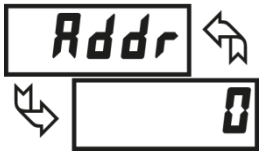
Odd	EUEn	no



Set the parity bit to match that of the other serial communications equipment on the serial link. The meter ignores the parity when receiving data and sets the parity bit for outgoing data. If no parity is selected with 7 bit word length, an additional stop bit is used to force the frame size to 10 bits.

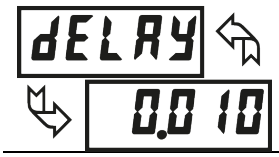
11.7.5. Meter address

0 to 99	ASCII Protocol
1 to 247	Modbus



Enter the serial meter (node) address. The address range is dependent on the tYPE parameter. With a single unit, configured for ASCII protocol (tYPE = rLC), an address is not needed and a value of zero can be used. With multiple units (RS485 applications), a unique 2 digit address number must be assigned to each meter.

11.7.6. Transmit delay



0.010 to 0.250

Following a transmit value ('*' terminator) or Modbus command, the INDI-PAXDP will wait this minimum amount of time in seconds before issuing a serial response.

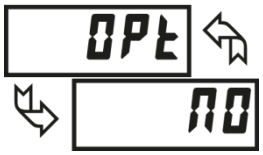
Parameters below only appear when communications type (tYPE) parameter is set to rLC.

11.7.7. Abbreviated printing

YES NO

Select NO for full print or Command T transmissions (meter address, parameter data and mnemonics) or YES for abbreviated print transmissions (parameter data only). This will affect all the parameters selected in the print options. (If the meter address is 00, it will not be sent during a full transmission.)

11.7.8. Print option



YES NO

YES - Enters the sub-menu to select those meter parameters to appear in the block print. For each parameter in the sub-menu select YES for the parameter to appear with the block print, and NO for that parameter information not to be sent. A print request is sometimes referred to as a block print because more than one parameter information (meter address, parameter data and mnemonics) can be sent to a printer or computer as a block.

Input A Value	InP A	YES	NO
Input B Value	InP b	YES	NO
Calculation	CALC	YES	NO
Total Value	tot	YES	NO
Max. & Min.	HILO	YES	NO
Setpoint Values*	SPnt	YES	NO

*Setpoints 1-4 are setpoint plug-in card dependent.

11.7.9. Serial Modbus communications

Modbus Communications requires that the Serial Communication Type Parameter (tYPE) be set to "Pn brt" or "Pn bAS".

11.7.9.1. Supported function codes

FC03: Read Holding Registers

1 Up to 32 registers can be requested at one time.
2 HEX <8000> is returned for non-used registers.

FC04: Read Input Registers

1 Up to 32 registers can be requested at one time.
2 Block starting point can not exceed register boundaries.
3 HEX <8000> is returned in registers beyond the boundaries.
4 Input registers are a mirror of Holding registers.

FC06: Preset Single Register

1 HEX <8001> is echoed back when attempting to write to a read only register.
2 If the write value exceeds the register limit (see Register Table), then that register value changes to its high or low limit. It is also returned in the response.

FC08: Diagnostics

The following is sent upon FC08 request:
Module Address, 08 (FC code), 04 (byte count), "Total Comms" 2 byte count, "Total Good Comms" 2 byte count, checksum of the string
"Total Comms" is the total number of messages received that were addressed to the INDI-PAXDP. "Total Good Comms" is the total messages received by the INDI-PAXDP with good address, parity and checksum. Both counters are reset to 0 upon response to FC08 and at power-up.

FC16: Preset Multiple Registers

1 No response is given with an attempt to write to more than 32 registers at a time.
2 Block starting point cannot exceed the read and write boundaries (40001-41280).
3 If a multiple write includes read only registers, then only the write registers will change.
4 If the write value exceeds the register limit (see Register Table), then that register value changes to its high or low limit.

FC17: Report Slave ID

The following is sent upon FC17 request:
RLC-PAXDP a b <0100h> <20h> <20h> <10h>

- 16 Guid/Scratch Pad
- Max Register Reads (32)
- Max Register Writes (32)
- Software Version Number
- b = Linear Card installed "0" = No, "1" = Yes
- a = SP Card installed, "0"-No SP, "2" or "4" SP

11.7.9.2. Supported exception codes

01: Illegal Function

Issued whenever the requested function is not implemented in the meter.

