DISP-PAXD

1/8 DIN UNIVERSAL DC INPUT PANEL METER

CE

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

1. INTRODUCTION

- Four voltage ranges (300 VDC Max)
- Five current ranges (2 ADC Max)
- Three resistance ranges (10 kΩ Max)
- Selectable 24V, 2V, 1.75mA excitation
- 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 set-point 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-PAXD (Universal DC Input Meter) offers many features and performance capabilities to suit a wide range of industrial applications. The optional plug-in output cards allow the opportunity to configure the meter for present applications, while providing easy upgrades for future needs.

The meter employs a bright 0.56" (14.2 mm) 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 Universal DC Meter has four voltage inputs (±200 mVDC, ±2 VDC, ±20 VDC and ±300 VDC), five current inputs (±200 µADC, ±2 mADC, ±20 mADC, ±200 mADC and ±2 ADC) and three resistance inputs (100 Ω, 1000 Ω and 10 kΩ). He has three different excitations: 24 V, 2 V or 1.75 mA. A 16 point scaling feature compensates for square-law devices and other non-linear process characteristics.

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 set-point outputs, implemented on Plug-in option cards. The Plug-in cards provide dual FORM-C relays (5 A), quad FORM-A (3 A), or either quad sinking or quad sourcing open collector logic outputs. The set-point 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 RS-232, RS-485, Modbus, DeviceNet, Profibus-DP and USB. Readout values and set-point 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 RS-232, RS-485 or USB card installed, it is possible to configure the meter using Windows.

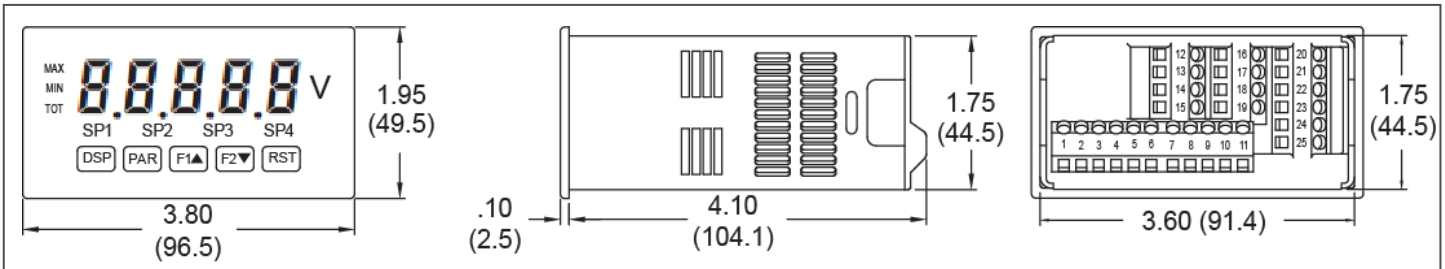
A linear DC output signal is available as an optional Plug-in card. The card provides either 20 mA or 10 V signals. The output can be scaled independent of the input range and can track either the input, totalizer, max or min readings.

Once the meter has been initially configured, the parameter list may be locked out from further modification in its entirety or only the set-point 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" (53.4 mm) H x 5" (127 mm) 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-PAXD): AC Power: 85 to 250 VAC, 50/60 Hz, 15 VA
Isolation: 2300 Vrms for 1 min. to all inputs and outputs.
DC Versions (DISP-PAXD24): DC Power: 11 to 36 VDC, 11 W (Derate operating temperature to 40°C if operating <15 VDC and three plug-in cards are installed)
AC Power: 24 VAC, ±10%, 50/60 Hz, 15 VA
Isolation: 500 Vrms for 1 min. to all inputs and outputs (50 V working).

3.3. Annunciators

MAX - max readout selected
MIN - min. readout selected
TOT - totalizer readout selected, flashes when total overflows
SP1 – set-point alarm 1 is active
SP2 – set-point alarm 2 is active
SP3 – set-point alarm 3 is active
SP4 – set-point alarm 4 is active
Units Label - software controlled 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: 20/readings sec
Step response: 200 msec. max. to within 99% of final readout value (digital filter and internal zero correction disabled)[1]
700 msec. max. (digital filter disabled, internal zero correction enabled)1
Display update rate: 1 to 20 updates/sec
Set-point output on/off delay time: 0.0 to 3275.0 sec
Analog output update rate: 0.0 to 10.0 sec
Max./Min. capture delay time: 0.0 to 3275.0 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

[1] The meter periodically (every 12 seconds) imposes a 500 msec delay to compensate for internal zero drift. If the delay affects applications where step response is critical, it can be defeated. Set the display update to 20/sec to disable. In this case, add a zero error of 0.2% FS to the 24 mV input range over the 0 to 50°C span.

3.8. Input ranges

Input Range	Accuracy [2] (18 to 28°C)	Accuracy[2] (0 to 50°C)	Impedance/ compliance	Max continuous overload	Resolution
±200 µADC	0.03% of reading +0.03 µA	0.12% of reading +0.04 µA	1.11 kΩ	15 mA	10 nA
±2mADC	0.03% of reading +0.3 µA	0.12% of reading +0.4 µA	111 Ω	50 mA	0.1µA
±20mADC	0.03% of reading +3 µA	0.12% of reading +4 µA	11.1 Ω	150 mA	1 µA
±200 mADC	0.05% of reading +30 µA	0.15% of reading +40 µA	1.1 Ω	500 mA	10 µA
±2ADC	0.5% of reading +0.3 mA	0.7% of reading +0.4 mA	0.1 Ω	3 A	0.1 mA
±200 mVDC	0.03% of reading +30 µV	0.12% of reading +40 µV	1.066 MΩ	100 V	10 µV
±2VDC	0.03% of reading +0.3 mV	0.12% of reading +0.4 mV	1.066 MΩ	300 V	0.1 mV
±20VDC	0.03% of reading +3 mV	0.12% of reading +4 mV	1.066MΩ	300 V	1 mV
±300VDC	0.05% of reading +30 mV	0.15% of reading +40 mV	1.066 MΩ	300 V	10 mV
100Ω	0.05% of reading +30 mΩ	0.2% of reading +40 mΩ	0.175 V	30 V	0.01 Ω
1000Ω	0.05% of reading +0.3 Ω	0.2% of reading +0.4 Ω	1.75 V	30 V	0.1 Ω
100Ω	0.05% of reading +1 Ω	0.2% of reading +1.5 Ω	17.5 V	30 V	1 Ω

3.9. Excitation power

Transmitter power: 24 VDC, ±5%, regulated, 50 mA max.
Reference Voltage: 2 VDC, ±2%
Compliance: 1 kΩ load min. (2 mA max.)
Temperature coefficient: 40 ppm/°C max.
Reference Current: 1.75 mADC, ± 2%
Compliance: 10 kΩ load max.
Temperature coefficient: 40 ppm/°C max.

3.10. Low frequency noise rejection

Normal Mode: > 60 dB @ 50 or 60 Hz ±1%, digital filter off
Common Mode: >100 dB, DC to 120 Hz (w.r.t. earth)

3.11. User inputs (logic level)

Three programmable user inputs, jumper selectable for sink/source logic
Max. Continuous Input: 30 VDC
Isolation to sensor input common: Not isolated
Response Time: 50 msec. max.
Logic State: Jumper selectable for sink/source logic.

Input state	Sinking inputs 22 kΩ pull-up to +5 V	Sourcing inputs 22 kΩ pull-down
Active	V_{IN} < 0.7 VDC	V_{IN} > 2.5 VDC
Inactive	V_{IN} > 2.5 VDC	V_{IN} < 0.7 VDC

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.

3.15. Certifications and compliances

UL Recognized Component, File #E179259, UL61010A-1, CSA C22.2 No. 61010-1
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 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 I
IP65 Enclosure rating (Face only), IEC 529
IP20 Enclosure rating (Rear of unit), IEC 529

3.16. Electromagnetic compatibility

Emissions and Immunity to EN 61326:2006: Electrical Equipment for Measurement, Control and Laboratory use.
Immunity to industrial locations

Electrostatic discharge	EN 61000-4-2	Criterion A 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A* 10 V/m (80MHz to 1G Hz) 3 V/m (1.4 GHz to 2 GHz) 1 V/m (2 GHz to 2.7 GHz)

[2] After 20 minutes 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.

Fast transients (burst)	EN 61000-4-4	Criterion B 2 kV power 1 kV I/O signal 2 kV I/O signal connected to power
Surge	EN 61000-4-5	Criterion A
power		3 kV
signal		1 kV
RF conducted interference	EN 61000-4-6	Criterion A 3 Vrms
Power freq. magnetic fields	EN 61000-4-8	Criterion A 30 A/m
AC power	EN61000-4-11	
Voltage dip		Criterion A 0% during 1 cycle 40% during 10/12 cycle 70% during 25/30 cycle
Short interruptions		Criterion C 0% during 250/300 cycles

Emissions

Emissions	EN 55011	Class A

Criterion A: Normal operation within specified limits.
Criterion B: Temporary loss of performance from which the unit self recovers.
Criterion C: Temporary loss of function where system reset occurs.
* Self-recoverable loss of performance during EMI disturbance at 10 V/m :

- Measurement input and/or analog output signal may deviate during EMI disturbance.

For operation without loss of performance:

- Unit is mounted in a metal enclosure (Buckeye SM7013-0 or equivalent)
- I/O and power cables are routed in metal conduit connected to earth ground.

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)
Vibration According to IEC 68-2-6: Operational 5 to 150 Hz, in X, Y, Z direction for 1.5 hours, 2 g.
Shock According to IEC 68-2-27: Operational 25 g (10 g relay), 11 msec in 3 directions.
Storage Temperature Range: -40 to 60°C
Operating and Storage Humidity: 0 to 85% max. RH non-condensing
Altitude: Up to 2000 meters

3.1. Connections

High compression cage-clamp terminal block
Wire Strip Length: 0.3" (7.5 mm)
Wire Gage: 30-14 AWG copper wire
Torque: 4.5 inch-lbs (0.51 N·m) max.

3.1. 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.

3.1. Weight

10.4 oz. (295 g)

4. ORDERING INFORMATION

TYPE	MODEL NO.	DESCRIPTION	PART NUMBER
Meter	DISP-PAXD	Universal DC Input Panel Meter, Upgradeable, 85…280 VAC Powered	DISP-PAXD
		Universal DC Input Panel Meter, Upgradeable, 10…30 VDC/24 VAC Powered	DISP-PAXD24
Optional Plug-in Cards	CARD-CDS	Dual Set-point Relay Output Card	CARD-CDS-10
		Quad Set-point Relay Output Card	CARD-CDS-20
		Quad Set-point Sinking Open Collector Output Card	CARD-CDS-30
		Quad Set-point Sourcing Open Collector Output Card	CARD-CDS-40
	CARD-CDC	RS-485 Serial Communications Card	CARD-CDC-10
		RS-232 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-PAXD 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 Set-point 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-PAXD. Only one of these cards can be installed at a time. When programming the unit the RS-232, RS-485, or USB Cards must be used.

