DDD

Dual-Line 6-Digit Process Meter

Rev. H, 08/2024
Document #9004570; Part #125816-0019

PRECISE, COMPACT, VERSATILE

The only 1/8 DIN process meter you will ever need. A built-in 24 VDC power supply, a second 40 mA power supply provided with the 4-20 mA output option, NEMA 4X rated front panel and a 6-digit dual-line display, four relays and 4-20 mA output option, advanced signal input conditioning, all easily programmed with your PC.

Features

0-20 mA, 4-20 mA, 0-5 V, 1-5 V, and ±10 V Field
    Selectable Inputs
Isolated 24 VDC @ 200 mA Transmitter Power Supply
2 or 4 Relays with Interlocking Capability
    + Isolated 4-20 mA Output Options
Input Power Options: 85-265 VAC or 12-24 VDC

Field-Ready Enclosure

1/8 DIN Digital Panel Meter with NEMA 4X, IP65 Front
Optional SunBright Display Models
Operating Temperature Range -40 to 65°C
No Assembly Required

User-Friendly Display

Dual-Line 6-Digit Display, 0.6" (15 mm) & 0.46" (12 mm)
Display Input in Two Different Scales
Programmable Display, Function Keys & Digital Input

Feature-Rich Capabilities

Multi-Pump Alternation Control
Round Horizontal Tank Formula
32-Point, Square Root, or Exponential Linearization
Free PC-Based MeterView Pro Programming Software

Accessories

External 4-Relay & Digital I/O Expansion Modules
RS-232 & RS-485 Serial Communication Options with
    Modbus RTU
Light/Horn & Button Accessory
Control Station Accessory For Remote Operation
Stainless Steel Sun Hood Accessory

Certifications & Warranty

UL & C-UL Listed. E160849
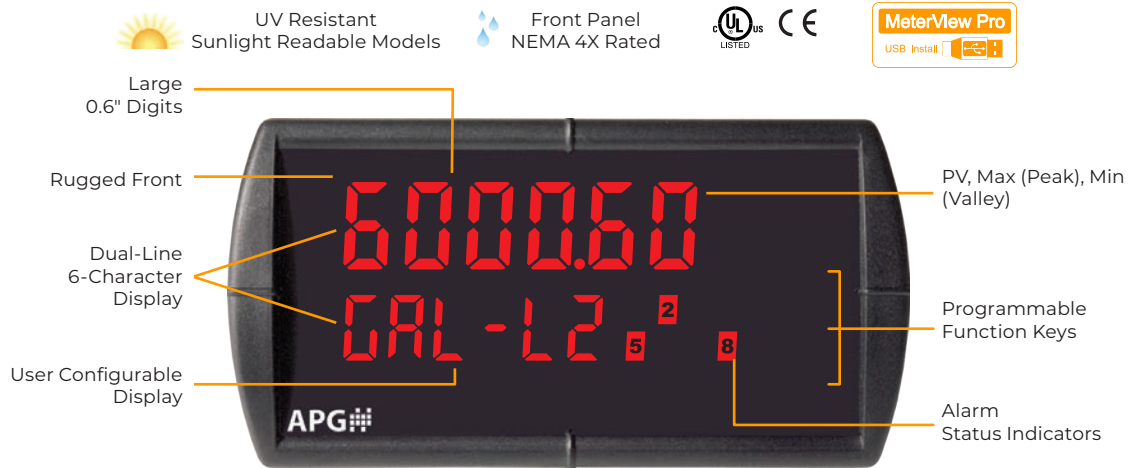508 Industrial Control Equipment
3-Year Warranty

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OVERVIEW

Front

UV Resistant
Sunlight Readable Models

Front Panel
NEMA 4X Rated

MeterView Pro
USB Install

Large
0.6" Digits

Rugged Front

Dual-Line
6-Character
Display

User Configurable
Display

6000.60
GAL-L2.

PV, Max (Peak), Min
(Valley)

Programmable
Function Keys

Alarm
Status Indicators

APG

Connections

4-20 mA Output
Powered by DDD

+ −

RELAY4   RELAY3   RELAY2   RELAY1   MA OUT

| 6 | 5 | 4 | 3 | 2 | 1 | 6 | 5 | 4 | 3 | 2 | 1 | 6 | 5 | 4 | 3 | 2 | 1 | 3 | 2 | 1 |
| NO | NC | C | NO | NC | C | | NO | NC | C | NO | NC | C | | I- | I+ | R |

└ 24 V ┘

SIGNAL

P+   P-   F4   COM   V+   mA+

| 1 | 2 | 3 | 4 | 5 | 6 |

+ −

DDD provides
24 VDC power
to the transmitter

M-LINK

1 2 3 4 5 6 7 8

POWER

+ −
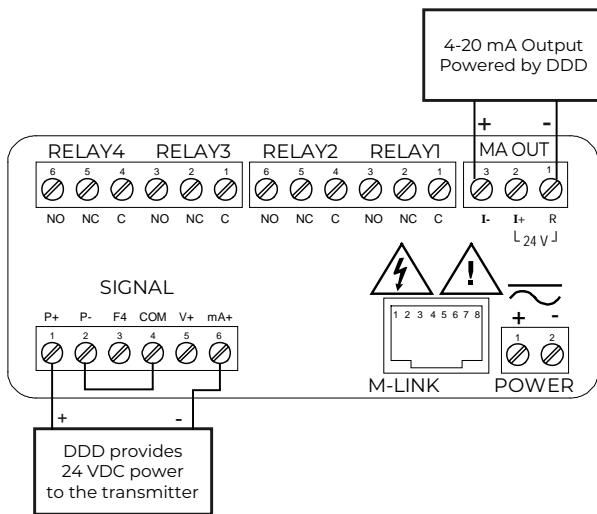
1 2

- Form C (SPDT) relays
- Two isolated supplies available even on 12/24 VDC input power models
- Removable terminal blocks
- 2 or 4 relays + isolated 4-20 mA output option
- Universal 85-265 VAC or 12/24 VDC input power
- Voltage or current inputs
- No jumpers needed for V/mA input selection
- M-Link for adding expansion modules
- Digital input (F4)

THE ONLY PROCESS METER YOU WILL EVER NEED

Front, back and in between, DDD meters boast specifications, features and functionality that make them the only 1/8 DIN process meters you will ever need. The number one feature that makes the DDD meter such a useful device is its built-in 24 VDC power supply to drive the transmitter as illustrated by the above diagram. This feature not only saves the cost of an external power supply, but also greatly simplifies wiring. In addition, there is a second 40 mA power supply provided with the 4-20 mA output option, evident also in the above diagram.

The picture above illustrates several other reasons why this is the only process meter you will ever need. First off, is the NEMA 4X rated front panel which means you can install the meter in panels exposed to moisture, dust and other adverse conditions. The picture also points out that the meter is available with an optional Sunbright display which means you can install and read it in direct sunlight. The next thing to notice is the 6-digit dual-line display that can display numbers up to 999,999 on the upper line and show either a tag or the input in a different scale on the lower line.

Other key features include four relays and 4-20 mA output option, advanced signal input conditioning like automatic round horizontal tank linearization, function keys, pump alternation capability, and Modbus RTU serial communications. Finally all these features and capabilities can easily be programmed with free MeterView Pro PC-based software.

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ISOLATED TRANSMITTER POWER SUPPLIES

## 24 V @ 200 mA Transmitter Power Supply

One of the most useful standard features of the AC powered DDD is its built-in isolated, 24 V @ 200 mA power supply to power the transmitter. This feature saves money by eliminating an external power supply and also simplifies wiring by reducing the number of devices in the loop. It can be configured for 5, 10, or 24 V (default) by means of a simple internal jumper. This power supply is even available on meters that are powered from DC power (24 V @ 100 mA). To use an external power supply instead of the internal power supply, simply make connections to different terminals on the meter.

The following diagrams illustrate how to wire the meter so it will power the transmitter:
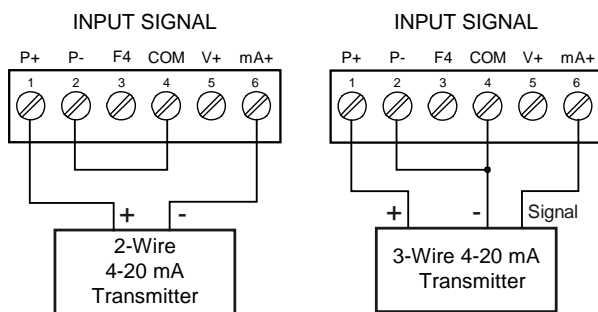
24 V @ 40 mA 4-20 mA Output Power Supply

Not only can the DDD power the 4-20 mA input signal, but an additional power supply of 24 V @ 40 mA is provided with the 4-20 mA output option to power the 4-20 mA output.
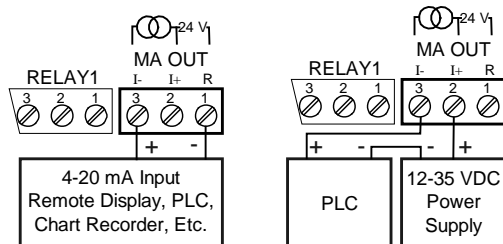

Resettable Fuse Prevents Current Overload

Another very useful aspect of the DDD is that the current input is protected against current overload by a resettable fuse. The fuse limits the current to a safe level when it detects a fault condition, and automatically resets itself when the fault condition is removed.