02: Illegal Data Address

Issued whenever an attempt is made to access a single register that does not exist (outside the implemented space) or to access a block of registers that falls completely outside the implemented space.

03: Illegal Data Value

Issued when an attempt is made to read or write more registers than the meter can handle in one request.

07: Negative Acknowledge

Issued when a write to a register is attempted with an invalid string length.

11.7.9.3. INDI-PAXDP frequently used Modbus registers

Only frequently used registers are shown below. Ask SENSY for the entire Modbus Register Table. The below limits are shown as Integers or HEX < > values. Read and write functions can be performed in either Integers or Hex as long as the conversion was done correctly. Negative numbers are represented by two's complement.

Note: The INDI-PAXDP should not be powered down while parameters are being changed. Doing so may corrupt the non-volatile memory resulting in checksum errors.

REGISTER ADRESS[3]	REGISTER NAME	LOW LIMIT[4]	HIGH LIMIT[2]	FACTORY SETTING	ACCESS	COMMENTS
	Frequently used registers					
40001	Input A Relative Value (Hi word)	N/A	N/A	N/A	Read Only	Process value of present input level. This value is affected by Input Type, Resolution, Scaling & Offset Value (Relative Value = Absolute Input Value + Offset Value)
40002	Input A Relative Value (Lo word)					
40003	Input B Relative Value (Hi word)	N/A	N/A	N/A	Read Only	
40004	Input B Relative Value (Lo word)					
40005	Calculation Value (Hi word)	N/A	N/A	N/A	Read Only	Calculation Result of Math Function
40006	Calculation Value (Lo word)					
40007	Maximum Value (Hi word)	-19999	99999	N/A	Read/Write	
40008	Maximum Value (Lo word)					
40009	Minimum Value (Hi word)	-19999	99999	N/A	Read/Write	
40010	Minimum Value (Lo word)					
40011	Total Value (Hi word)	-199999000	999999000	N/A	Read/Write	
40012	Total Value (Lo word)					
40013	Setpoint 1 Value (Hi word)	-19999	99999	100	Read/Write	
40014	Setpoint 1 Value (Lo word)					
40015	Setpoint 2 Value (Hi word)	-19999	99999	200	Read/Write	
40016	Setpoint 2 Value (Lo word)					
40017	Setpoint 3 Value (Hi word)	-19999	99999	300	Read/Write	
40018	Setpoint 3 Value (Lo word)					
40019	Setpoint 4 Value (Hi word)	-19999	99999	400	Read/Write	
40020	Setpoint 4 Value (Lo word)					
40021	Setpoint Output Register (SOR)	0	15	N/A	Read/Write See Note	Status of Setpoint Outputs: Bit State: 0=Off, 1=On, Bit 3=SP1, Bit 2=SP2, Bit 1=SP3, Bit 0=SP4 Outputs can only be activated/reset with this register when respective bits in Manual Mode (MMR) register are set
40022	Manual Mode Register (MMR)	0	31	0	Read/Write	Bit State: 0=Auto Mode, 1=Manual Mode Bit, 4=SP1, Bit 3=SP2, Bit 2=SP3, Bit 1=SP4, Bit 0=Linear Output
40023	Reset Output Register	0	15	0	Read/Write	Bit State: 1= Reset Output; Bit is returned to zero following reset processing Bit 3=SP1, Bit 2=SP2, Bit 1=SP3, Bit 0=SP4
40024	Analog Output Register (AOR)	0	4095	0	Read/Write	Functional only if Linear Output is in manual mode (MMR bit 0=1). Linear Output Card is written to only if Linear Out (MMR bit 0) is set
40025	Input A Absolute Value (Hi word)	N/A	N/A	N/A	Read Only	Gross value of present Input A (or B) level.

[3] For Input Registers, replace the 4xxxx with a 3xxxx in the above register address. The 3xxxx are a mirror of the 4xxxx Holding Registers.

[4] An attempt to exceed a limit will set the register to its high or low limit value.