CARD-CDC10 – RS-485 Serial
CARD-CDC20 – RS-232 Serial
CARD-CDC30 - DeviceNet
CARD-CDC40 - Modbus
CARD-CDC50 - Profibus-DP
CARD-PAX-USB - USB (Mini B)

5.1.1. *Serial communications card*

Type: RS-485 or RS-232
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 (RS-485)
Transmit Delay: Selectable for 2 to 50 msec or 50 to 100 msec (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: RS-485; 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. Set-point cards (CARD-CDS)

The DISP-PAXD has 4 available set-point 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 @ 120/240 VAC or 28 VDC (resistive load), 1/8 HP @120 VAC, 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 @ 240 VAC or 30 VDC (resistive load), 1/10 HP @120 VAC, inductive load.
- Total current with all four relays energized not to exceed 4 amps

Life Expectancy: 100 K 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: 100 mA max @ VSAT = 0.7 V max VMAX=30 V

5.2.4. *Quad sourcing open connector card*

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

5.2.5. *All four set-point card*

Response Time:

- 200 msec. max. to within 99% of final readout value (digital filter and internal zero correction disabled)
- 700 msec. 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 20 mA, 4 to 20 mA or 0 to 10 VDC
Accuracy: 0.17%FS (18 to 28°C); 0.4%FS (0 to 50 °C)
Resolution: 1/3500
Compliance:

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

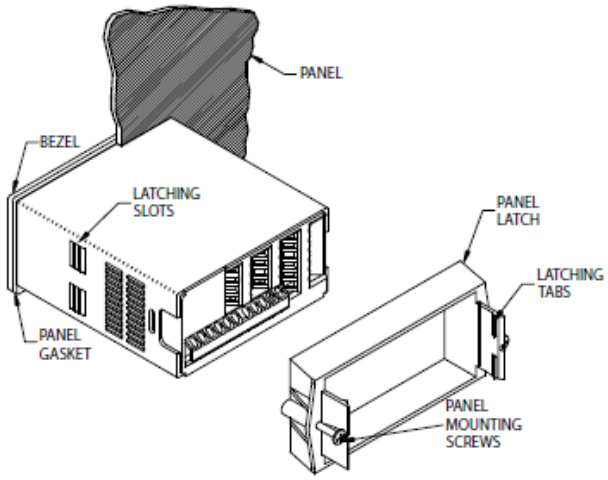
Update time:

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

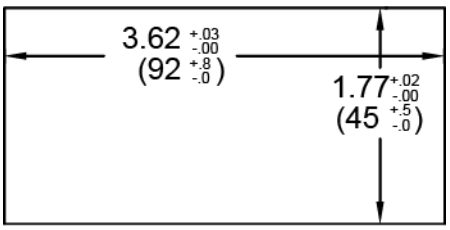
6. INSTALLING THE METER

6.1. Installation

The DISP-PAXD 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.



PANEL CUT-OUT

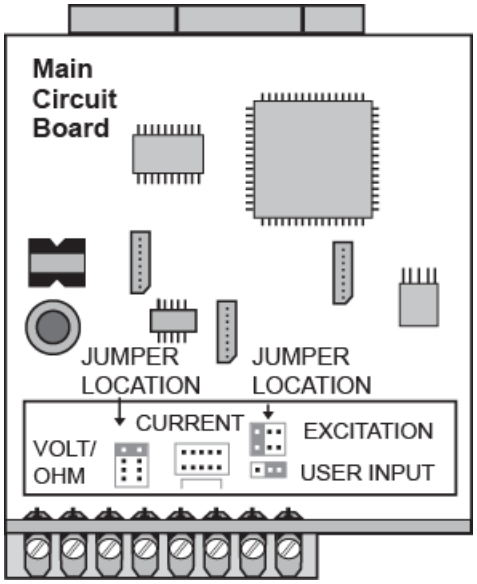


While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug 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 Range Jumper

This jumper is used to select the proper input range. The input range selected in programming must match the jumper setting. Select a range that is high enough to accommodate the maximum input to avoid overloads. See the Jumper Selection Figure for appropriate meter. ONLY ONE JUMPER IS ALLOWED IN THIS AREA. Do not have a jumper in both the voltage and current ranges at the same time. Avoid placing the jumper across two ranges.

7.2. Excitation Output Jumper

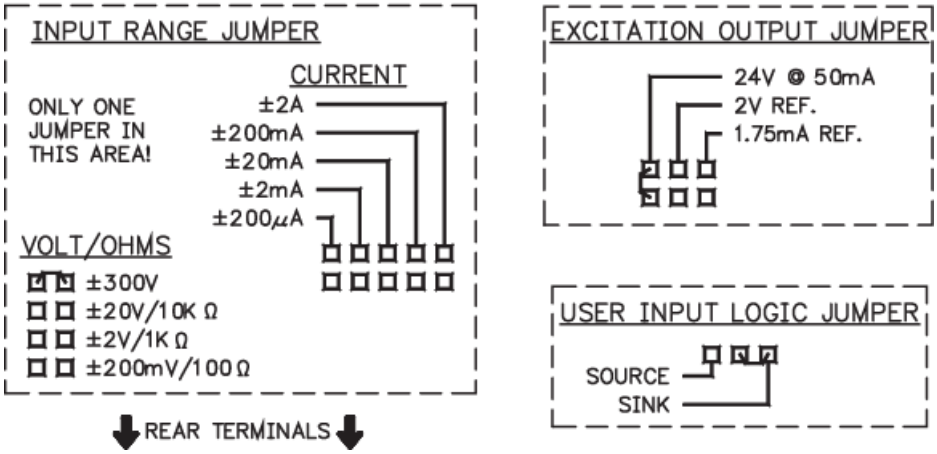
If your meter has excitation, this jumper is used to select the excitation range for the application. If excitation is not being used, it is not necessary to check or move this jumper.

7.3. User Input Logic Jumper

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

JUMPER SELECTIONS

The ⌐¬ indicates factory setting.

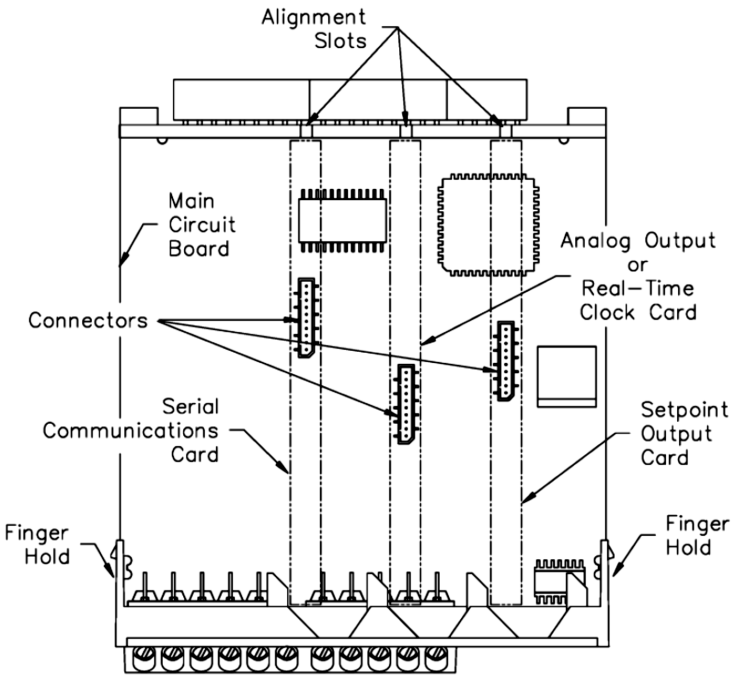


8. INSTALLING AN OPTION CARD

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
   - TDK # ZCAT3035-1330A
   - Steward #28B2029-0A0

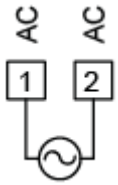
   Line Filters for input power cables:
   - Schaffner # FN610-1/07
   - Schaffner # FN670-1.8/07
   - Corcom #1VR3

   Note: Reference manufacturer's instructions when installing a line filter.

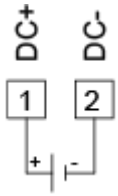
7. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
8. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.

9.3. Power wiring

AC Power
Terminal 1: VAC
Terminal 2: VAC



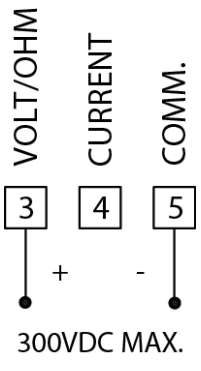
DC Power
Terminal 1: +VDC
Terminal 2: -VDC



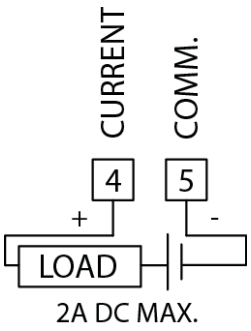
9.4. Input signal wiring

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

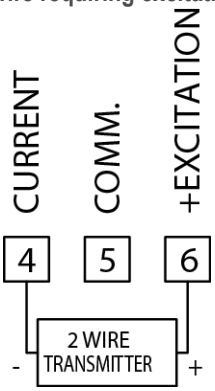
Voltage signal (self-powered)



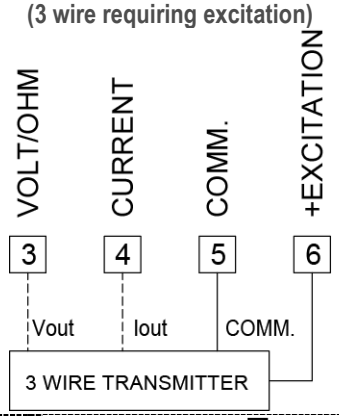
Current signal (self-powered)



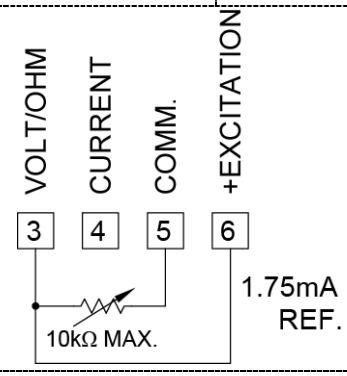
Current signal (2 wire requiring excitation)



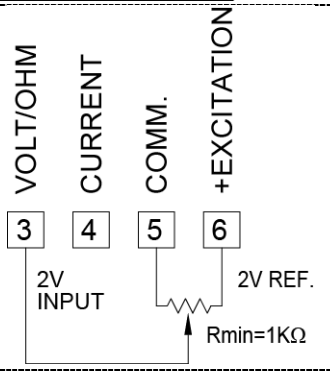
Current signal / Voltage signal (3 wire requiring excitation)



Resistance Signal (3 wire requiring excitation)



Potentiometer Signal (3 wire requiring excitation)

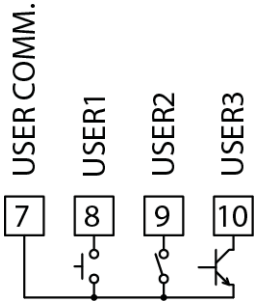


9.5. User input wiring

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.