## Other Uses for the Transmitter Power Supplies

The most common use for these two power supplies is for the 200 mA transmitter power supply to power the field transmitter and 40 mA power supply to power the 4-20 mA output from the meter. However, since these two power supplies are isolated they can be used in other ways. For instance, some level transmitters require the use of a heated lens. The meter's 200 mA power supply could be used to power the heated lens and the meter's 40 mA power supply could be used to power the 4-20 mA input.
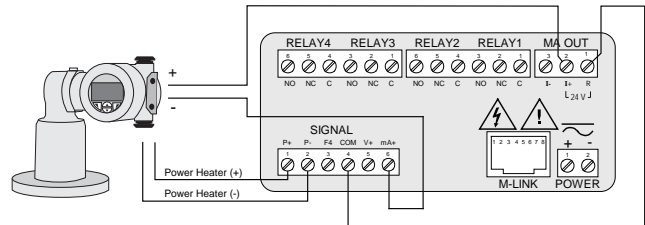
DDD Powers Both Heater and 4-20 Output

External Power Supply for the Loop

For applications that require an external transmitter power supply, the same meter is used and merely wired in a different fashion as shown in the following diagrams:
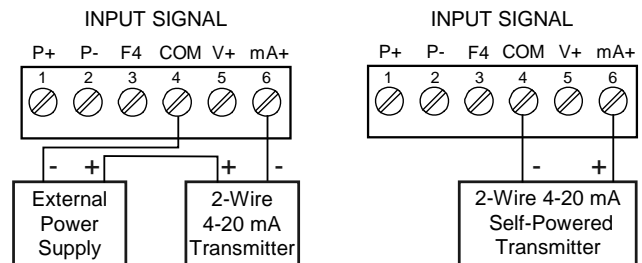
PDA1024-01 24 VDC Transmitter Power Supply

APG offers the PDA1024-01 for applications that require more than the 200 mA power that the DDD can provide.

Specifications
Output Voltage: 24 VDC ±10% @ 1.5A rated current
Dimensions: 1.40" x 3.50" x 2.10" (35 mm x 90 mm x 54.5 mm) (W x H x D)

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ADVANCED DISPLAY FEATURES

Dual-Line Makes All the Difference

Display 1 can be programmed to indicate PV, maximum (peak), minimum (valley), alternating maximum/minimum, one of eight alarm set points, or Modbus input. Display 2 can be configured to display engineering units, set points, user defined messages, or simply turned off.

The DDD's dual-line display makes all the difference both when programming the instrument and when using it in the field. When programming the instrument, the dual line display prompts for the needed information and also helps you keep track of where you are in the setup process. When using the instrument, the dual line display provides more information such as displaying the input in two different scales like height and volume for a level application. We call this the Dual-Scale feature.

Programming Assistance

The DDD's dual-line display makes programming the instrument much easier because the lower line prompts for the needed information and also helps you keep track of where you are in the setup process.

The DDD is prompting for the value for Input 2 and displaying the default value of 20.00 mA. The "2" in 20.00 is brighter than the rest of the digits indicating that it is the number that will be changed by the Up and Right arrows.

The DDD is now prompting for what the user wants Display 2 to be; that is the value that corresponds to 20 mA. In this case Display 2 is currently set to 95.00.

Rounding Feature for Even Steadier Display

The rounding feature is used to give the user a steadier display with fluctuating signals. It causes the display to round to the nearest value according to the rounding value selected (1, 2, 5, 10, 20, 50, or 100). For example, with a rounding value of 10, and an input of 12346, the display would indicate 12350.

Toggling Between Reading & Units with Tag

The DDD can also be programmed so the upper line toggles between the reading and units and the lower line displays a tag. For instance, the upper line toggles between 9500 and Gal and the lower line displays Tank 1.

Dual-Scale Display Feature

The DDD has a rather unique, and very flexible dual-scale capability. This is of particular value in level applications where a second scaled display can represent the measured input in a different form (i.e. gallons & height). Both displays are independently scaled and are based on the 4-20 mA input signal. Beyond level, this function has been used for pressure & force, current & power, feet & meters, GPM & CFM, and more.

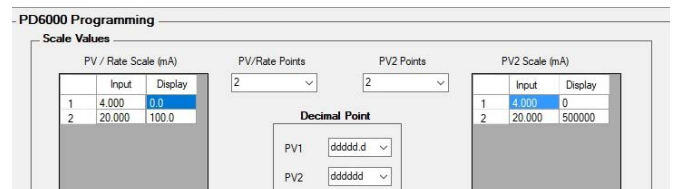Gallons & mA   Gallons & Height

Gallons & Percent   Gallons & Head PSI

MeterView Pro can be used to program the DDD to display the input in two different scales:

DBD Super-Bright Display Models

The standard DDD's display is bright enough for most applications, including moderate sun exposure. However, for direct sunlight exposure the DBD is available, boasting super-bright LEDs that make it possible to read the DDD even in direct sunlight. Both versions of the DDD have eight levels of adjustable intensity.

Other Uses for Lower Line

The lower line can also be used indicate units, a tag, or even a setpoint as the following pictures illustrate:

Volume in Tank   Gallons & Setpoint

Level in Feet   Pressure Indication

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QUICK & EASY SCALE & PROGRAMMING METHODS

The DDD can be programmed either via the front panel push buttons or free, PC-based MeterView Pro software. MeterView Pro can be downloaded for free online and the meter is connected to your PC with a provided USB cable, so it is by far the easiest way to program the DDD. The DDD can be calibrated either by applying a known signal or scaled by entering a desired value with the front panel buttons or MeterView Pro software. Most customers will use the scaling method because it is simpler and does not require a calibrated signal source. Selecting the input to be current or voltage is done with the front panel buttons or MeterView Pro software. Once programming is completed it can be locked with a password.

Free PC-Based MeterView Pro USB Programming Software & Cable
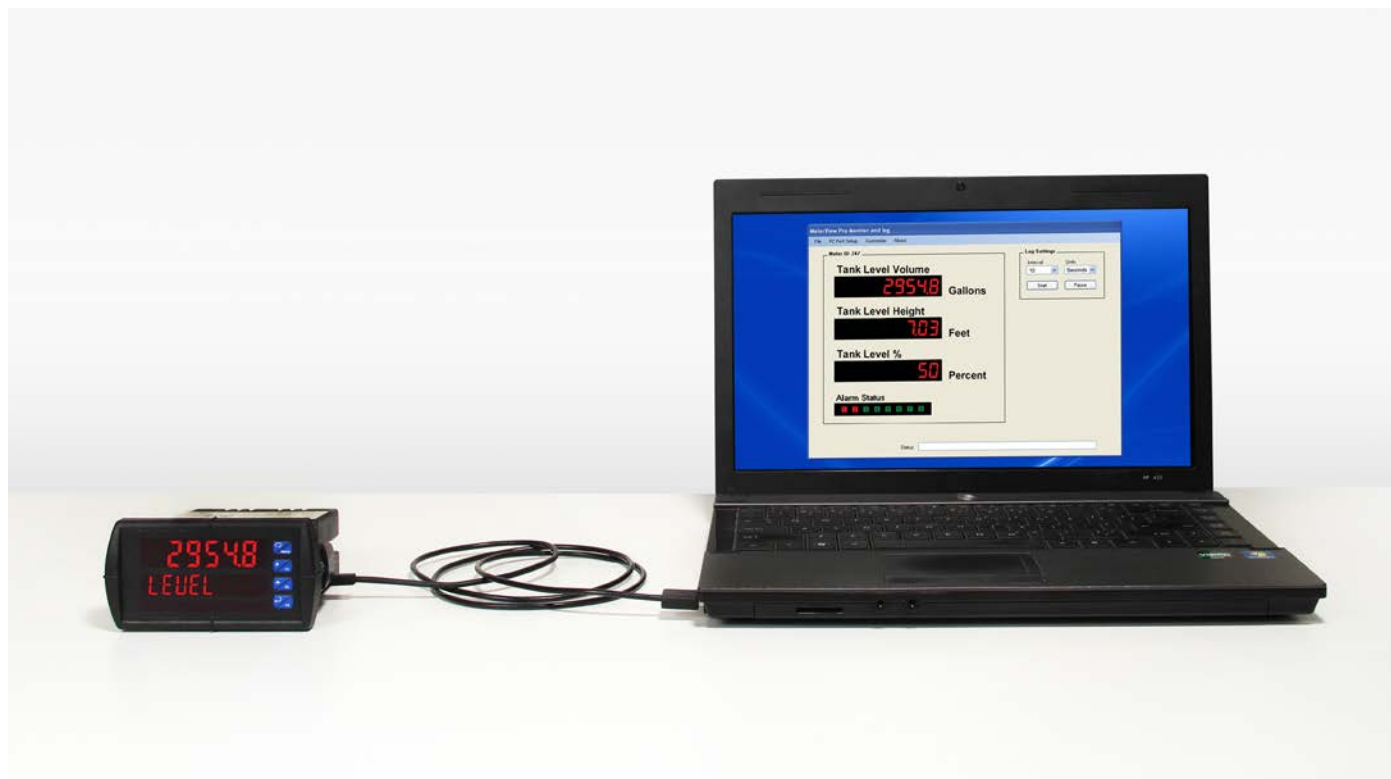
When you connect your DDD to your PC and open MeterView Pro, the software automatically selects the model you are using, and you're ready to start programming immediately. Further simplifying the programming process, the DDD can be powered from the USB port, so no need to apply external power while programming your meter. In addition to programming, the software will also allow you to monitor and datalog a DDD using your PC. You can also generate and save programming files for later use.