REGISTER ADRESS[3]	REGISTER NAME	LOW LIMIT[4]	HIGH LIMIT[2]	FACTORY SETTING	ACCESS	COMMENTS
40026	Input A Absolute Value (Lo word)					This value is affected by Input Type, Resolution, Scaling, but not affected by Offset Value
40027	Input B Absolute Value (Hi word)	N/A	N/A	N/A	Read Only	
40028	Input B Absolute Value (Lo word)					
40029	Input A Offset Value (Hi word)	-19999	99999	0	Read/Write	Relative Input Value (standard meter value) is sum of Input Offset Value and Input Absolute Value
40030	Input A Offset Value (Lo word)					
40031	Input B Offset Value (Hi word)	-19999	99999	0	Read/Write	
40032	Input B Offset Value (Lo word)					
40033	Main Setpoint 1 Value (Hi word)	-19999	99999	100	Read/Write	Setpoint List A
40034	Main Setpoint 1 Value (Lo word)					
40035	Main Setpoint 2 Value (Hi word)	-19999	99999	200	Read/Write	Setpoint List A
40036	Main Setpoint 2 Value (Lo word)					
40037	Main Setpoint 3 Value (Hi word)	-19999	99999	300	Read/Write	Setpoint List A
40038	Main Setpoint 3 Value (Lo word)					
40039	Main Setpoint 4 Value (Hi word)	-19999	99999	400	Read/Write	Setpoint List A
40040	Main Setpoint 4 Value (Lo word)					
40041	Alternate Setpoint 1 Value (Hi word)	-19999	99999	100	Read/Write	Setpoint List B
40042	Alternate Setpoint 1 Value (Lo word)					
40043	Alternate Setpoint 2 Value (Hi word)	-19999	99999	200	Read/Write	Setpoint List B
40044	Alternate Setpoint 2 Value (Lo word)					
40045	Alternate Setpoint 3 Value (Hi word)	-19999	99999	300	Read/Write	Setpoint List B
40046	Alternate Setpoint 3 Value (Lo word)					
40047	Alternate Setpoint 4 Value (Hi word)	-19999	99999	400	Read/Write	Setpoint List B
40048	Alternate Setpoint 4 Value (Lo word)					

11.7.10. Serial protocol communications

RLC Communications requires the Serial Communications Type Parameter (tYPE) be set to rLC.

11.7.10.1. Sending Serial Commands and Data

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by the command terminator character * or $.

Command Chart

COMMAND	DESCRIPTION	NOTES
N	Node Address Specifier	Address a specific meter. Must be followed by one or two digit node address. Not required when node address = 0.
T	Transmit Value (read)	Read a register from the meter. Must be followed by register ID character.
V	Value change (write)	Write to register of the meter. Must be followed by register ID character and numeric data.
R	Reset	Reset a register or output. Must be followed by register ID character
P	Block Print Request (read)	Initiates a block print output. Registers are defined in programming.

Command string construction

The command string must be constructed in a specific sequence. The meter does not respond with an error message to illegal commands. The following procedure details construction of a command string:

1. The first characters consist of the Node Address Specifier (N) followed by a 1 or 2 character node address number. The node address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the Node Address Specifier, the next character is the command character.
3. The next character is the register ID. This identifies the register that the command affects. The P command does not require an ID character. It prints according to the selections made in print options.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters * or $. The meter does not begin processing the command string until this character is received. See timing diagram figure for differences of * and $ terminating characters.

Register identification chart

ID	VALUE DESCRIPTION	REGISTER NAME[5]	COMMANDS SUPPORTED[6]	
A	Input A Relative Value	INA	T, R	(Reset command zeros the input or tares input)
B	Input B Relative Value	INB	T, R	(Reset command zeros the input or tares input)
C	Calculation Value	CLC	T	
D	Total	TOT	T,R	(reset command zeros Total)
E	Min input	MIN	T, R	(Reset command loads current reading)
F	Max input	MAX	T, R	(Reset command loads current reading)
G	Input A Absolute (Gross) Value	ABA	T	
H	Input B Absolute (Gross) Value	ABB	T	
I	Input A Offset	OFA	T, V	
J	Input B Offset	OFB	T, V	
M	Setpoint 1	SP1	T, V, R	(reset command resets setpoint output)
N	Setpoint 2	SP2	T, V, R	(reset command resets setpoint output)
Q	Setpoint 3	SP3	T, V, R	(reset command resets setpoint output)
S	Setpoint 4	SP4	T, V, R	(reset command resets setpoint output)
U	Auto/Manual Register	MMR	T, V	
W	Analog Output Register	AOR	T, V	
X	Setpoint Register	SOR	T, V	