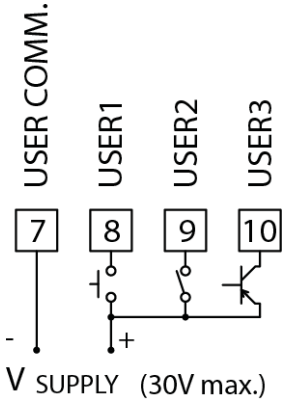
Sinking Logic

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

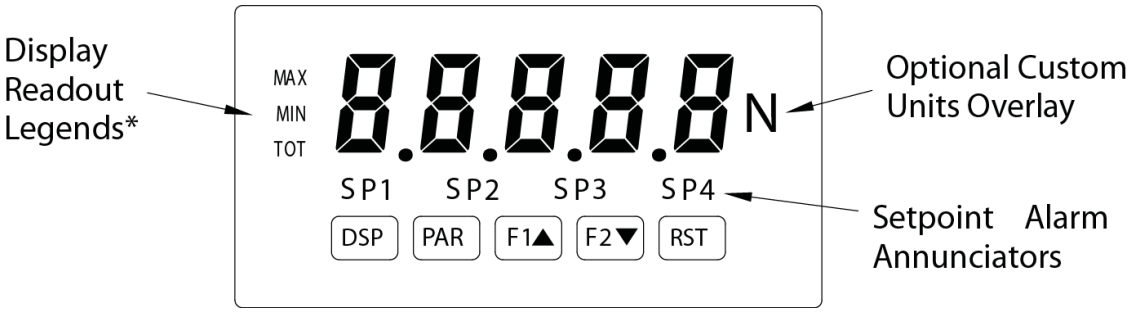


Sourcing Logic

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



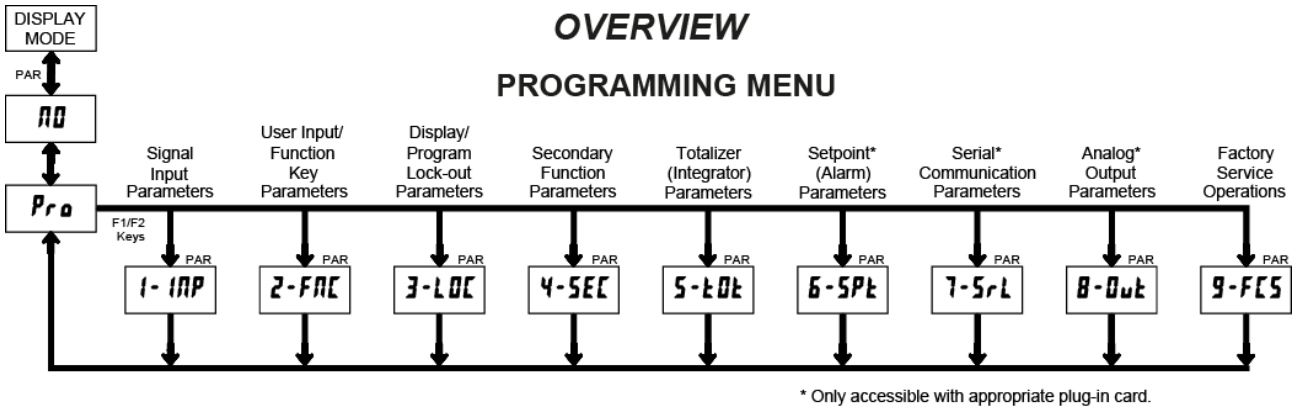
10. REVIEWING THE FRONT BUTTONS AND DISPLAY



KEY	DISPLAY MODE OPERATION	PROGRAMMING MODE OPERATION
DSP	Index display through max/min/total/input readouts	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

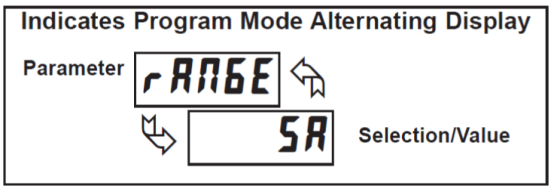
The meter normally operates in the Display Mode. In this mode, the meter displays can be viewed consecutively by pressing the DSP key. The annunciators to the left of the display indicate which display is currently shown; Max Value (MAX), Min Value (MIN), or Totalizer Value (TOT). Each of these displays can be locked from view through programming. (See Module 3) The Input Display Value is shown with no annunciator.

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.

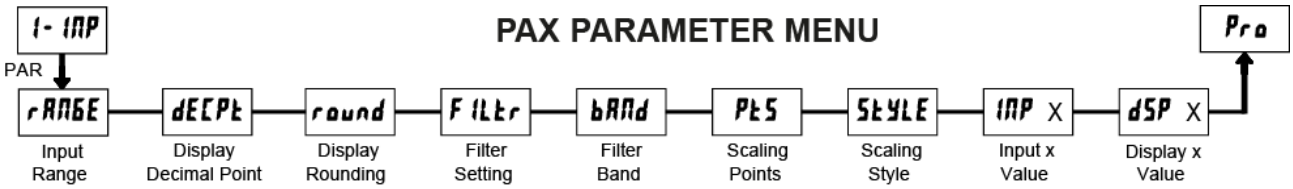
Numerical value entry (arrow, RST & PAR keys)

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 excited 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-IMP)



11.1.1. Input range

Selection	Range resolution	Selection	Range resolution
200uA	±200.00 µA	2u	±2.0000 V
0.002A	±2.0000 mA	20u	±20.000 V
0.02A	±20.000 mA	300u	±300.00 V
0.2A	±200.00 mA	100o	±100.00 Ω
2A	±2.0000 A	1000o	±1000.0 Ω
0.2u	±200.00 mV	10Ko	±10000 Ω

Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

11.1.2. Display decimal point

0 0 0.0 0.00 0.000 0.0000

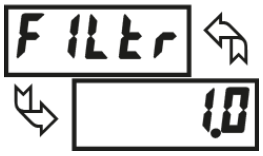
Select the decimal point location for the Input, **MAX** and **MIN** displays. (The **TOT** display decimal point is a separate parameter.) This selection also affects Round and dSPx parameters and set-point values.

11.1.3. 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, set-point values, etc.) are not automatically adjusted to this display rounding selection.

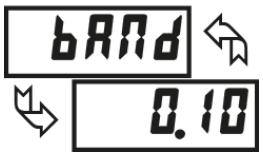
11.1.4. Filter setting



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.

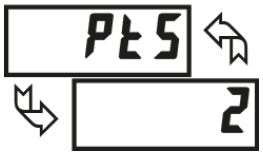
11.1.5. Filter band



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.

11.1.6. Scaling points



2 to 16

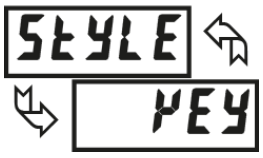
Linear - Scaling Points (2)

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).

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.

11.1.7. *Scaling style*

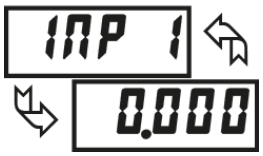


KEY Key-in data
APLY Apply signal

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.

11.1.8. *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. With 0.02A Input Range, 4mA would be entered as 4.000. 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.

*Note: APLY style - Pressing the **RST** key will advance the display to the next scaling display point without storing the input value.*

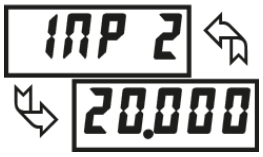
11.1.9. *Display value for scaling point 1*

-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.

11.1.10. *Input value for scaling point 2*

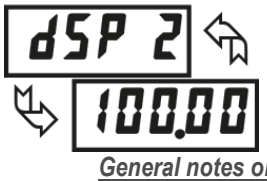
-19999 to **99999**



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.)

11.1.11. *Display value for scaling point 2*

-19999 to **99999**



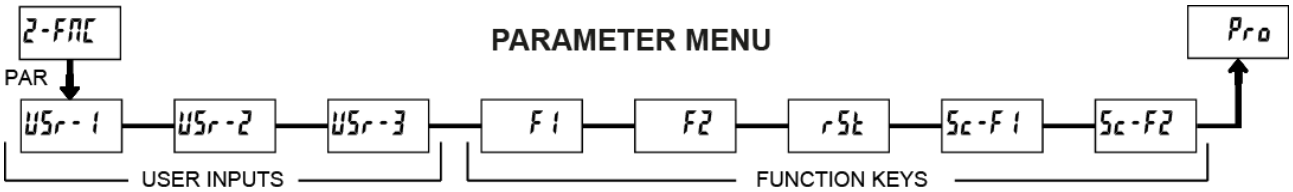
Enter the second coordinating Display Value by using the arrow keys. This is the same for KEY and APLY scaling styles. (Follow the same procedure if using more than 2 scaling points.)

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: 20 mA 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: 0 mA and 20 mA 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 +20 mA range the maximum +20 mA can be scaled to is 32767 with 0 mA 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 -20 mA even if it is not used. With Display Rounding of 2, +20 mA can be scaled for 65535 (32767 x 2) but with even Input Display values shown.

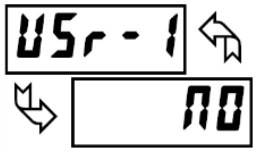
5. For input levels beyond the first programmed Input Value, the meter extends the Display Value by calculating the slope from the first two coordinate pairs (INP 1/dSP 1 & INP2/dSP2). If INP 1=4 mA and dSP 1=0, then 0 mA would be some negative Display Value. This could be prevented by making INP 1=0 mA/dSP 1=0, INP2=4 mA/dSP2=0, with INP3=20 mA/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)

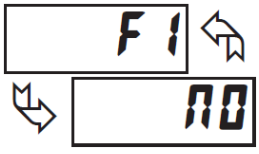


The three user inputs are individually programmable to perform specific meter control functions. While in the Display Mode or Program Mode, the function is executed the instant the user input transitions to the active state.
The front panel function keys are also individually programmable to perform specific meter control functions. While in the Display Mode, 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 three user inputs. F 1 will represent all five function keys.

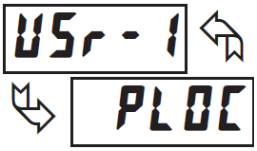
11.2.1. No function



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.