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Setup Screen

- Select Voltage or Current Input
- Activate Dual-Scale (Level) Function
- Select Decimal Point
- Set Line 1 Display Parameters
- Set Line 2 Display Parameters
- Set Analog Output Values
- Enable Manual Control
- Test Relays & Digital Outputs

Programming Screen

- Set Scale Values
- Set the Number of Points (up to 32)
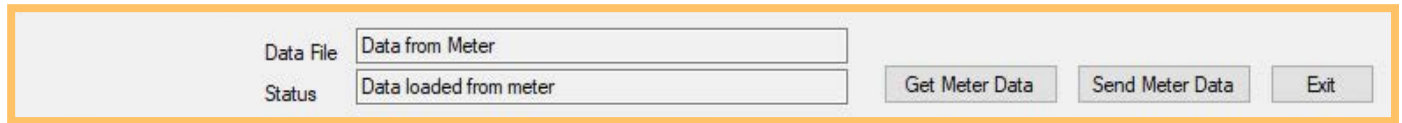- Import from Excel
- Export to Excel

Relays Screen

- Greatly Simplifies Programming a Variety
  of Relay Features
- Set Relay Action
- Set Sampling Time
- Set Set & Reset Points
- Set On/Off Time Delays
- Set Fail Safe Operation
- Set Input Break Relay Action

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Save/Open Configuration

At the bottom of most MeterView screens are two tabs:

1. **Get Meter Data:** This reads the programming of the meter that is currently connected to the PC.
2. **Send Meter Data:** Clicking this button, sends current MeterView programming to the meter.

The configuration file can be sent or retrieved from the directory of your choice. This makes it very easy to program multiple meters with the same programming. It is also a great backup utility as well.
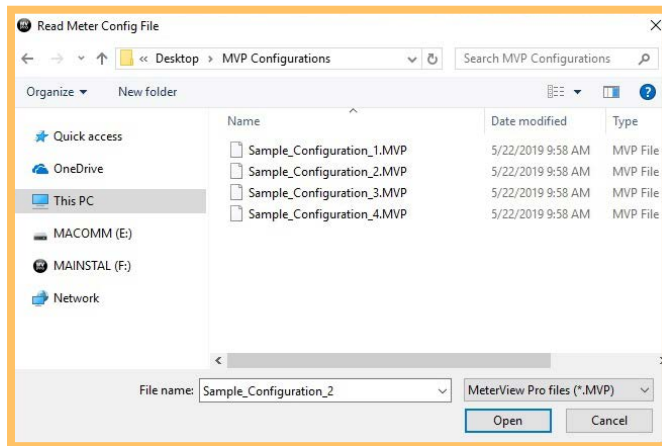
Specifications

System Requirements:
   Microsoft® Windows® 10/11
Communications:
   Onboard USB (firmware version 4.0 or higher),
   RS-232 Adapter or RS-485 Adapter
Meter Address: 1 - 247
Reports:
   · Data logging: Save as CSV file format
   · Configuration: Save as PDC file format or print configuration
Baud Rate: 300 - 19,200 bps
Configuration: One meter at a time
Protocol:
   Modbus RTU (requires firmware version 4.0 or higher)

*Note: Windows® 32/64-bit operating systems

Password Protection

The Password menu is used for programming three levels of security to prevent unauthorized changes to the programmed parameter settings:

Pass 1: Allows use of function keys and digital inputs

Pass 2: Allows use of function keys, digital inputs and editing set/reset points

Pass 3: Restricts all programming, function keys, and digital inputs

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4-20 mA OUTPUT & RELAYS
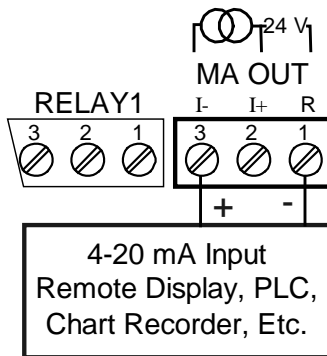
4-20 mA Analog Output

The isolated analog retransmission signal can be configured to represent the process variable (PV), maximum (peak) value, minimum (valley) value, the value for any of the eight relay set points, or Modbus input. While the output is nominally 4-20 mA, the signal will accurately accommodate under- and over-ranges from 1 to 23 mA.

The 4-20 mA output can be reversed scaled such that 4 mA represents the high value and 20 mA represents the low value. For instance, a 4-20 mA output signal could be generated as the meter went from 100.0 to 0.0.
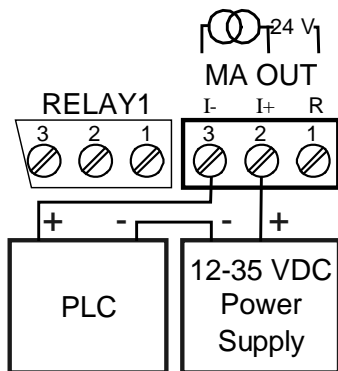
For applications where the input was linearized by the DDD, the 4-20 mA output will represent that linearized value.

Connections

The DDD can provide 40 mA at 24 VDC to power the 4-20 mA output signal or an external power supply can be used:


4-20 mA Output Powered by DDD

4-20 mA Output Powered by External Power Supply

The internal 24 VDC power supply powering the analog output may be used to power other devices, if the analog output is not used. The I+ terminal is the +24 V and the R terminal is the return.

The 4-20 mA output can either be programmed using the front panel push buttons or free MeterView Pro software.

Front Panel Push Button Programming

The 4-20 mA analog output can be scaled to provide a 4-20 mA signal for any display range selected. No equipment is needed to scale the analog output; simply program the display values to the corresponding mA output signal. The Analog Output menu is used to program the 4-20 mA output based on display values.
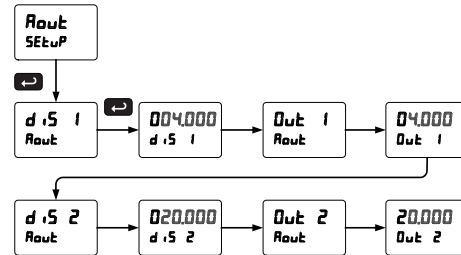
MeterView Pro Software Programming

When a meter is programmed as shown below, the output will be 4.00 mA when the display reads 0 and the output will be 20.00 mA when the display reads 150000.

The meter can be set up for reverse scaling as shown below: the output will be 4.00 mA when the display reads 150000 and the output will be 20.00 mA when the display reads 0.

Source: Source for generating the 4-20 mA output (e.g. PV)

Break: Analog output value when loop break is detected

Overrange: Analog output value with display in overrange condition

Underrange: Analog output value with display in underrange condition

Max: Maximum analog output value allowed regardless of input

Min: Minimum analog output value allowed regardless of input

Relays for Alarm & Control Applications

Adding relays to the DDD meter turns it into a sophisticated alarm device as well as a powerful, yet simple, alternative to a more complicated PLC system for control applications. One such application would be pump control using the DDD's relays in pump alternation mode. The DDD can be equipped with up to four 3 A Form C (SPDT) internal relays and an additional four more 3 A Form A (SPST) external relays. Relays are highly user-configurable as the following screen shot from MeterView Pro indicates:

*Values are intended to show programming choices. They are not intended to represent an actual application.

Setting Set and Reset Points (HI / LO Alarms)

All relays are independent of each other and may be programmed as high or low alarms with user desired set and reset points. Setting a set point above a reset point results in a high alarm and setting a set point below a reset point results in a low alarm. Alarms have 0 – 100% deadband and set and reset points may be set anywhere in the range of the meter.

Resetting the Relays (Action in MV Pro)

All relays are independent of each other and may be programmed to reset (**Action** in MV Pro) in the following ways:

- **Automatic:** Alarm will reset automatically once the alarm condition has cleared.
- **Automatic/Manual:** Alarm will reset automatically once the alarm condition has cleared but can also be reset using the F3 front panel button* at any time.
- **Latching:** Alarm must be reset manually and can be done so at any time. Press the F3 front panel button* at any time to clear the alarm.
- **Latching with Reset after Cleared:** Alarm must be reset manually and can only be done so after the alarm condition has cleared. Press the F3 front panel button* after the alarm condition has cleared to reset the alarm.

* Or by connecting an external switch to F4 terminal or with an optional digital input.

Time Delay (On and Off)

In many applications it is desirable to wait before turning off or on a relay – such as waiting for a process to settle before taking action. Each relay on the DDD can be programmed with independent on and off time delays of 0 to 999.9 seconds to achieve this.

Relays Auto Initialization

When power is applied to the meter, the front panel LEDs and alarm relays will reflect the state of the input to the meter.

Signal Loss or Loop Break Relay Operation

When the meter detects a break in the 4-20 mA loop, the relay will go to one of the following selected actions:

1. Turn On (Go to alarm condition)
2. Turn Off (Go to non-alarm condition)
3. Ignore (Processed as a low signal condition)

User Selectable Fail-Safe Operation

All relays are independent of each other and may be programmed for user selectable fail-safe operation. With the fail-safe feature activated, the relays will transfer to the alarm state on power loss to the meter.

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Front Panel LEDs

The meter is supplied with four alarm points that include front panel LEDs to indicate alarm conditions. This standard feature is particularly useful for alarm applications that require visual-only indication.

Manual Output Control

Take control of any output with this feature. All relays can be forced ON or OFF, and the 4-20 mA output signal can be set to any value within its range. When the relays and 4-20 mA output are controlled manually, an LED labeled "M" is turned on and the associated Alarm LEDs (1-8) flash every 10 seconds indicating that the meter is in manual control mode.