Command String Examples

1. Address = 17, Write 350 to Setpoint 1
   String: N17VM350*
2. Address = 5, Read Input A value
   String: N5TA*
3. Address = 0, Reset Setpoint 4 output
   String: RS*

[5] Register Names are also used as Register Mnemonics during full transmission.
[6] The registers associated with the P command are set up in Print Options (Module 7). Unless otherwise specified, the Transmit Details apply to both T and V Commands.

Transmitting Data To The Meter

Numeric data sent to the meter must be limited to Transmit Details listed in the Register Identification Chart. Leading zeros are ignored. Negative numbers must have a minus sign. The meter ignores any decimal point and conforms the number to the scaled resolution.
(For example: the meter's scaled decimal point position = 0.0 and 25 is written to a register. The value of the register is now 2.5 In this case, write a value = 25.0).
Note: Since the meter does not issue a reply to value change commands, follow with a transmit value command for readback verification.

Transmitting Data From The Meter

Data is transmitted by the meter in response to either a transmit command (T), a print block command (P) or User Function print request. The response from the meter is either a full field transmission or an abbreviated transmission. See Abbreviated Printing (**Abru**) parameter.

Full Transmission

BYTE	DESCRIPTION
1, 2	2 byte Node Address field [00-99]
3	<SP> (Space)
4-6	3 byte Register Mnemonic field
7-18	12 byte numeric data field; 10 bytes for number, one byte for sign, one byte for decimal point
19	<CR> carriage return
20	<LF> line feed
21	<SP>* (Space)
22	<CR>* carriage return
23	<LF>* line feed

** These characters only appear in the last line of a block print.*

The first two characters transmitted (bytes 1 and 2) are the unit address. If the address assigned is 00, two spaces are substituted. A space (byte 3) follows the unit address field. The next three characters (bytes 4 to 6) are the register mnemonic. The numeric data is transmitted next.
The numeric field (bytes 7 to 18) is 12 characters long. Except if the requested value exceeds eight digits for count values or five digits for rate values, byte 8 is always a space. The remaining ten positions of this field (bytes 9 to 18) consist of a minus sign (for negative values), a floating decimal point (if applicable), and eight positions for the requested value. The data within bytes 9 to 18 is right-aligned with leading spaces for any unfilled positions.
The end of the response string is terminated with <CR> (byte 19), and <LF> (byte 20). When a block print is finished, an extra <SP> (byte 21), <CR> (byte 22), and <LF> (byte 23) are used to provide separation between the transmissions.

Abbreviated transmission

BYTE	DESCRIPTION
1-12	12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point
13	<CR> carriage return
14	<LF> line feed
15	<SP>* (Space)
16	<CR>* carriage return
17	<LF>* line feed

** These characters only appear in the last line of a block print.*

The abbreviated response suppresses the node address and register ID, leaving only the numeric part of the response.

Meter response examples

1. Address = 17, full field response, Input A = 875
   17 INA 875 <CR><LF>
2. Address = 0, full field response, Setpoint 2 = -250.5
   SP2 -250.5<CR><LF>
3. Address = 0, abbreviated response, Setpoint 2 = 250, last line of block print
   250<CR><LF><SP><CR><LF>

Auto/Manual Mode Register (MMR) ID: U

This register sets the controlling mode for the outputs. In Auto Mode (0) the meter controls the setpoint and analog output. In Manual Mode (1) the outputs are defined by the registers SOR and AOR. When transferring from auto mode to manual mode, the meter holds the last output value (until the register is changed by a write). Each output may be independently changed to auto or manual. In a write command string (VU), any character besides 0 or 1 in a field will not change the corresponding output mode.