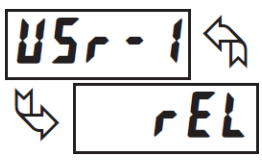


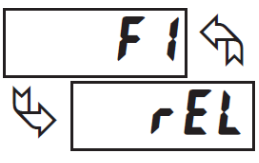
11.2.2. Programming Lock-Out



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

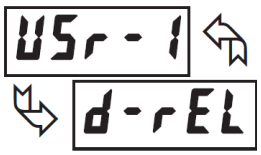
11.2.3. Zero (tare) display





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

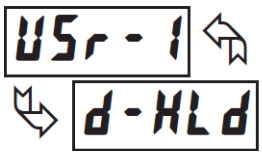
11.2.4. Relative/absolute display



This function will switch the Input Display between Relative and Absolute. The Relative is a net value that includes the Display Offset Value. The Input Display will normally show the Relative unless switched by this function. Regardless of the display selected, all meter functions continue to operate based on relative values. The Absolute is a gross value (based on Module 1 **DSP** and **INP** entries) without the Display Offset Value. The

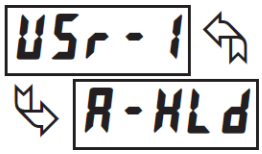
Absolute display is selected as long as the user input is activated (maintained action) or at the transition of the function key (momentary action). When the user input is released, or the function key is pressed again, the input display switches back to Relative display. AbS (absolute) or rEL (relative)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

11.2.5. Hold display



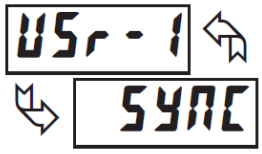
The shown display is held but all other meter functions continue as long as activated (maintained action).

11.2.6. Hold all functions



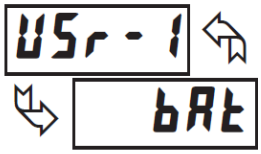
The meter disables processing the input, holds all display contents, and locks the state of all outputs as long as activated (maintained action). The serial port continues data transfer.

11.2.7. Synchronize meter reading

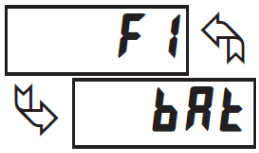


The meter suspends all functions as long as activated (maintained action). When the user input is released, the meter synchronizes the restart of the A/D with other processes or timing events.

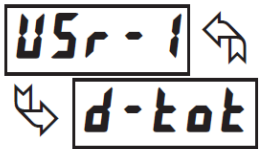
11.2.8. Store batch reading in totalizer



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.

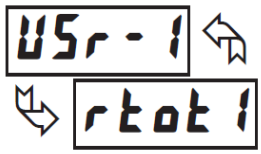


11.2.9. Select totalizer display

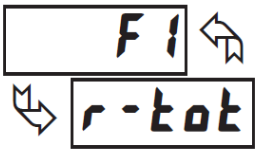


The Totalizer display is selected as long as activated (maintained action). When the user input is released, the Input Display is returned. The **DSP** key overrides the active user input. The Totalizer continues to function including associated outputs independent of being displayed.

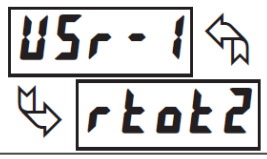
11.2.10. Reset totalizer



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.

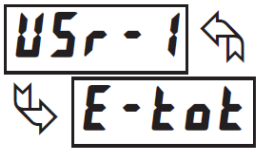


11.2.11. Reset and enable totalizer



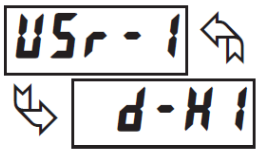
When activated (momentary action), rESEt flashes and the Totalizer resets to zero. The Totalizer continues to operate while active (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

11.2.12. 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.

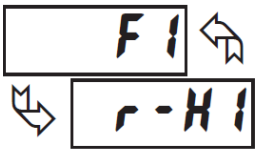
11.2.13. Select maximum display



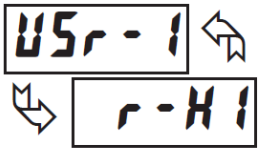
The Maximum display is selected as long as activated (maintained action). When the user input is released, the Input Display returns. The **DSP** key overrides the active user input. The Maximum continues to function independent of being displayed.

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.

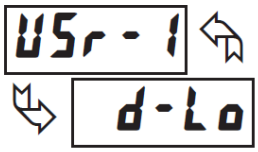


11.2.15. Reset, select, enable maximum display



When activated (momentary action), the Maximum value is set to the present Input Display value. Maximum continues from that value while active (maintained action). When the user input is released, Maximum detection stops and holds its value. This selection functions independent of the selected display. The **DSP** key overrides the active user input display but not the Maximum function.

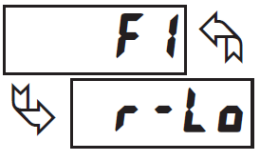
11.2.16. Select minimum display



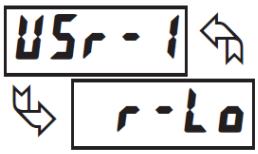
The Minimum display is selected as long as activated (maintained action). When the user input is released, the Input Display is returned. The **DSP** key overrides the active user input. The Minimum continues to function independent of being displayed.

11.2.17. 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.

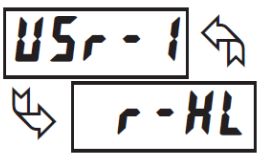


11.2.18. Reset, select, enable minimum display

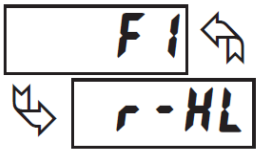


When activated (momentary action), the Minimum value is set to the present Input Display value. Minimum continues from that value while active (maintained action). When the user input is released, Minimum detection stops and holds its value. This selection functions independent of the selected display. The **DSP** key overrides the active user input display but not the Minimum function.

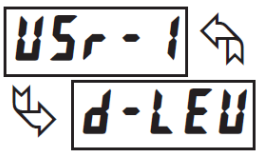
11.2.19. Reset maximum and minimum



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.



11.2.20. *Change display intensity level*



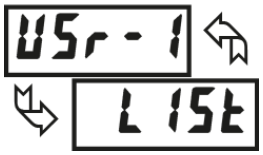
When activated (momentary action), the display intensity changes to the next intensity level (of 4). The four levels correspond to Display Intensity Level (d-LEu) settings of 0, 3, 8, and 15. The intensity level, when changed via the User Input/ Function Key, is not retained at power-down, unless Quick Programming or Full Programming mode is entered and exited. The meter will power-up at the last saved intensity level.

11.2.21. *Set-point selection*

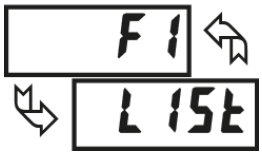
The following selections are accessible only with the Set-point plug-in card installed. Refer to the card's manual for an explanation of their operation.

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

11.2.22. *Select set-point list*

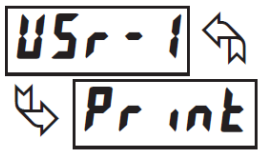


Two lists of values are available for SP-1, SP-2, SP-3, SP-4. The two lists are named LSt-A and LSt-b. If a user input is used to select the list then LSt-A is selected when the user input is not active and LSt-b is selected when the user input is active (maintained action). If a front panel key is used 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.

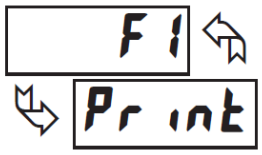


To program the values for LSt-A and LSt-b, first complete the programming of all the parameters. Exit programming and switch to the other list. Re-enter programming and enter the values for SP-1, SP-2, SP-3, SP-4. If any other parameters are changed then the other list values must be reprogrammed.

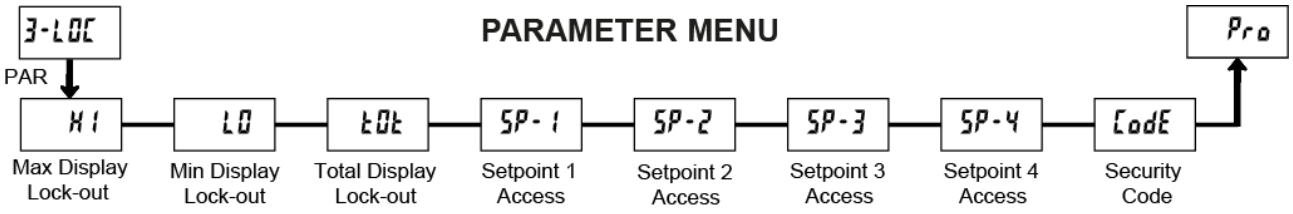
11.2.23. *Print request*



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 Display lock-out and "Full" and "Quick" Program lock-out.

When in the Display Mode, the available displays can be read consecutively by repeatedly pressing the **DSP** key. An annunciator indicates the display being shown. These displays can be locked from being visible. It is recommended that the display be set to LOC when the corresponding function is not used.

SELECTION	DESCRIPTION
rEd	Visible in display mode
LOC	Not visible in display mode

"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 set-point values can still be read and/or changed per the selections below. The Display Intensity Level (d-LEU) parameter also appears whenever Quick Programming Mode is enabled and the security code is greater than zero.

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

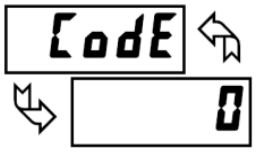
11.3.1. *Maximum, minimum and totalizer display lock-out*

These displays can be programmed for LOC or rEd. When programmed for LOC, the display will not be shown when the **DSP** key is pressed regardless of Program Lock-out status. It is suggested to lock-out the display if it is not needed. The associated function will continue to operate even if its display is locked-out.

11.3.2. *SP-1 SP-2 SP-3 SP-4 set-point access*

The set-point displays can be programmed for LOC, rEd or EnE (See the following table). Accessible only with the Set-point plug-in card installed.

11.3.3. *Program mode security code*



2 to 250

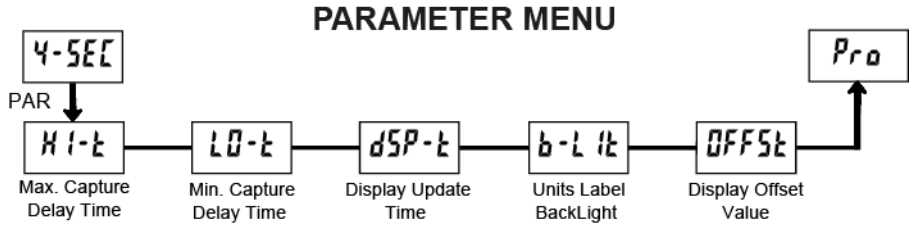
By entering any non-zero value, the prompt CodE 0 will appear when trying to access the Program Mode. Access will only be allowed after entering a matching security code or universal code of 222. With this lock-out, a user input would not have to be configured for Program Lock-out. However, this lock-out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

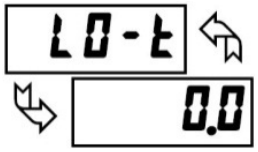


11.4.1. *Max capture delay time*

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.