Sampling Function (PV Triggered Timed Relay)

The sampling function allows the operator to set a relay as a "sampling" relay. When the PV reaches that set point, it will close that relay's contacts for a preset period of time (0.1 to 5999.9 seconds). An example of its use may be for beer/ale fermentation. When the batch reaches a certain pH, the relay contacts would close and by some means (light, horn, etc.) alert someone to take a sample, or provide the trigger to automatically take a sample of the batch. The utility of this function can, of course, be expanded beyond sampling and be used whenever a timed relay output closure is required when the PV reaches a certain set point.

Interlock Relay(s)

This function allows a process to use one or more very low voltage input signals or simple switch contacts to control the state of one or more internal "interlock" relays. A violation (i.e. loss of input, open switch, or open circuit) forces one or more N/O interlock relay contacts to open. One input can be used in series with a number of interlock switches, or up to eight inputs can be required to force-on one (or more) internal interlock relays. Requires PDA1044 Digital I/O module or use of on-board digital input F4.
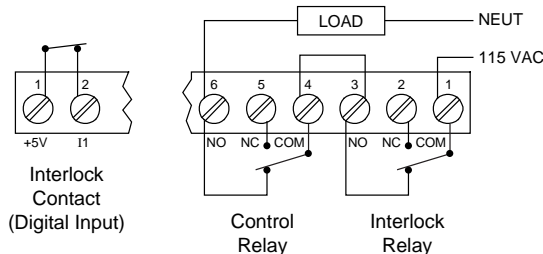
Switching Inductive Loads

The use of suppressors (snubbers) is strongly recommended when switching inductive loads to prevent disrupting the microprocessor's operation. The suppressors also prolong the life of the relay contacts. APG offers the PDX6901.

Multi-Pump Alternation

The DDD can be used as a pump controller when combined with a continuous level transmitter. The most common pump control application is shown below: controlling and alternating two pumps and providing high and low-level alarms. The light/horn accessory can be added to provide visual and audible alarm indication.
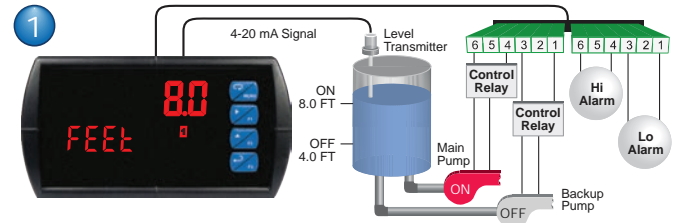
Relay #1 turns the main pump on at 8.0 feet and turns it off at 4.0 feet.
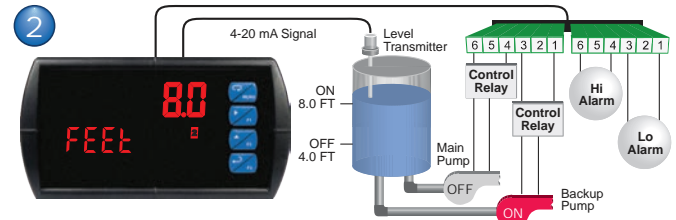
With the Pump Alternation feature activated, the next time the level reaches 8.0 feet, relay #2 transfers and starts the backup pump.
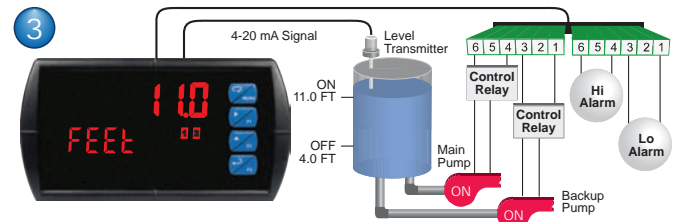
If the backup pump is not able to keep up, and the level reaches 11.0 feet, relay #1 transfers and starts the main pump as well.
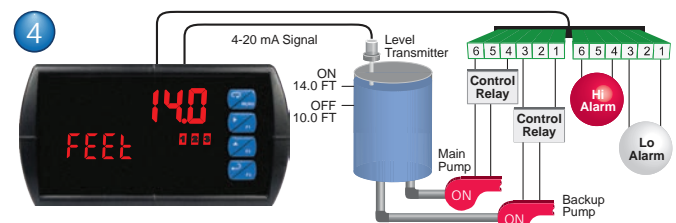
Relay #3 trips the High-Level Alarm at 14.0 feet and resets at 10.0 feet.
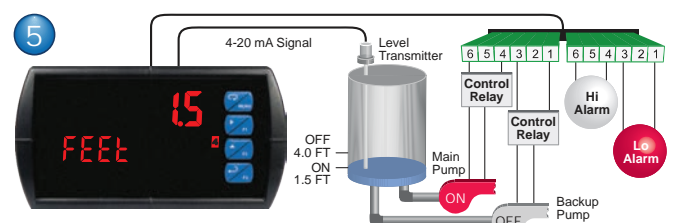
Relay #4 trips the Low-Level Alarm at 1.5 feet and resets at 4.0 feet.

SIGNAL INPUT CONDITIONING

There are many applications in the industrial world that can't be satisfied with simple, two-point linear scaling so the DDD has advanced linearization capabilities to handle applications like round horizontal tank volume measurement, open channel flow, DP flow, and others. And all of these capabilities are easily programmed using MeterView Pro programming software.

32-Point Linearization

The most common way to linearize a non-linear signal is to break it up into smaller ranges that are more linear than the overall range. The DDD is available with up to 32 points of linearization and if dual scale feature is used, the second PV can have up to eight points of linearization. The linearization data can be imported from an Excel spreadsheet or can be exported from MeterView Pro to an Excel spreadsheet. The following screen shot from MeterView Pro shows PV1 with 9 points of linearization and PV 2 with 5 points of linearization:
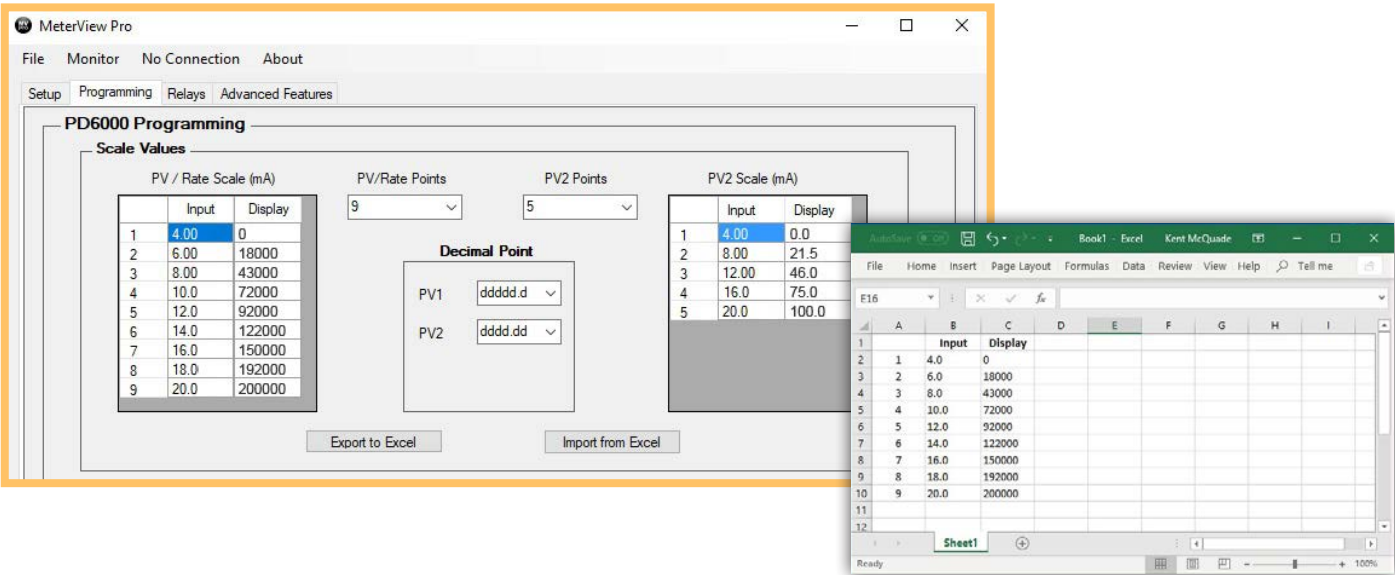
Scale values can also be imported from an Excel spreadsheet.

Specialized Linearization Functions

In addition to the generic 32- and 8-point linearization functions, the DDD is also available with specialized functions for round horizontal tanks, open channel flow, and DP flow.

Round Horizontal Tank	Programmable Exponent	Square Root Extraction
The user enters the diameter and length of a flat-ended round horizontal tank resulting in a display of volume.	The input is raised to an exponent progrmmable by the user resulting in a display of open channel flow rate.	The square root of the input is taken resulting in a display of flow rate.