U a b c d e
- e = Analog Output
- d = SP4
- c = SP3
- b = SP2
- a = SP1

Example: VU00011 places SP4 and Analog in manual.

(AOR) Analog Output Register ID : W

This register stores the present signal value of the analog output. The range of values of this register is 0 to 4095, which corresponds to the analog output range per the following chart:

REGISTER VALUE	OUTPUT SIGNAL* 0-20mA	4-20mA	0-10V
0	0.000	4.000	0.000
1	0.005	4.004	0.0025
2047	10.000	10.000	5.000
4094	19.995	19.996	9.9975
4095	20.000	20.000	10.000

**Due to the absolute accuracy rating and resolution of the output card, the actual output signal may differ 0.15% FS from the table values. The output signal corresponds to the range selected (0-20 mA, 4-20 mA or 0-10 V).*

Writing to this register (VW) while the analog output is in the Manual Mode causes the output signal level to update immediately to the value sent. While in the Automatic Mode, this register may be written to, but it has

no effect until the analog output is placed in the manual mode. When in the Automatic Mode, the meter controls the analog output signal level. Reading from this register (TW) will show the present value of the analog output signal.

Example: VW2047 will result in an output of 10.000 mA, 12.000 mA or 5.000V depending on the range selected.

Setpoint Output Register (SOR) ID: X

This register stores the states of the setpoint outputs. Reading from this register (TX) will show the present state of all the setpoint outputs. A "0" in the setpoint location means the output is off and a "1" means the output is on.

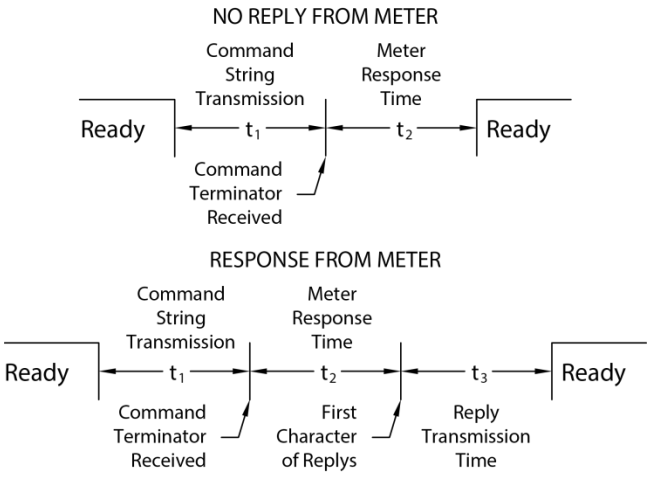
X a b c d
- d = SP4
- c = SP3
- b = SP2
- a = SP1

In Automatic Mode, the meter controls the setpoint output state. In Manual Mode, writing to this register (VX) will change the output state. Sending any character besides 0 or 1 in a field or if the corresponding output was not first in manual mode, the corresponding output value will not change. (It is not necessary to send least significant 0s.)

Example: VX10 will result in output 1 on and output 2 off.

11.7.10.2. Command response time

Timing Diagram Figure



The meter can only receive data or transmit data at any one time (half-duplex operation). The meter ignores commands while transmitting data, but instead uses RXD as a busy signal. When sending commands and data to the meter, a delay must be imposed before sending another command. This allows enough time for the meter to process the command and prepare for the next command.

At the start of the time interval t_1, the computer program prints or writes the string to the com port, thus initiating a transmission. During t_1, the command characters are under transmission and at the end of this period, the command terminating character (*) is received by the meter. The time duration of t_1 is dependent on the number of characters and baud rate of the channel: $t_1 = \frac{(10 * \#\ of\ characters)}{baud\ rate}$

At the start of time interval t2, the meter starts the interpretation of the command and when complete, performs the command function. This time interval t2 varies from 2 msec to 15 msec. If no response from the meter is expected, the meter is ready to accept another command.

If the meter is to reply with data, the time interval t2 is controlled by the use of the command terminating character and the Serial Transmit Delay parameter (**dELAY**). The standard command line terminating character is '*'. This terminating character results in a response time window of the Serial Transmit Delay time (**dELAY**) plus 15msec. maximum. The **dELAY** parameter should be programmed to a value that allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with '$'

results in a response time window (t2) of 2 msec minimum and 15 msec maximum. The response time of this terminating character requires that sending drivers release within 2 msec after the terminating character is received.