11.4.2. *Min capture delay time*



0.0 to **3275.0** sec

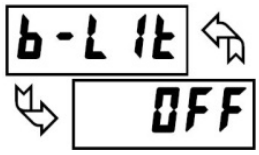
When the Input Display is below the present MIN value for the entered delay time, the meter will capture that display value as the new MIN reading. A delay time helps to avoid false captures of sudden short spikes.

11.4.3. *Display update rate*

1 **2** **5** **10** **20** Updates/sec

This parameter determines the rate of display update. When set to 20 updates/second, the internal re-zero compensation is disabled, allowing for the fastest possible output response.

11.4.4. *Unites label backlight*



On **OFF**

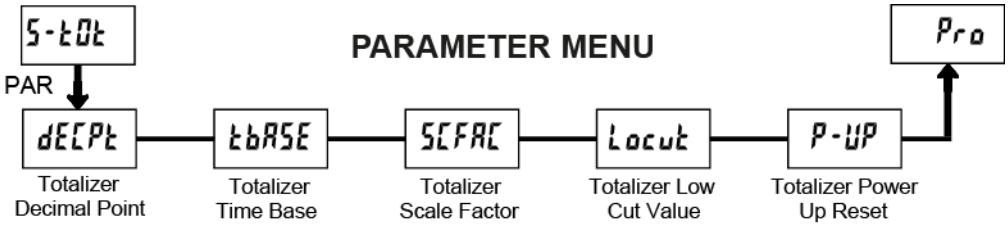
The Units Label Kit Accessory contains a sheet of custom unit overlays which can be installed in to the meter's bezel display assembly. The backlight for these custom units is activated by this parameter.

11.4.5. *Display offset value*

-19999 to **19999**

Unless a Zero Display was performed or an offset from Module 1 scaling is desired, this parameter can be skipped. The Display Offset Value is the difference from the Absolute (gross) Display value to 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.

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



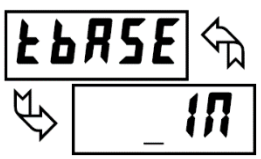
The totalizer accumulates (integrates) the Input Display value using one of two modes. The first is using a time base. This can be used to compute a time temperature product. The second is through a user input or function key programmed for Batch (one time add on demand). This can be used to provide 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 decimal point*

0 **0.0** **0.00** **0.000** **0.0000**

For most applications, this matches the Input Display Decimal Point (**dECPt**). If a different location is desired, refer to Totalizer Scale Factor.

11.5.2. *Totalizer time base*

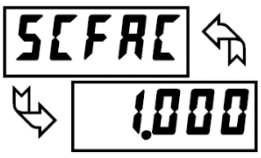


SEC seconds (÷1)
_in minutes (÷60)
hour hours (÷3600)
dAY days (÷86400)

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.

11.5.3. Totalizer scale factor

0.000 to 65.000



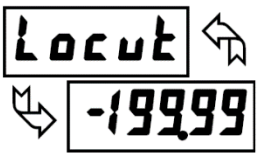
For most applications, the Totalizer reflects the same decimal point location and engineering units as the Input Display. In these cases, the Totalizer Scale Factor is 1.000. The Totalizer Scale Factor can be used to scale the Totalizer to a different value than the Input Display. Common possibilities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

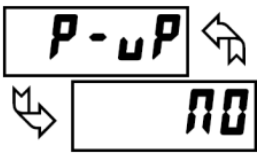
11.5.4. Totalizer low cut value

-19999 to 99999



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

11.5.5. 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.

11.5.6. Totalizer high order display

When the total exceeds 5 digits, the front panel annunciator TOT flashes. 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. When the total exceeds a 9 digit value, the Totalizer will show "E ..." and will stop.

11.5.7. Totalizer batching

The Totalizer Time Base and scale factor are overridden when a user input or function key is programmed for store batch (bAt). 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.

11.5.8. 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

11.5.9. 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	
TOTALIZER dECPt	SCALE FACTOR
0.0	10
0	1
x10	0.1
x100	0.01
x1000	0.001

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

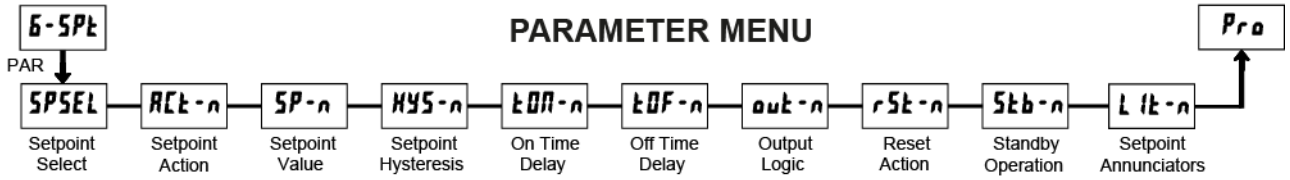
Input (dECPt)=0.00	
TOTALIZER dECPt	SCALE FACTOR
0.000	10
0.00	1
0.0	0.1
0	0.01
x10	0.001

(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 – Set-point (Alarm) parameters (6-SPt)

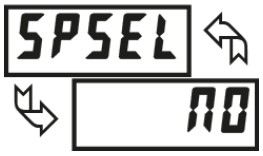


A set-point card must be installed in order to access this module.

Depending on the card installed, there will be two or four set-point outputs available. For maximum input frequency, unused Set-points should be configured for OFF action.

The set-point assignment and the set-point action determine certain set-point feature availability.

11.6.1. *Set-point selection*



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

Enter the set-point (alarm output) to be programmed. The n in the following parameters will reflect the chosen set-point number. After the chosen set-point is completely programmed, the display will return to SPSEL no. Repeat step for each set-point to be programmed. The no chosen at SPSEL will return to PAR no. The number of set-points available is set-point output card dependent.

11.6.2. *Set-point action*

OFF Ab-HI Ab-LO AU-HI AU-LO
dE-HI dE-LO bAnd totLo totHI

Enter the action for the selected set-point (alarm output). See Set-point Alarm Figures for a visual detail of each action.

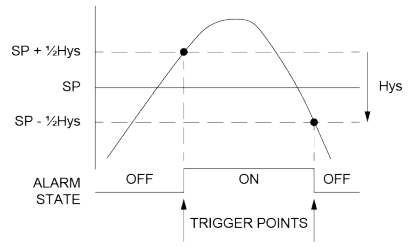
OFF	=	Set-point always off, (returns to SPSEL no)
Ab-HI	=	Absolute high, with balanced hysteresis
Ab-LO	=	Absolute low, with balanced hysteresis
AU-HI	=	Absolute high, with unbalanced hysteresis
AU-LO	=	Absolute low, with unbalanced hysteresis
dE-HI	=	Deviation high, with unbalanced hysteresis *
dE-LO	=	Deviation low, with unbalanced hysteresis *
bAnd	=	Outside band, with unbalanced hysteresis *
totLo	=	Lower Totalizer absolute high, unbalance hysteresis**
totHI	=	Upper Totalizer absolute high, unbalance hysteresis**

* Deviation and band action set-points are relative to the value of set-point 1. It is not possible to configure set-point 1 as deviation or band actions. It is possible to use set-point 1 for an absolute action, while its value is being used for deviation or band.

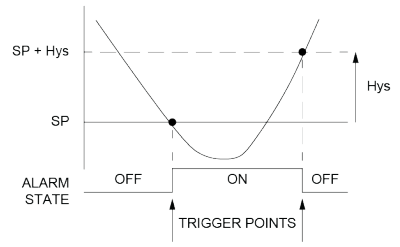
** The lower Totalizer action totLo allows set-points to function off of the lower 5 digits of the Totalizer. The upper Totalizer action totHi allows set-points to function off of the upper 4 digits of the Totalizer. To obtain absolute low alarms for the Totalizer, program the totLo or totHi output logic as reverse.

11.6.2.1. Set-point Alarm Figures

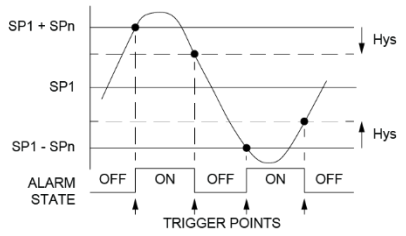
With reverse output logic **rEu**, the below alarm states are opposite.



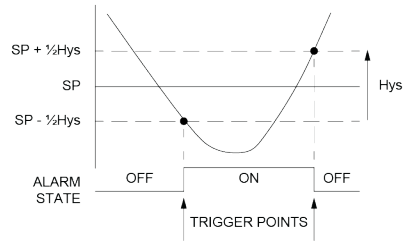
Absolute High Acting (Balanced Hys) = **Rb-H I**



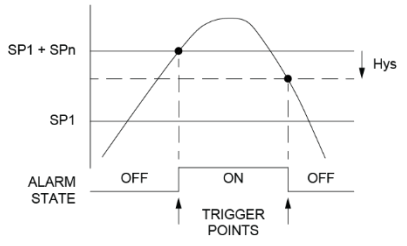
Absolute Low Acting (Unbalanced Hys) = **AU-Lo**



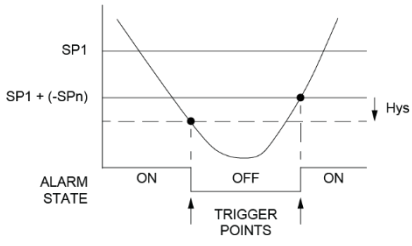
Band Outside Acting = **bAnd**



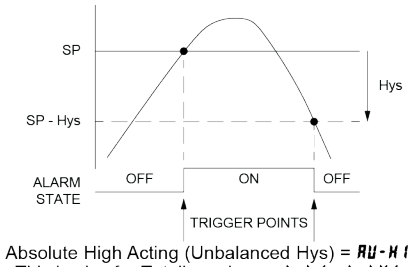
Absolute Low Acting (Balanced Hys) = **Rb-Lo**



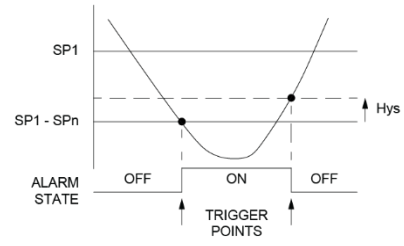
Deviation High Acting (SP > 0) = **dE-H I**



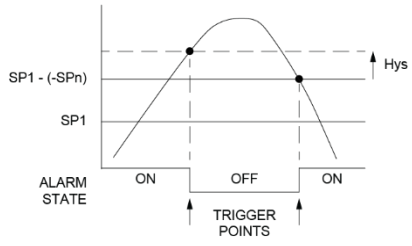
Deviation High Acting (SP < 0) = **dE-H I**



Absolute High Acting (Unbalanced Hys) = **AU-H I**
This is also for Totalizer alarms: **tot Lo**, **totH I**



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



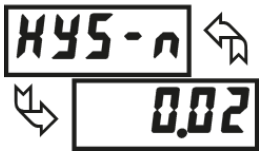
Deviation Low Acting (SP < 0) = **dE-Lo**

11.6.3. Set-point value

-19999 to **99999**

Enter desired set-point alarm value. These set-point values can also be entered in the Display Mode during Program Lock-out when the set-point is programmed as **Ent** in Parameter Module 3. When a set-point 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**.