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Round Horizontal Tank Volume Linearizer
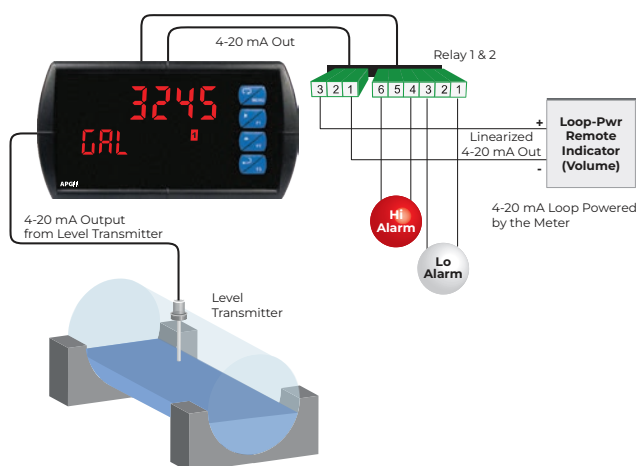
In this application, a level sensor is measuring the height in the round horizontal tank and the DDD is converting that signal to volume using the RHT function. All the user has to do is input the diameter and length of the tank and the meter converts the signal to volume.

DP Flow via Square Root Extraction
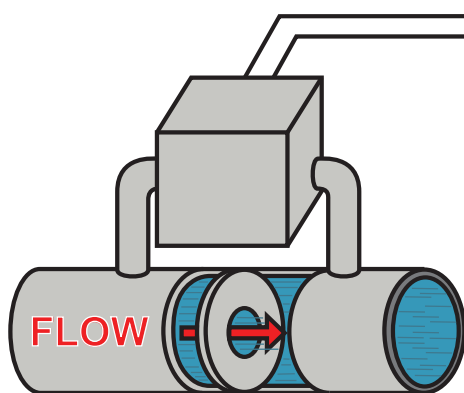
In this application, the DDD is displaying flow rate by extracting the square root from the 4-20 mA signal from a differential pressure transmitter. The user selectable low-flow cutoff feature gives a reading of zero when the flow rate drops below a user selectable value.

Linear 4-20 mA Analog Output

For applications where the input was linearized by the DDD, the 4-20 mA output will represent that linearized value.

Open Channel Flow Rate Indication
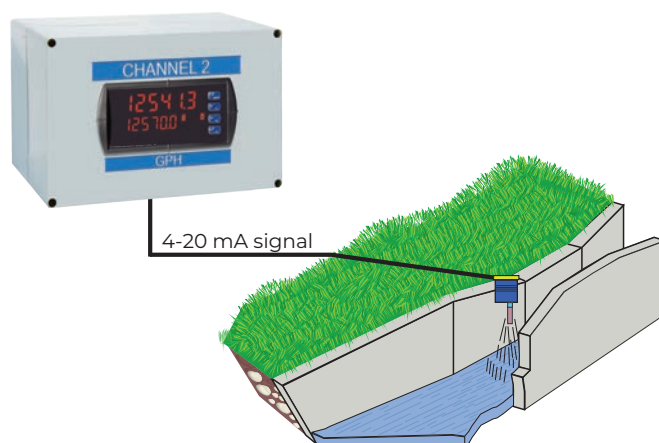
In this application, a level sensor is measuring the height in a weir and the DDD is converting that signal to flow rate using the programmable exponent function. All the user has to do is input the corresponding exponent for their weir and the meter will convert the signal to flow.

The following information is required for programming the DDD for open channel flow rate:

1. The exponent value associated with the flow calculation for the specific weir or flume being used.

2. The zero head, or water depth, mA value from the level transmitter.

3. The mA value from the transmitter for the maximum head, and the flow rate at that level. The level transmitter is normally programmed to provide 20 mA at the maximum head value and flow rate.

Example:

A 120˚ V-notch weir flow formula for millions of gallons per day is shown below.

$$MGD = 2.798 \, H^{2.5}$$

The exponent component is 2.5.

The level transmitter has been programmed so that at zero head, when the water level is at the base of the V-notch, the output is 4 mA.

The level transmitter has been programmed so that at the top of the V-notch, at 2.00 ft, the output is 20 mA.[1]

The coefficient of the flow equation (2.798 in the above example), is not needed for programming the meter; the scaling function of the meter incorporates the coefficient and the head height automatically.

1. Isco Open Channel Flow Measurement Handbook, Sixth Edition, ed. Diane K. Walkowiak, M.A. (Teledyne Isco, Inc., 2006), 168-169.

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DIGITAL COMMUNICATIONS

Modbus RTU Serial Communications

With the purchase of a serial communication adapter, DDD meters can communicate with any Modbus Master device using the ever-popular Modbus communications protocol that is included in every meter. In addition to the typical Modbus capabilities of reading PVs and writing set points, below are some examples of other things that can be done with the meter's Modbus communications:

- Send a 6-character message to lower display upon an event
- Convert a digital value to a 4-20 mA signal
- Remote user control (i.e. change set points, acknowledge alarms)
- Input a Modbus digital PV (in place of analog input)
- Remote override of any or all relays and analog outputs

Modbus PV Input   Remote Message

Serial Communication Devices

Automation Products Group provides a variety of serial communication devices to interface the meter with other devices.

PDA1232 & PDA1485 Communication Modules

Serial communications on the meter can be added anytime with external PDA1232 (RS-232) or PDA1485 (RS-485) communication adapters. Free Modbus protocol is included for use with the serial communications modules.

Serial Adapters & Converters*

PDA1232
RS-232
Serial Adapter

PDA1485
RS-485
Serial Adapter

PDA7485-I
RS-232 to RS-422/485
Isolated Converter

PDA8232-N
USB to RS-232
Non-Isolated
Converter

PDA8485-I
USB to
RS-422/485
Isolated Converter

*All adapters and connectors supplied with appropriate cables.

FIELD EXPANSION MODULES

Add functionality to the DDD meter in the field with easy-to-install external expansion modules. Add RS-232 or RS-485 communications, I/O modules (up to 2), and 4-relay expansion module. The menu items for these modules do not appear until the module is connected, simplifying the basic menu. Relay and digital I/O modules are shown below with optional DIN rail mounting kit, P/N PDA1002.

PDA1044 I/O Expansion Module

Four digital inputs and four digital outputs are available per expansion module. The meter will accept two of these modules. External digital inputs can function similarly to the front panel function keys or on-board digital input F4. They can be configured to trigger certain events (i.e. acknowledge/reset alarms, reset max and/or min values, disable/enable all output relays, and hold current relay states), provide direct menu access point, or mimic front panel keys. The I/O module can be used to configure the DDD remotely, in essence giving the user control of the four front panel push buttons. This feature is particularly useful if the meter is mounted inside an explosion-proof enclosure.

Digital outputs can be used to remotely monitor the meter's alarm relay output states, or the states of a variety of actions and functions executed by the meter.
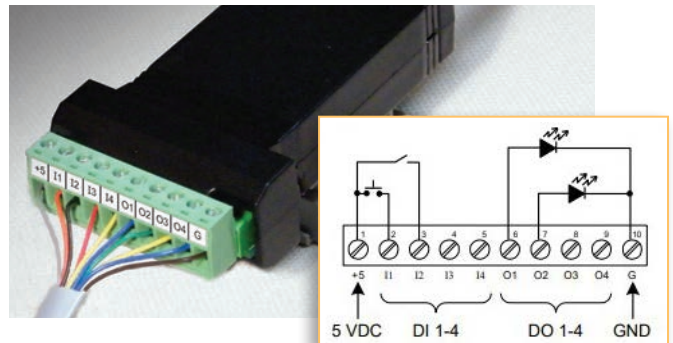
PDA1004 Relay Expansion Module

An external module containing four 3 A Form A (SPST) relays can be added to the meter at anytime. Removable screw terminal blocks accept 12 to 22 AWG wire.

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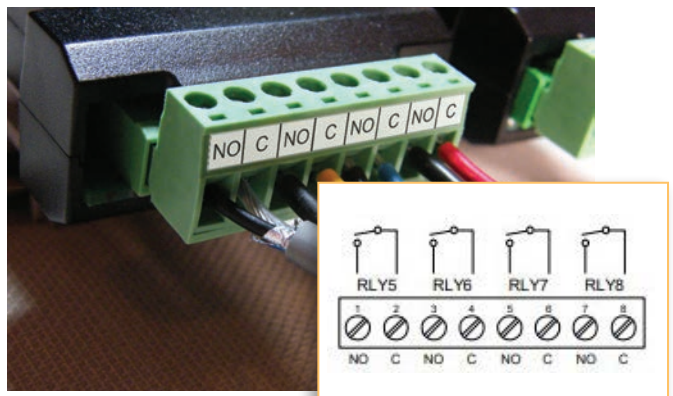
PHYSICAL FEATURES

The DDD is designed for ease-of-use in industrial applications. Considerations include a NEMA 4X front panel, wide operating temperature range, removable screw terminal connectors, snap in place mounting brackets, forgiving panel cutout requirement, and UL Listing for electrical safety. All of these features are backed by a 3-year warranty.

Type 4X / NEMA 4X Front Panel

Not only does the DDD's front panel UL Type 4X approval indicate it is waterproof, but it also indicates it is rugged. Part of the UL Type 4X test is to drop a 2 inch solid stainless steel ball from 8 feet on top of the meter's faceplate.

Wide Operating Temperature Range

The DDD can operate from -40 to 65°C (-40 to 150°F) meaning it can be installed in a wide variety of indoor and outdoor industrial applications. And over this range, the DDD will drift no more than 0.005% of calibrated span/°C max from 0 to 65°C ambient and 0.01% of calibrated span/°C max from -40 to 0°C ambient.

Removable Screw Terminal Connectors

Industrial applications require screw terminal connections for easy field wiring and the DDD goes one step further in convenience by also making them removable.