At the beginning of time interval t_3, the meter responds with the first character of the reply. As with t_1, the time duration of t_3 is dependent on the number of characters and baud rate of the channel: $t_3 = \frac{(10 * \#\ of\ characters)}{baud\ rate}$. At the end of t_3, the meter is ready to receive the next command.

The maximum serial throughput of the meter is limited to the sum of the times t_1, t_2 and t_3.

11.7.10.3. Communication format

Data is transferred from the meter through a serial communication channel. In serial communications, the voltage is switched between a high and low level at a predetermined rate (baud rate) using ASCII encoding. The receiving device reads the voltage levels at the same intervals and then translates the switched levels back to a character.

The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

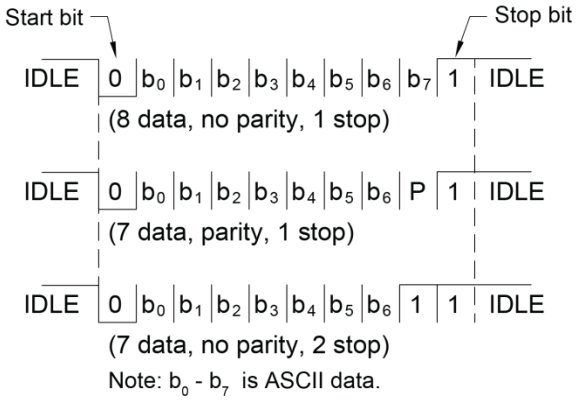
LOGIC	INTERFACE STATE	RS232*	RS485*
1	mark (idle)	TXD, RXD; -3 to -15V	a-b < -200mV
0	space (active)	TXD, RXD; +3 to +15V	a-b > +200mV

**Voltage levels at the receiver*

Data is transmitted one byte at a time with a variable idle period between characters (0 to ∞). Each ASCII character is "framed" with a beginning start bit, an optional error detection parity bit and one or more ending stop bits. The data format and baud rate must match that of other equipment in order for communication to take place. The figures list the data formats employed by the meter.

Start bit and Data bits

Data transmission always begins with the start bit. The start bit signals the receiving device to prepare for reception of data. One bit period later, the least significant bit of the ASCII encoded character is transmitted, followed by the remaining data bits. The receiving device then reads each bit position as they are transmitted. Since the sending and receiving devices operate at the same transmission speed (baud rate), the data is read without timing errors.



Character Frame Figure

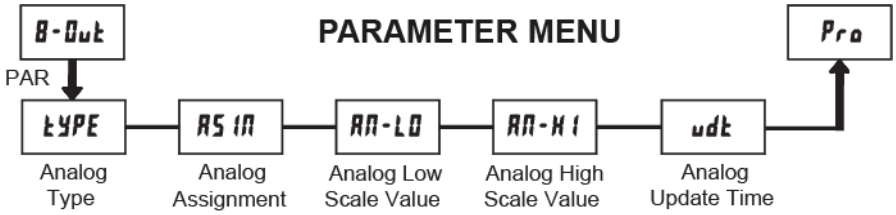
Parity bit

After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

Stop bit

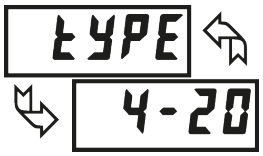
The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit.

11.8. Module 8 - Analog Output Parameters (8-Out)



An analog output card must be installed in order to access this module.

11.8.1. Analog type



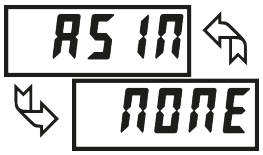
Selection	Range
0-20	0 to 20mA
4-20	4 to 20mA
0-10	0 to 10V

Enter the analog output type. For 0-20mA or 4-20mA, use terminals 18 and 19. For 0-10V, use terminals 16 and 17. Only one range can be used at a time.