11.6.4. Hysteresis value

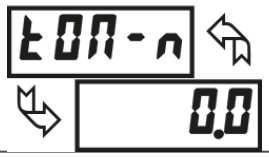


1 to **65000**

Enter desired hysteresis value. See Set-point Alarm Figures for visual explanation of how set-point alarm actions (balance and unbalance) are affected by the hysteresis. When the set-point 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 set-points and functions on the high side for low acting set-points.

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

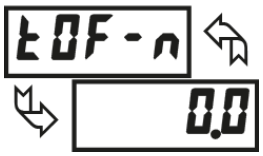
11.6.5. On time delay



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.

11.6.6. *Off time delay*



0.0 to **3275.0** sec

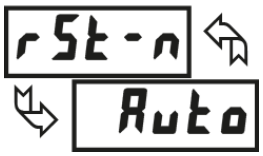
Enter the time value in seconds that the alarm is delayed from turning off after the trigger point is reached. A value of 0.0 allows the meter to update the alarm status per the response time listed in the Specifications. When the output logic is **rEu**, this becomes on time delay. Any time accumulated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

11.6.7. *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 Set-point Alarm Figures are reversed.

11.6.8. *Reset action*



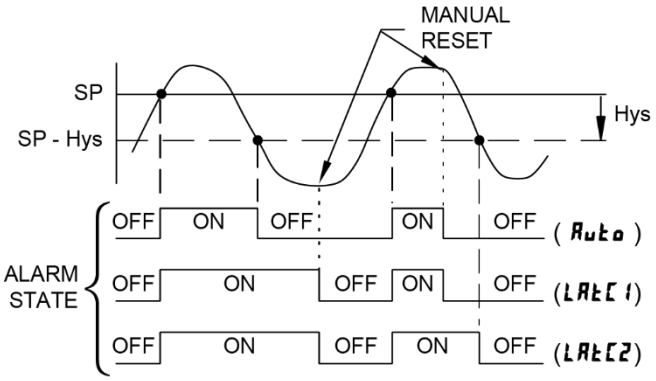
Auto **LAtC1** **LAtC2**

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 Set-point Action shown in Set-point 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.

LAtC1 = Latch with immediate reset action; This action latches the alarm output on at the trigger point per the Set-point Action shown in Set-point 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 set-point value.)

LAtC2 = Latch with delay reset action; This action latches the alarm output on at the trigger point per the Set-point Action shown in Set-point 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 set-point value. During a power cycle, the meter erases a previous Latch 2 reset if it is not activated at power up.)



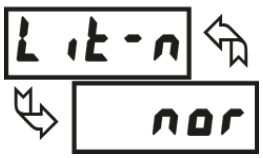
Setpoint Alarm Reset Actions

11.6.9. 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 Set-point Action and Reset Mode.

11.6.10. Set-point annunciators



OFF nor rEu FLASH

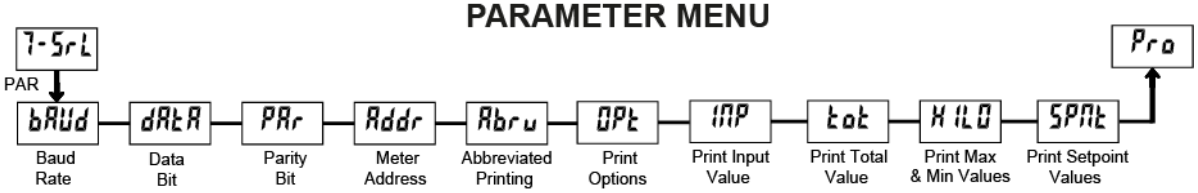
The OFF mode disables display set-point annunciators. The nor mode displays the corresponding set-point annunciators of "on" alarm outputs. The rEu mode displays the corresponding set-point annunciators of "off" alarms outputs. The FLASH mode flashes the corresponding set-point annunciators of "on" alarm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

11.6.11. Alternate Set-points

An Alternate list of set-point values can be stored and recalled as needed. The Alternate list allows an additional set of set-point values. (The set-point 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.

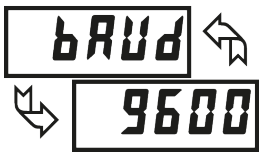
11.7. Module 7 – Serial communications parameters (7-SrL)

PARAMETER MENU



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

11.7.1. Baud rate



300 600 1200 2400 4800 9600 19200

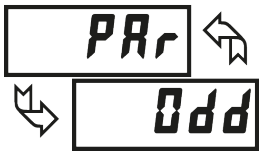
Set the baud rate to match that of other serial communications equipment. Normally, the baud rate is set to the highest value that all of the serial communications equipment is capable of transmitting.

11.7.2. Data bit

7 8

Select either 7 or 8 bit data word lengths. Set the word length to match that of other serial communication equipment. Since the meter receives and transmits 7-bit ASCII encoded data, 7 bit word length is sufficient to request and receive data from the meter.

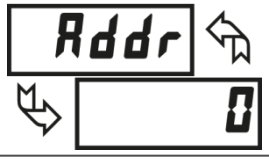
11.7.3. Parity bit



Odd EVEN no

Set the parity bit to match that of the other serial communications equipment used. 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 the meter transmits and receives data with 2 stop bits. (For example: 10 bit frame with mark parity)

11.7.4. Meter address



0 to 99

Enter the serial node address. With a single unit on a bus, an address is not needed and a value of zero can be used (RS-232 applications). Otherwise, with multiple bussed units, a unique address number must be assigned to each meter. The node address applies specifically to RS-485 applications.

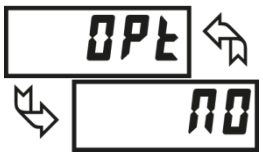
11.7.5. *Abbreviated printing*

YES NO

Select abbreviated transmissions (numeric only) or full field transmission. When the data from the meter is sent directly to a terminal for display, the extra characters that are sent identify the nature of the meter parameter displayed. In this case, select NO. When the data from the meter goes to a computer, it may be desirable to suppress the node address and mnemonic when transmitting. In this case, set this parameter to YES.

11.7.6. *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 to disable the parameter.

Input Value	InP	YES	NO
Max and Min Values	hILO	YES	NO
Total Value	tot	YES	NO
Set-point values*	SPnt	YES	NO

*Set-points 1-4 are set-point plug-in card dependent.

11.7.7. *Sending 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 $.

11.7.7.1. 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.

11.7.7.2. 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 2 or 3 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 optional 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 a register 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.

11.7.7.3. Register indentification chart

ID	VALUE DESCRIPTION	REGISTER ID	APPLICABLE COMMANDS/COMMENTS	
A	Input	INP	T, P, R	(Reset command [Ver2.5+] zeros the input ["REL" or Tare])
B	Total	TOT	T, P, R	(Reset command resets total to zero)
C	Max input	MAX	T, P, R	(Reset command resets MAX to current reading)
D	Min input	MIN	T, P, R	(Reset command resets MIN to current reading)
E	Set-point 1	SP1	T, P, V, R	(Reset command resets the set-point output)
F	Set-point 2	SP2	T, P, V, R	(Reset command resets the set-point output)
G	Set-point 3	SP3	T, P, V, R	(Reset command resets the set-point output)
H	Set-point 4	SP4	T, P, V, R	(Reset command resets the set-point output)
I	Analogue output register	AOR	T, V	(Applies to manual mode)
J	Control status register	CSR	T, V	
L	Absolute (gross) input display value	ABS GRS †	T, P	
Q	Offset/Tare (INDI-PAXS)	OFS TAR †	T, P, V	(Ver 2.5+)

† -Register ID for the INDI-PAXS.

11.7.7.4. Command String Examples

1. Node address = 17, Write 350 to Set-point 1, response delay of 2 msec min
   String: N17VE350$
2. Node address = 5, Read Input value, response delay of 50 msec min
   String: N5TA*
3. Node address = 0, Reset Set-point 4 output, response delay of 50 msec min
   String: RH*

11.7.7.5. Sending numeric data

Numeric data sent to the meter must be limited to 5 digits (-19.999 to 99.999). If more than 5 digits are sent, the meter accepts the last 5. 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.

11.7.8. Receiving data

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. In this case, the response contains only the numeric field. The meter response mode is established in programming.

11.7.8.1. Full Field 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 data field; 10 bytes for number, one byte for sign, one byte for decimal point (The T command may be a different byte length)
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 are the node address, unless the node address assigned =0, in which case spaces are substituted. A space follows the node address field. The next three characters are the register ID (Serial Mnemonic).
The numeric data is transmitted next. The numeric field is 12 characters long (to accommodate the 10 digit totalizer), with the decimal point position floating within the data field. Negative value has a leading minus sign. The data field is right justified with leading spaces.
The end of the response string is terminated with a carriage return <CR> and <LF>. When block print is finished, an extra <SP><CR> <LF> is used to provide separation between the blocks.

11.7.8.2. 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.

11.7.8.3. Meter response examples

1. Node address = 17, full field response, Input = 875
   17 INP 875 <CR><LF>
2. Node address = 0, full field response, Set-point 2 = -250.5
   SP2 -250.5<CR><LF>
3. Node address = 0, abbreviated response, Set-point 2 = 250, last line of block print
   250<CR><LF><SP><CR><LF>

11.7.9. (CSR) Control Status Register

The Control Status Register is used to both directly control the meter's outputs (set-points and analog output) and interrogate the state of the set-point outputs. The register is bit mapped with each bit position within the register assigned to a particular control function. The control functions are invoked by writing to each bit position. The bit position definitions are:

Bit 0: Set-point 1 Output Status
- 0 = output off
- 1 = output on

Bit 1: Set-point 2 Output Status
- 0 = output off
- 1 = output on

Bit 2: Set-point 3 Output Status
- 0 = output off
- 1 = output on

Bit 3: Set-point 4 Output Status
- 0 = output off
- 1 = output on

Bit 4: Manual Mode
- 0 = automatic mode
- 1 = manual mode

Bit 5: Always stays 0, even if 1 is sent.