Easy Plug-in Removable Terminal Connectors

Secured-in-Place Rugged Mounting Brackets

If you're installing the DDD outdoors in the hot or cold weather, the last thing you want to do is fumble around with mounting brackets that don't stay in place. The DDD's mounting brackets can be easily secured into place and then screwed down to the panel. These brackets are rugged so they can be tightened to the panel to provide a solid NEMA 4X seal.

Easy Secured-in-Place Mounting Brackets

Forgiving Panel Cutout Requirement

The DDD's bezel has been oversized to allow for not perfectly executed panel cutouts where NEMA 4X seal is not required.

Over-Sized Bezel to Completely Cover Panel Cutouts

UL Listing for Electrical Safety

UL & C-UL Listed: USA & Canada
UL 508 Industrial Control Equipment
UL File Number: E160849
Front Panel: UL Type 4X, NEMA 4X, IP65; panel gasket provided
Low Voltage Directive: EN 61010-1:2010 Safety requirements for measurement, control, and laboratory use

USB Port for Easy Connection to MeterView Pro Free Software
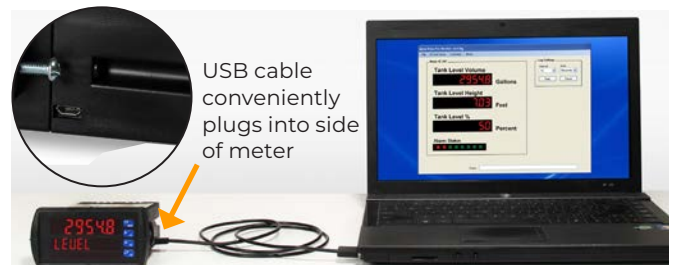
USB cable conveniently plugs into side of meter

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OPERATIONAL FEATURES

Function Keys, F4 Terminal, Digital Inputs

There are three ways the user can interact with the DDD to perform a variety of useful functions:

1. Three Front Panel Function Keys

The default settings for the function keys are:

	F1			F2			F3

Reset Max/Min Reading   Display Max/Min Reading   Acknowledge Relays

2. F4 On-Board Digital Input

The DDD includes a digital input as standard. This digital input can operate with the tare, reset tare, or interlock relays feature, force relays on from a signal from a PLC or relay on other equipment, and much more. This is ideal for installations where the meter is inaccessible behind a cover, or where an additional function key is needed for customized operation.

P+   P-   F4   COM   V+   mA+
1   2   3   4   5   6
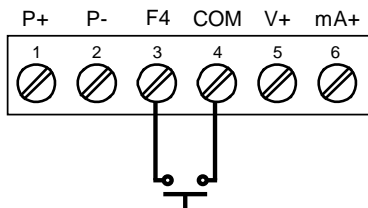
The F4 terminal is particularly useful for wiring up a remote switch to reset the relays as shown here:

3. Optional 4 Digital Input/Output Module PDA1044

+5   I1   I2   I3   I4   O1   O2   O3   O4   G

5 VDC   DI 1-4   DO 1-4   GND
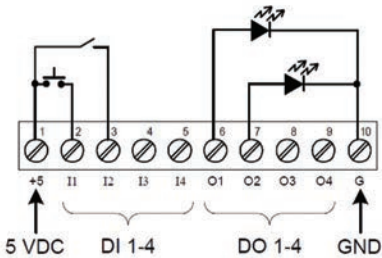
With these three methods, the DDD can be programmed to trigger certain events (i.e acknowledge relays, reset max and/or min, disable/enable output relays, or hold current relay states), provide direct menu access points and more.

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Function Key, Digital Inputs, & Digital Outputs Descriptions

The following table describes the actions that the function keys and digital inputs can be programmed to perform. The table also describes how the digital outputs can be used to remotely monitor the meter's alarm relay states, or the states of a variety of actions and functions executed by the meter.

| Display	Description	Item
rSt Hi	Reset the stored maximum display value	FK, DI, DO
rSt Lo	Reset the stored minimum display value	FK, DI, DO
rSt HL	Reset the stored maximum & minimum display values	FK, DI, DO
tArE	Capture tare and zero the display	FK, DI, DO
rSt tr	Reset captured tare and resume normal operation	FK, DI, DO
rELAY	Directly access the relay menu	FK, DI
SEt 1*	Directly access the set point menu for relay 1 (*through 8)	FK, DI
rLY d	Disable all relays until a button assigned to enable relays (rLY E) is pressed	FK, DI
rLY E	Enable all relays to function as they have been programmed	FK, DI
O Hold	Hold current relay states and analog output as they are until a button assigned to enable relays (rLY E) is pressed	FK, DI
d Hold	Hold the current display value, relay states, and analog output momentarily while the function key or digital input is active. The process value will continue to be calculated in the background.	FK, DI
Ln1 Hi	Display maximum display value on line 1	FK, DI
Ln1 Lo	Display minimum display value on line 1	FK, DI
Ln1 HL	Display maximum & minimum display values on line 1	FK, DI

Display	Description	Item
Ln2 Hi	Display maximum display value on line 2	FK, DI
Ln2 Lo	Display minimum display value on line 2	FK, DI
Ln2 HL	Display maximum & minimum display values on line 2	FK, DI
F On 1*	Force relay 1 (*through 4) into the on state. This is used in conjunction with a digital input expansion module to achieve interlock functionality.	FK, DI
Contrl	Directly access the control menu	FK, DI
diSAbL	Disable the selected function key or digital I/O	FK, DI
AcH	Acknowledge all active relays that are in a manual operation mode such as auto-manual or latching	FK, DI, DO
rESEt	Directly access the reset menu	FK, DI
mEnu	Mimic the menu button functionality (digital inputs only)	DI
riGHt	Mimic the right arrow/F1 button functionality (digital inputs only)	DI
uP	Mimic the up arrow/F2 button functionality (digital inputs only)	DI
EntEr	Mimic the enter/F3 button functionality (digital inputs only)	DI
ALm 1*	Provide indication when alarm 1 (*through 8) has been triggered (digital outputs only)	DO

FK: Function Keys   DI: Digital Inputs   DO: Digital Outputs

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Remote Operation of Front Panel Buttons

The user can operate the front panel buttons from a remote location by using digital inputs programmed in the following manner:
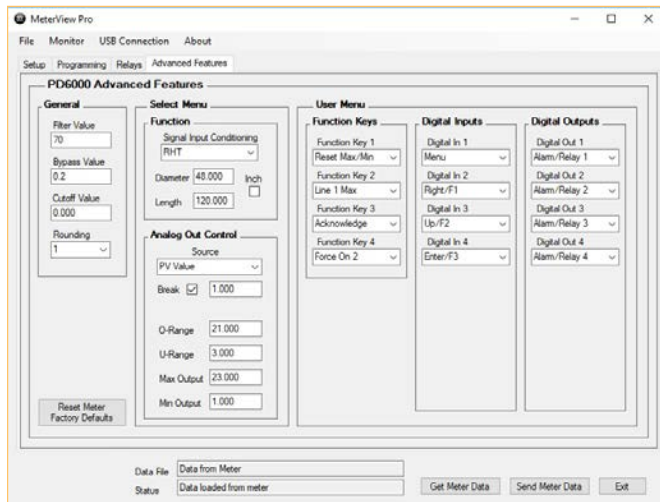
Tare

The tare function zero's out the display. In the case of scale weight, tare is used to eliminate container weight and provide net weight readings. There are two tare functions; Capture Tare and Reset Tare. When the capture tare function is used, the display reading is offset by the displayed amount to make the displayed value zero. This modified display value is the net value. The originally displayed value without the tare offset is the gross value. Both may be chosen as a display option. Reset tare removes the display offset.

| Before tare | After capture tare | After reset tare |
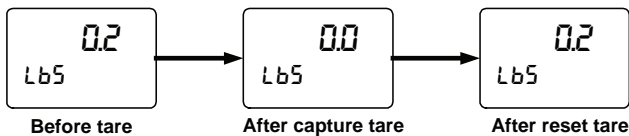
Reset tare removes the display offset of the net value, and the gross and net values become the same until a new capture tare is entered.

Max / Min Display

Max/Min (or Peak/Valley) is standard on the DDD series meter. Either display can be configured to show either maximum or minimum excursion since last reset. The displays can also be configured to toggle between Max and Min values. Both values can be simply reset from the front panel.

MeterView Pro Monitoring & Datalogging Software

Not only does free MeterView Pro software greatly simplify setup and programming of the meter, it can also be used to monitor and datalog your process.
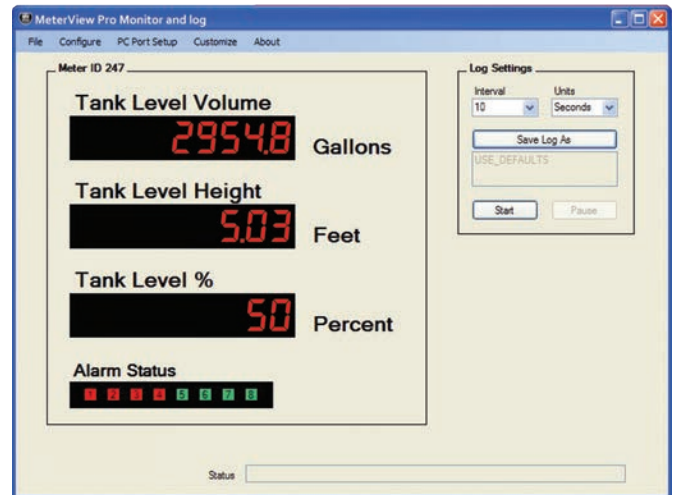
- Custom Tags: i.e. Tank Level Volume
- Custom Units: i.e. Gallons, Feet, Percent
- Alarm Status Indicators

Datalog Report

Collected data logger information can be sent to a CSV file for importing into a spreadsheet program. Below is an example of one such file. Of course, once within the spreadsheet, much can be done to customize the data.