11.8.2. Analog assignment

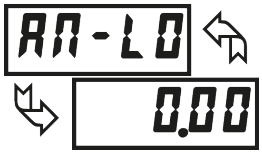
NONE r-EL A-Ab5 b-rEL
b-Ab5 CALC tot HI LO

Enter the source for the analog output to retransmit:



- rEL = Relative (net) Input Value. The Relative Input Value is the Absolute Input Value that includes the Display Offset Value.
- Ab5 = Absolute (gross) Input Value. The Absolute Input Value is based on Module 1 dSP and INP entries.
- CALC = Calculation Value
- tot = Totalizer Value
- LO = Minimum Display Value
- HI = Maximum Display Value

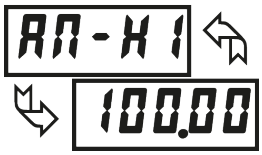
11.8.3. Analog low scale value



-19999 to 99999

Enter the Display Value that corresponds to 0mA (0-20mA), 4mA (4-20mA) or 0VDC (0-10VDC).

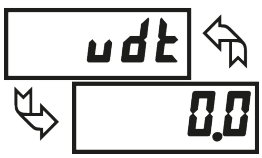
11.8.4. Analog high scale value



-19999 to 99999

Enter the Display Value that corresponds to 20mA (0-20mA), 20mA (4-20mA) or 10VDC (0-10VDC).

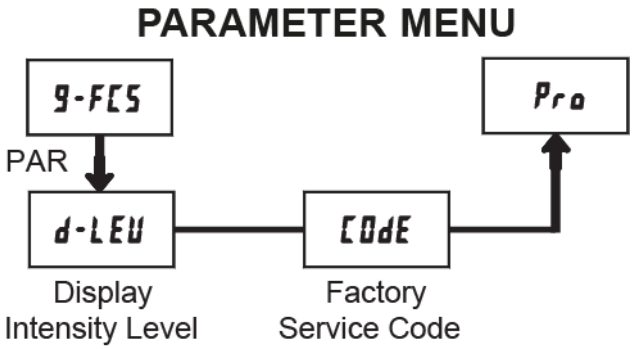
11.8.5. Analog update time



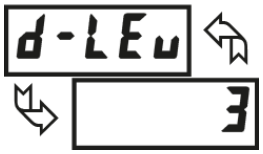
0.0 to 10.0

Enter the analog output update rate in seconds. A value of 0.0 allows the meter to update the analog output at the ADC Conversion rate.

11.9. Module 9 – Factory service operations (9-FCS)

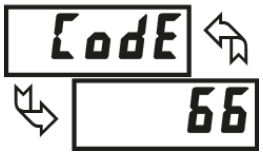


11.9.1. Display intensity level



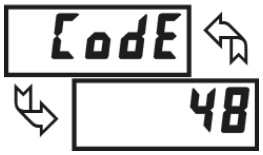
Enter the desired Display Intensity Level (0-15) by using the arrow keys. The display will actively dim or brighten as the levels are changed. This parameter also appears in Quick Programming Mode when enabled.

11.9.2. Restore factory defaults



Use the arrow keys to display **CodE 66** and press **PAR**. The meter will display **rESEt** and then return to **CodE 50**. Press **DSP** key to return to Display Mode. This will overwrite all user settings with the factory settings.

11.9.3. Calibration



The meter has been fully calibrated at the factory. Scaling to convert the input signal to a desired display value is performed in Module 1. If the meter appears to be indicating incorrectly or inaccurately, refer to Troubleshooting before attempting to calibrate the meter.

When recalibration is required (generally every 2 years), it should only be performed by qualified technicians using appropriate equipment. Calibration does not change any user programmed parameters. However, it may affect the accuracy of the input signal values previously stored using the Apply (**APLY**) Scaling Style.

Calibration may be aborted by disconnecting power to the meter before exiting Module 9. In this case, the existing calibration settings remain in effect.

Input Calibration

WARNING: Calibration of this meter requires a signal source with an accuracy of 0.01% or better and an external meter with an accuracy of 0.005% or better.

Before starting, verify that the Input Ranger Jumper is set for the range to be calibrated. Also verify that the precision signal source is connected and ready. Allow a 30 minute warm-up period before calibrating the meter. no and **PAR** can be chosen to exit the calibration mode without any changes taking place.