Bit 6: Not applied

Bit 7: Always stays 0, even if 1 is sent.

Although the register is bit mapped starting with bit 7, HEX < > characters are sent in the command string. Bits 7 and 5 always stay a zero, even if a "1" is sent. This allows ASCII characters to be used with terminals that may not have extended character capabilities. Writing a "1" to bit 4 of CSR selects manual mode. In this mode, the set-point outputs are defined by the values written to the bits b0, b1, b2, b3; and the analog output is defined by the value written to the AOR. Internal control of these outputs is then overridden.
In automatic mode, the set-point outputs can only be reset off. Writing to the set-point output bits of the CSR has the same effect as a Reset command (R). The contents of the CSR may be read to interrogate the state of the set-point outputs.

11.7.9.1. Examples:

1. Set manual mode, turn all set-points off:

		7	6	5	4	3	2	1	0:bit location
VJ<30>* or VJ0*	ASCII 0 =	0	0	1	1	0	0	0	0 or <30>

V is command write, J is CSR and * is terminator.

2. Turn SP1, SP3 outputs on and SP2, SP4 outputs off:

		7	6	5	4	3	2	1	0:bit location
VJ<35>* or VJ5*	ASCII 0 =	0	0	1	1	0	1	0	1 or <35>

3. Select Automatic mode:

		7	6	5	4	3	2	1	0: bit location
VJ<40>* or VJ@*	ASCII 0 =	0	1	0	0	0	0	0	0 or <40>

Note: Avoid writing values <0A> (LF), <0D> (CR), <24> ($) and <2E> (*) to the CSR. These values are interpreted by the meter as end of command control codes and will prematurely end the write operation.

11.7.10. (AOR) Analog Output Register

The Analog Output Register controls the analog output of the meter. The manual mode must first be engaged by setting bit 4 of the Control Status Register. The range of values of this register is 0 to 4095, which corresponds to 0 mA, 0 V and 20 mA, 10 V; respectively. The table lists correspondence of the output signal with the register value.

REGISTER VALUE	OUTPUT SIGNAL* I (mA)	V (V)
0	0.000	0.000
1	0.005	0.0025
2047	10.000	5.000
4094	19.995	9.9975
4095	20.000	10.000

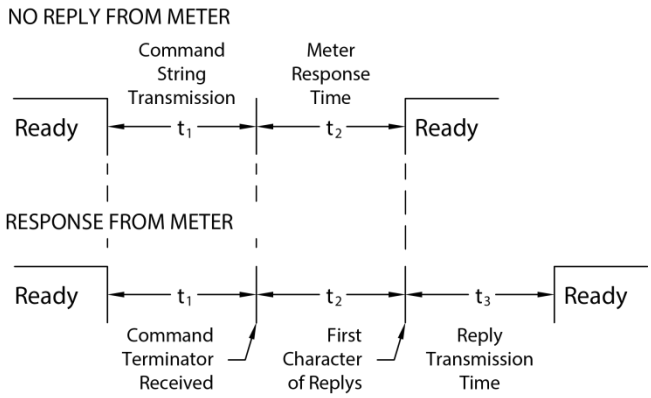
**Due to the absolute accuracy rating and resolution of the output card, the actual output signal may differ 0.15% FS from the table values. The output signal corresponds to the range selected (20 mA or 10 V)*

Writing to this register, while the meter is in the manual mode, causes the output signal to update immediately. While in the automatic mode, this register may be written to, but the output will not update until the meter is placed in manual mode.

11.7.10.1. Examples:

1. Set output to full scale:
   VI4095*
2. Set output to zero scale:
   VI0*

11.7.11. 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 t_2, the meter starts the interpretation of the command and when complete, performs the command function. This time interval t_2 varies from 2msec to 50msec. 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 t_2 is controlled by the use of the command terminating character. The standard command line terminating character is '*'. This terminating character results in a response time window of 50msec minimum and 100msec maximum. This 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 (t_2) of 2msec minimum and 50msec maximum. The faster response time of this terminating character requires that sending drivers release within 2msec 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.

11.7.12. 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.

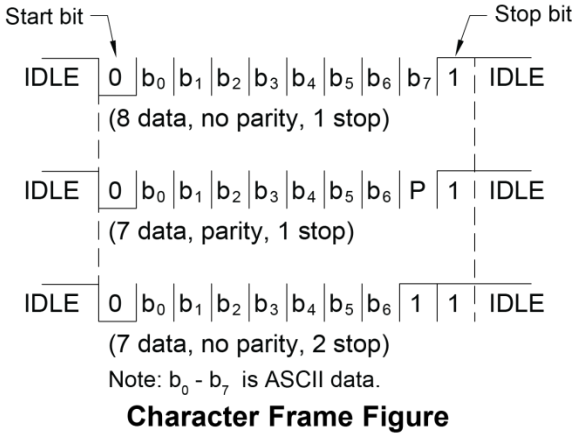
The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

LOGIC	INTERFACE STATE	RS-232*	RS-485*
1	mark (idle)	TXD, RXD; -3 to -15 V	a-b < -200 mV
0	space (active)	TXD, RXD; +3 to +15 V	a-b > +200 mV

**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.



Character Frame Figure

11.7.12.1. 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.

11.7.12.2. Parity bit

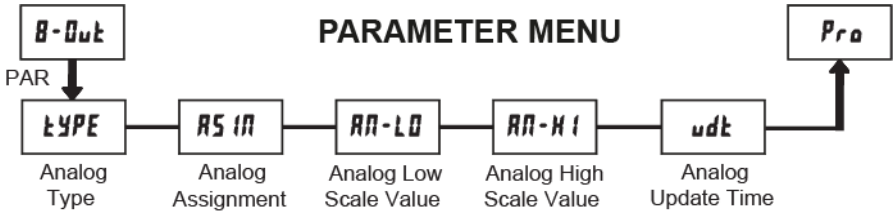
After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd

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.

11.7.12.3. Stop bit

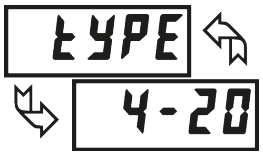
The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit.

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



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

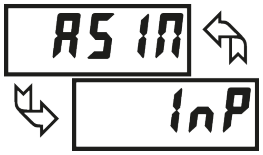
11.8.1. Analog type



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

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

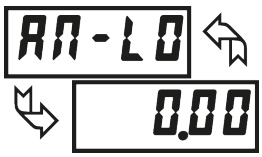
11.8.2. Analog assignment



InP HI LO tot

Enter the source for the analog output to retransmit:
- InP= Display Input Value
- HI = Maximum Display Input Value
- LO = Minimum Display Input Value
- tot = Totalize Display Value

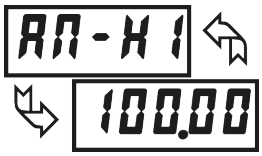
11.8.3. Analog low scale value



-19999 to 99999

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

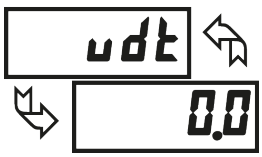
11.8.4. Analog high scale value



-19999 to 99999

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

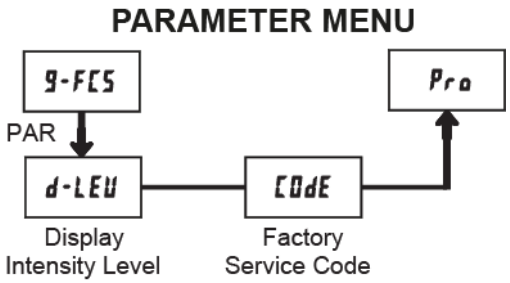
11.8.5. Analog update time



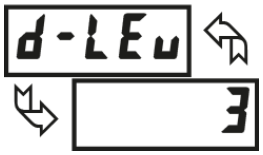
0.0 to 10.0

Enter the analog output update rate in seconds. A value of 0.0 allows the meter to update the analog output at a rate of 20/sec.

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

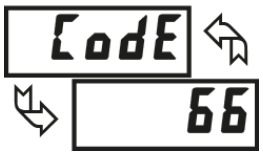


11.9.1. Display intensity level



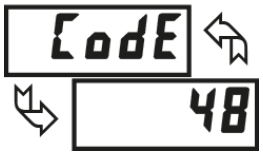
Enter the desired Display Intensity Level (0-15) by using the arrow keys. The display will actively dim or brighten as the levels are changed. This parameter also appears in Quick Programming Mode when enabled.

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. Resistance inputs require a resistance substitution device with an accuracy of 0.01% or better.

Before starting, verify that the precision signal source is connected to the correct terminals 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 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
   - Resistance ranges: dead short with current source connected
4. Press **PAR** and ---- will appear on the display for about 10 seconds.
5. When the top range limit appears on the display, apply the appropriate:
   - Voltage ranges: top range value applied (The 300 V range is the exception. It is calibrated with a 100 V signal.)
   - Current ranges: top range value

- Resistance ranges: top range value (The ohms calibration requires connection of the internal current source through a resistance substitution device and the proper voltage range selection.)

6. Press **PAR** and - - - - will appear on the display for about 10 seconds.
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.
10.

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**.