Relay Control

Relays can be controlled from MeterView Pro for testing purposes. This is commonly done to determine whether the relays are functioning properly. In the **Setup** window, under **Relay and Digital Out Test** you have the option of selecting the relays you want in an ON state or OFF state and also whether you want to leave the relays in manual control or to return them to automatic operation.

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ACCESSORIES

Plastic Control Stations For The DDD

The PDA2360 series of plastic control stations provide a convenient way to remotely control devices such as APG's DDD. The PDA2364-MRUE four-position control station mimics the DDD's four front panel buttons: Menu, Right Arrow, Up Arrow, and Enter. The PDA2360-E is an emergency stop button, the PDA2361-A is used to acknowledge an alarm, and the PDA2361-Q is to silence an alarm.

PDA2360-E

PDA2361-Q

PDA2364-MRUE

PDA2361-A

- Complete Pre-Assembled Stations
- Normally Open (NO) Spring Return Plastic Bezel Pushbuttons
- Trigger Action Turn to Release Pushbutton (PDA2360-E only)
- IP65 / NEMA 4, 4X and 13 Rated
- Four-Position Control Station for Remote Operation of DDD Buttons
- Wall Mountable

PDA2360 Series Control Stations	
Model	Description
PDA2360-E	Emergency Stop Button
PDA2361-A	1 Black Ack Button
PDA2361-Q	1 Black Silence Button
PDA2364-MRUE	4 Black Buttons: Menu, Right, Up, Enter

PDA1024-01 24 VDC DIN Rail Power Supply

For transmitters and sensors that require more than the 200 mA power that the DDD can provide, use the PDA1024-01 24 VDC power supply as shown here.

PDA1024-01 24 VDC Power Supply

Input Voltage	85 ~ 264VAC 120 ~ 370VDC
Output Voltage	24 VDC ±10% @ 1.5A rated current
Input Frequency	47 ~ 63Hz
AC Current	0.88A/115VAC 0.48A/230VAC
Connections	Two terminals provided for +V and -V to simplify wiring of multiple devices
Operating Temperature	-20° to 60°C
Safety Standards	UL60950-1, TUV EN60950-1 Approved, Design refer to EN50178
EMC	Compliance to EN55011, EN55022 (CISPR22) Class B, EN61000-3-2, -3 EN61000-4-2, 3, 4, 5, 6, 8, 11, ENV50204, EN55024, EN61000-6-1, EN61204-3 Light industry, Criteria A
Dimensions	1.40" x 3.50" x 2.10" (35 mm x 90 mm x 54.5 mm) (W x H x D)

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DIMENSIONS

Optional Connectors Installed

1.76 (44.5)

2.45 (62)

0.59 (15)

4.77 (121)

5.05 (128)

6.0 (152) Clearance

Side View

4.17 (106)

3.61 (91.5)

4.68 (119)

Top View
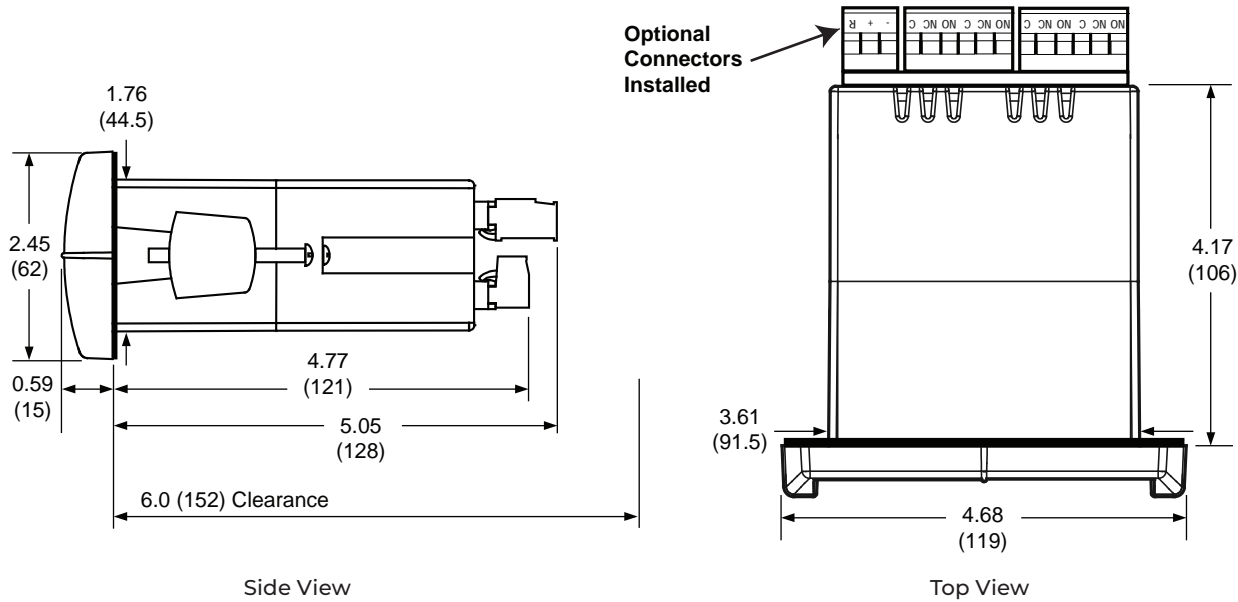
Notes:
1. Panel cutout required: 1.772" x 3.622" (45 mm x 92 mm)
2. Panel thickness: 0.040 - 0.250" (1.0 mm - 6.4 mm)
3. Mounting brackets lock in place for easy mounting
4. Clearance: Allow 6" (152 mm) behind the panel

CONNECTIONS

4-20 mA Output Powered by DDD

RELAY4	RELAY3	RELAY2	RELAY1	MA OUT
6 5 4	3 2 1	6 5 4	3 2 1	6 5 4	3 2 1	3 2 1
NO NC C	NO NC C	NO NC C	NO NC C	I- I+ R

24 V

SIGNAL

P+ P- F4 COM V+ mA+
1 2 3 4 5 6

M-LINK 1 2 3 4 5 6 7 8

POWER + - 1 2

+ -

DDD provides 24 VDC power to the transmitter
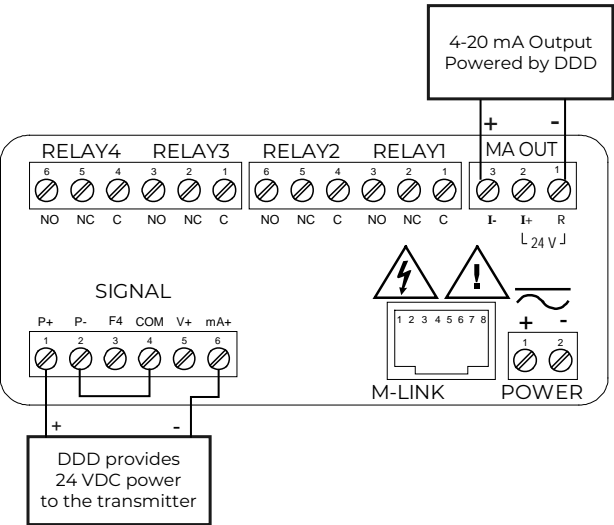
Fully Loaded DDD Meter
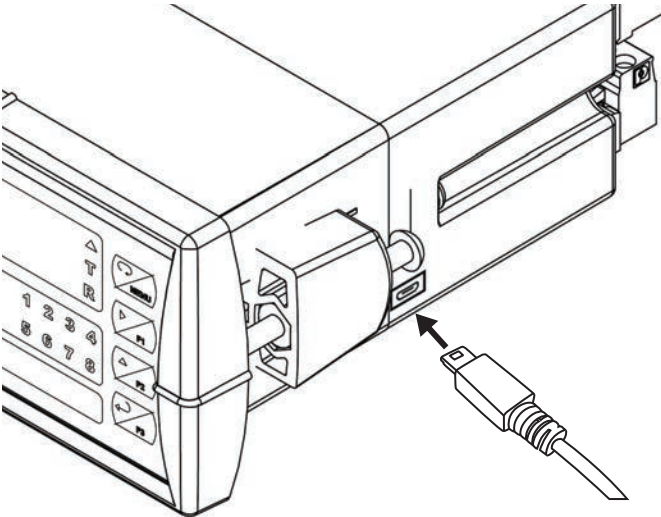
USB cable plugs into side of meter

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SPECIFICATIONS

Except where noted all specifications apply to operation at +25°C.