Then perform the following procedure:

1. Use the arrow keys to display CodE 48 and press **PAR**.
2. Choose the input channel/range to be calibrated by using the arrow keys and press **PAR**.
3. When the zero range limit appears on the display, apply the appropriate:
   - Voltage range: dead short applied
   - Current range: open circuit
4. Press **PAR** and the top range limit will appear on the display after approximately 1 second.
5. With the top range limit on the display, apply the appropriate:
   - Voltage range: 10 VDC
   - Current range: 20 mADC
6. Press **PAR** and CALno will appear on the display after approximately 1 second.
7. When no appears, press **PAR** twice.
8. If the meter is not field scaled, then the input display should match the value of the input signal.
9. Repeat the above procedure for each input range to be calibrated.

Analog output card calibration

Before starting, verify that the precision voltmeter (voltage output) or current meter (current output) is connected and ready. Perform the following procedure:

1. Use the arrow keys to display CodE 48 and press **PAR**.
2. Use the arrow keys to choose OUt and press **PAR**.
3. Using the chart below, step through the five selections to be calibrated. At each prompt, use the PAX arrow keys to adjust the external meter display to match the selection being calibrated. When the external reading matches, or if this range is not being calibrated, press **PAR**.

SELECTION	EXTERNAL METER	ACTION
0.0_A	0.00	Adjust if necessary, press **PAR**
4.0_A	4.00	Adjust if necessary, press **PAR**
20.0_A	20.00	Adjust if necessary, press **PAR**
0.0_u	0.00	Adjust if necessary, press **PAR**
10.0u	10.00	Adjust if necessary, press **PAR**

4. When no appears remove the external meters and press **PAR** twice.

12. TROUBLESHOOTING

PROBLEMS	REMEDIES
NO DISPLAY	CHECK: Power level, power connections
PROGRAM LOCKED-OUT	CHECK: Active (lock-out) user input ENTER: Security access code requested
MAX, MIN, TOT LOCKED-OUT	CHECK: Module 3 programming
INCORRECT INPUT DISPLAY VALUE	CHECK: Module 1 programming, position of the jumper for the input scale, input connections, input signal level, Module 4 Display Offset is zero, DSP is on Input Display PERFORM: Calibration (If the above does not correct the problem.)
"OLOL" in DISPLAY (SIGNAL LOW)	CHECK: Module 1 programming, input connections, position of the jumper for the input scale, input signal level
"ULUL" in DISPLAY (SIGNAL HIGH)	CHECK: Module 1 programming, input connections, position of the jumper for the input scale, input signal level
JITTERY DISPLAY	INCREASE: Module 1 filtering, rounding, input scale CHECK: Wiring is per EMC installation guidelines
MODULES or PARAMETERS NOT ACCESSIBLE	CHECK: Corresponding plug-in card installation
DISPLAY ZERO'S AT LEVELS BELOW 1% OF RANGE	PROGRAM: Module 4 as Hi-t: 0.0 LO-t: 3271.1 (to disable zero chop feature)
ERROR CODE (Err –n) Err -1	PRESS: RST Internal hardware fault: A fault of the microprocessor and/or the input circuit has been detected. Return the DISP-PAXDP for repair.
Err-2	Parameter list memory fault: One or more of set-up parameters has changed value due to possible electrical glitch or loss of power during parameter save operation. (during "End" display) Verify all set-up parameters, exit parameter set-up mode and cycle power the meter to clear error. If the error remains, return meter for repair.
Err-3	Calibration memory fault: Verify calibration accuracy of meter. If out of tolerance, re-calibrate the meter. Otherwise, to clear error, enter and exit parameter set-up mode and cycle power to meter. If the error remains, return meter for repair.
Err-4	Analogue output calibration memory fault: Verify calibration accuracy of analogue output. To clear error, enter and exit parameter set-up mode and cycle power to meter. If the error remains, replace output card.
Err-5	Defective keypad: The meter has detected one of the keypad switches is defective. Inspect keypad for signs of damage or sticking. Cycle power to meter to clear error. If the error remains, return meter for repair.

13. DISP-PAXDP PROGRAMMING QUICK OVERVIEW