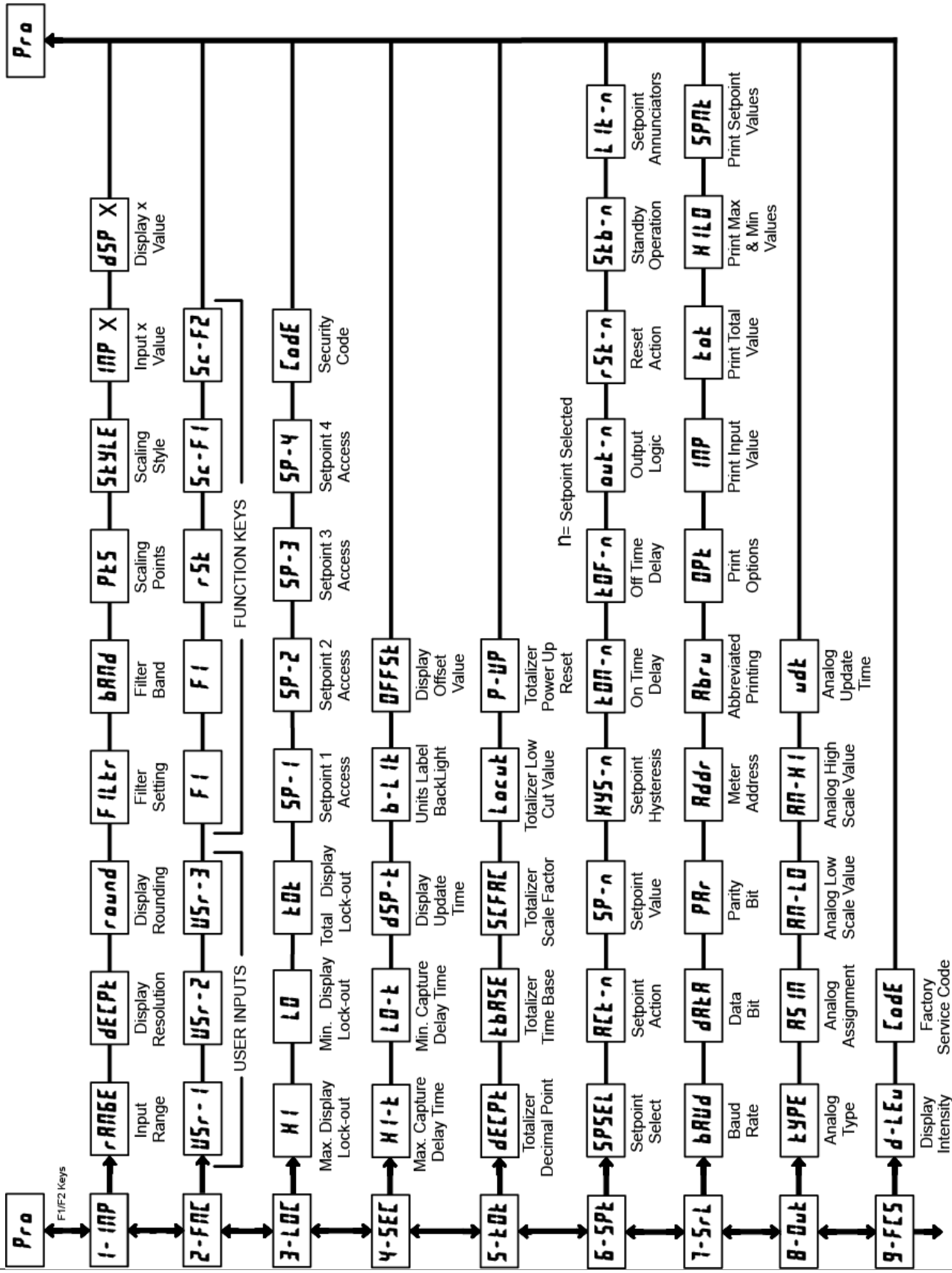
SELECTION	EXTERNAL METER	ACTION
0.0_A	0.00	Adjust if necessary, press **PAR**
4.0_A	4.00	Adjust if necessary, press **PAR**
20.0_A	20.00	Adjust if necessary, press **PAR**
0.0_u	0.00	Adjust if necessary, press **PAR**
10.0u	10.00	Adjust if necessary, press **PAR**

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

12. TROUBLESHOOTING

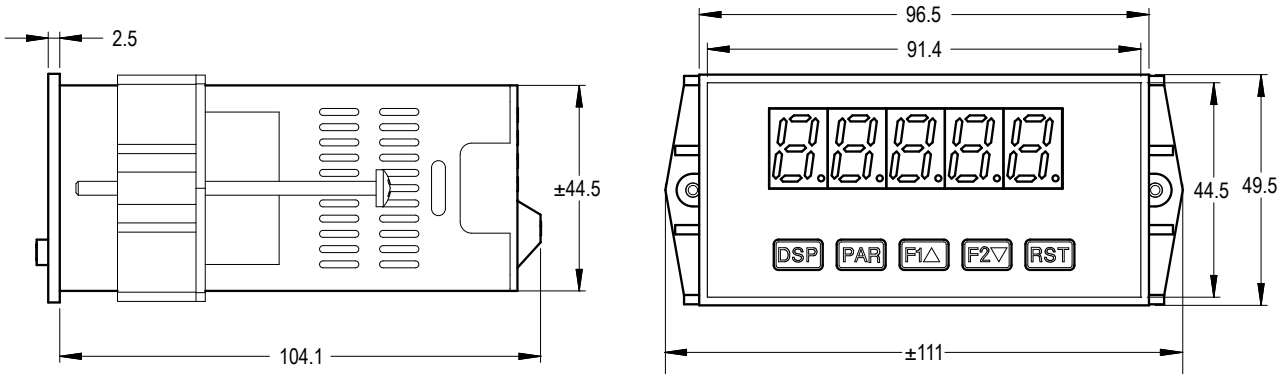
PROBLEMS	REMEDIES
NO DISPLAY	CHECK: Power level, power connections
PROGRAM LOCKED-OUT	CHECK: Active (lock-out) user input ENTER: Security access code requested
MAX, MIN, TOT LOCKED-OUT	CHECK: Module 3 programming
INCORRECT INPUT DISPLAY VALUE	CHECK: Module 1 programming, position of the jumper for the 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-PAXD 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.

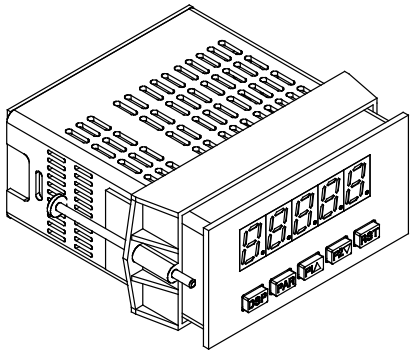
13. DISP-PAXD PROGRAMMING QUICK OVERVIEW

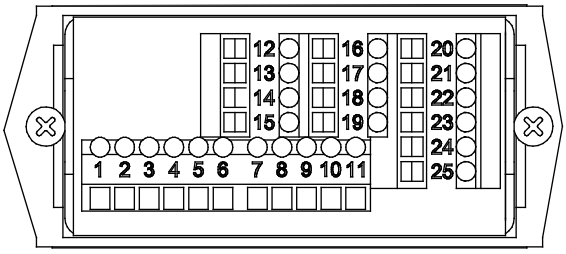


TECHNICAL DRAWINGS: ANALOGUE INPUT PANEL METERS

INDI-PAXS DISP-PAX > STANDARD DIMENSIONS





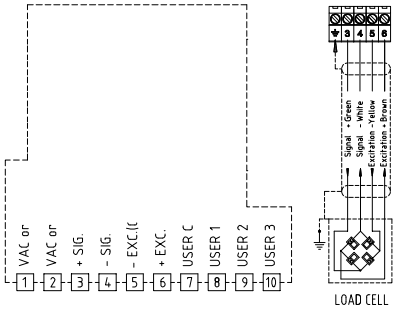


Note: recommended min. clearance (behind the panel) for mounting is 140 mm deep and 53.4 mm high. Panel cut-out 92 mm (-0+0.8) 45 mm (-0+0.5)

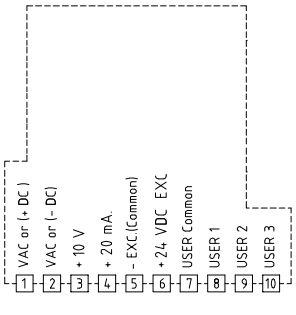
Dimensions in mm

Terminals

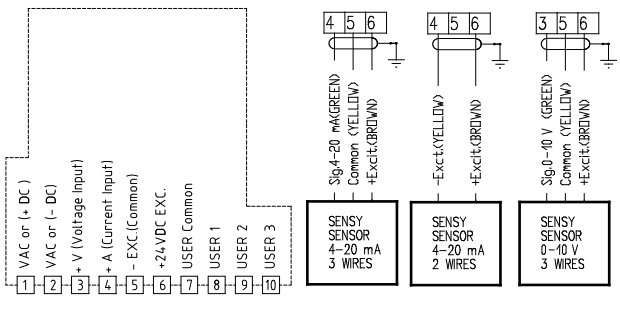
INDI-PAXS



DISP-PAXP



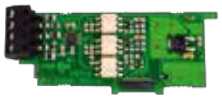
DISP-PAXD



OPTION CARDS

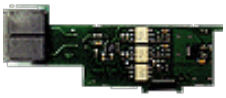
Communication cards (max. 1 choice)

CARD-CDC10

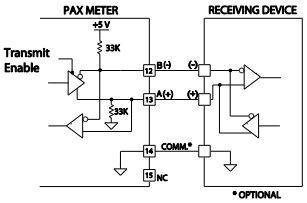


- RS-485 field bus communication interface
  Available with crew terminals or DB9 connector

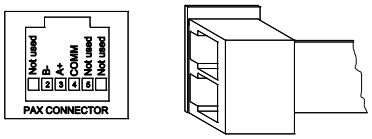
CARD-CDC1C



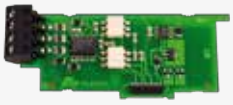
CARD-CDC10



CARD-CDC1C



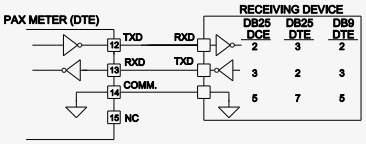
CARD-CDC20



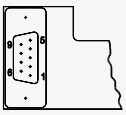
CARD-CDC2C

- RS-232 half-duplex communication interface
  Available with crew terminals or DB9 connector

CARD-CDC20



CARD-CDC2C



FEMALE

PIN 2 TXD
PIN 3 RXD
PIN 5 COMMON

CARD-CDC30

- DeviceNet communication interface

CARD-CDC40

- Modbus communication

CARD-CDC50 / CARD-CDC50-CRANE*

- Profibus-DP (EN 50170) communication interface

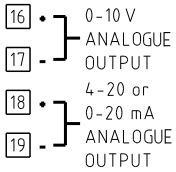
* As the CARD-CDC50 is too long for the housing of the CRANE-BOY, the CARD-CDC50-CRANE is supplied with a spacer to be inserted between the front of the electronics and the housing.

Analogue output card

CARD-CDL10

- Analogue output signal:0-20 mA, 4-20 mA, 0-10 VDC

CARD-CDL10

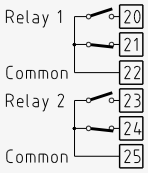


Relay cards (max. 1 choice)

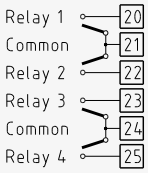
CARD-CDS10 & CARD-CDS20

- 2 or 4 set-points activating each an independent relay

CARD-CDS10



CARD-CDS20



Cards already included

- Analogue output card:
  CARD-CDL10

- Models:
  CABIN-2xB1SUMD; CABIN-4xB1SUMD

- Relay card:
  CARD-CDS20 (4 set-points)

- Models:
  INDI-BOY DISP-BOYP; CRANE-BOY CRANE-BOYP; DISP-BOYDP CRANE-BOYDP; CRANE-SUMD DISP-SUMD; CRANE-BOY-Exd; CABIN-2xB1SUMD; CABIN-4xB1SUMD.