General

Display	Line 1: 0.60" (15 mm) high, red LEDs Line 2: 0.46" (12 mm) high, red LEDs 6 digits each (-99999 to 999999), with lead zero blanking
Display Intensity	Eight user selectable intensity levels. Default value is six.
Display Update Rate	5/second (200 ms)
Overrange	Display flashes 999999
Underrange	Display flashes -99999
Display Assignment	Display Line 1: PV1, PV2, PCT, PV & units, gross weight, net & gross weight, max/min, max & min, set points, or Modbus input. Display Line 2: Same as Display Line 1; plus units, tag or turned off.
Programming Methods	Four front panel buttons, digital inputs, PC and MeterView Pro software, or Modbus registers.
Noise Filter	Programmable from 2 to 199 (0 will disable filter)
Filter Bypass	Programmable from 0.1 to 99.9% of calibrated span
Recalibration	All ranges are calibrated at the factory. Recalibration is recommended at least every 12 months.
Max/Min Display	Max/min readings reached by the process are stored until reset by the user or until power to the meter is turned off.
Rounding	Select 1, 2, 5, 10, 20, 50, or 100 (e.g. rounding = 10, value = 123.45, display = 123.50).
Tare	Tare function zeros out the meter to remove the for weight of a container. Tare function can be assigned to a function key, F4 terminal, or a digital input.
Password	Three programmable passwords restrict modification of programmed settings.
Non-Volatile Memory	All programmed settings are stored in non-volatile memory for a minimum of ten years if power is lost.
Power Options	85-265 VAC 50/60 Hz; 90-265 VDC, 20 W max; 12-24 VDC, 12-24 VAC, 15 W max. Powered over USB for configuration only.
Fuse	Required external fuse: UL Recognized, 5 A max, slow blow; up to 6 meters may share one 5 A fuse
Normal Mode Rejection	Greater than 60 dB at 50/60 Hz
Isolation	4 kV input/output-to-power line 500 V input-to-output or output-to-P+ supply
Overvoltage Category	Installation Overvoltage Category II: Local level with smaller transient overvoltages than Installation Overvoltage Category III.

Environmental	Operating temperature range: -40 to 65°C (-40 to 149°F) Storage temperature range: -40 to 85°C (-40 to 185°F) Relative humidity: 0 to 90% non-condensing
Connections	Removable screw terminal blocks accept 12 to 22 AWG wire, RJ45 for external relays, digital I/O, and serial communication adapters.
Enclosure	1/8 DIN, high impact plastic, UL 94V-0, color: black
Front Panel	NEMA 4X, IP65
Mounting	1/8 DIN panel cutout required: 3.622" x 1.772" (92 mm x 45 mm) Two panel mounting bracket assemblies are provided.
Tightening Torque	Screw terminal connectors: 5 lb-in (0.56 Nm)
Overall Dimensions	4.68" x 2.45" x 5.64" (119 mm x 62 mm x 143 mm) (W x H x D)
Weight	9.5 oz (269 g)
Warranty	3 years parts & labor. See Warranty Information and Terms & Conditions on www.apgsensors.com for complete details.

Process Input

Inputs	Field selectable: 0-20 mA, 4-20 mA ±10 V (0-5 V, 1-5 V, 0-10 V) Modbus PV (Slave)
Isolated Transmitter Power Supply	Terminals P+ & P-: 24 VDC ±10%. All models selectable for 24, 10, or 5 VDC supply (internal jumper J4). 85-265 VAC models rated @ 200 mA max, 12-24 VDC powered models rated @ 100 mA max. 5 & 10 VDC supply rated @ 50 mA max.
Accuracy	±0.03% of calibrated span ±1 count, square root & programmable exponent accuracy range: 10-100% of calibrated span
Temperature Drift	0.005% of calibrated span/°C max from 0 to 65°C ambient, 0.01% of calibrated span/°C max from -40 to 0°C ambient
Input Signal Conditioning	Linear, square root, programmable exponent, or round horizontal tank volume calculation
Multi-Point Linearization	2 to 32 points for PV or PV1 2 to 8 points for PV2 (Dual-scale Level feature)
Programmable Exponent	User selectable from 1.0001 to 2.9999 for open channel flow
Round Horizontal Tank	Diameter & Length: 999.999 inch or cm calculates volume in gallons or liters respectively.
Low-Flow Cutoff	0.1 to 999,999 (0 disables cutoff function). Point below at which display always shows zero.
Decimal Point	Up to five decimal places or none: dddddd, ddddd, dddd, ddd, dd, or dddddd

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Calibration Range	Input Range	Minimum Span Input 1 & 2
	4-20 mA	0.15 mA
	±10 V	0.10 V
	An error message will appear if the input 1 and input 2 signals are too close together.	

Input Impedance	Voltage ranges: greater than 500 kΩ Current ranges: 50 - 100 Ω (depending on internal resettable fuse impedance)
Input Overload	Current input protected by an internal resettable fuse, 30 VDC max. Fuse resets automatically after fault is removed.
HART Transparency	The meter does not interfere with existing HART communications; it displays the 4-20 mA primary variable and it allows the HART communications to pass through without interruption. The meter is not affected if a HART communicator is connected to the loop. The meter does not display secondary HART variables.

Relays

Rating	2 or 4 SPDT (Form C) internal and/or 4 SPST (Form A) external; rated 3 A @ 30 VDC and 125/250 VAC resistive load; 1/14 HP (≈ 50 W) @ 125/250 VAC for inductive loads
Noise Suppression	Noise suppression is recommended for each relay contact switching inductive loads.
Deadband	0-100% of span, user programmable
High or Low Alarm	User may program any alarm for high or low trip point. Unused alarm LEDs and relays may be disabled (turn off).
Relay Operation	Automatic (non-latching), latching (requires manual acknowledge) with/without clear, sampling (based on time), pump alternation control (2 to 8 relays), Off (disable unused relays and enable interlock feature, manual on/off control mode).
Relay Reset (Acknowledge)	User selectable via front panel buttons or digital inputs. 1. Automatic reset only (non-latching), when input passes the reset point. 2. Automatic + manual reset at any time (non-latching). 3. Manual reset only, at any time (latching). 4. Manual reset only after alarm condition has cleared (latching). Note: Front panel button or digital input may be assigned to acknowledge relays programmed for manual reset.
Time Delay	0 to 999.9 seconds, on & off relay time delays. Programmable and independent for each relay
Fail-Safe Operation	Programmable and independent for each relay. Note: Relay coil is energized in non-alarm condition. In case of power failure, relay will go to alarm state.
Auto Initialization	When power is applied to the meter, relays will reflect the state of the input to the meter
Additional Relays	An external module, model PDA1004, is available to add 4 SPST 3 A relays to the meter.

Isolated 4-20 mA Transmitter Output

Output Source	Process variable (PV), max, min, set points 1-8, Modbus input, or manual control mode
Scaling Range	1.000 to 23.000 mA for any display range
Calibration	Factory calibrated: 4.000 to 20.000 = 4-20 mA output
Analog Out Programming	23.000 mA maximum for all parameters: Overrange, underrange, max, min, and break
Accuracy	± 0.1% of span ± 0.004 mA
Temperature Drift	0.4 µA/°C max from 0 to 65°C ambient, 0.8 µA/°C max from -40 to 0°C ambient Note: Analog output drift is separate from input drift.
Isolated Transmitter Power Supply	Terminals I+ & R: 24 VDC ±10%. May be used to power the 4-20 mA output or other devices. All models rated @ 40 mA max.
External Loop Power Supply	35 VDC maximum

Output Loop Resistance	Power supply	Minimum	Maximum
	24 VDC	10 Ω	700 Ω
	35 VDC (external)	100 Ω	1200 Ω

Additional 4-20 mA Outputs	The PD659-1MA-2MA can split the optional 4-20 mA output into two isolated 4-20 mA outputs
0-10 VDC Output	The PD659-1MA-1V can convert the optional 4-20 mA output to a 0-10 VDC output

USB Connection

Function	Programming only
Compatibility	USB 2.0 Standard, Compliant
Connector Type	Micro-B receptacle
Cable	USB A Male to Micro-B Cable
Driver	Microsoft® Windows® 10/11
Power	USB port provides power to the meter. DO NOT apply AC or DC power to the meter while the USB port is in use.

On-Board Digital Input (F4)

Function	Remote operation of front-panel buttons, acknowledge/reset relays, reset max/min values.
Contacts	3.3 VDC on contact. Connect normally open contacts across F4 to COM.
Logic Levels	Logic High: 3 to 5 VDC Logic Low: 0 to 1.25 VDC
Additional I/O	Up to 2 external modules, model PDA1044 with 4 digital inputs and 4 digital outputs each can be added.

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Modbus RTU Serial Communications

Slave Id	1 – 247 (Meter address)
Baud Rate	300 – 19,200 bps
Transmit Time Delay	Programmable between 0 and 199 ms
Data	8 bit (1 start bit, 1 or 2 stop bits)
Parity	Even, Odd, or None with 1 or 2 stop bits
Byte-To-Byte Timeout	0.01 – 2.54 second
Turn Around Delay	Less than 2 ms (fixed)

Note: Refer to the DDD Modbus Register Tables located at www.predig.com for details.

MeterView Pro Software

Availability	Download from www.apgsensors.com
System Requirements	Microsoft® Windows® 10/11
Communications	USB 2.0 (for programming only) (Standard USB A to Micro USB B) RS-232 adapter, RS-485 adapter and RS-485 to USB converter (programming, monitoring, and data logging)
Configuration	Configure meters one at a time
Power	USB port provides power to the meter. <u>DO NOT</u> apply AC or DC power to the meter while the USB port is in use.

Digital I/O Expansion Module

Channels	4 digital inputs & 4 digital outputs per module
System	Up to 2 modules for a total of 8 inputs & 8 outputs
Digital Input Logic	**High:** 3 to 5 VDC **Low:** 0 to 1.25 VDC
Digital Output Logic	**High:** 3.1 to 3.3 VDC **Low:** 0 to 0.4 VDC
Source Current	10 mA maximum
Sink Current	1.5 mA minimum
+5 V Terminal	To be used as pull-up for digital inputs only.

4-Relay Expansion Module

Relays	Four Form A (SPST) rated 3 A @ 30 VDC and 125/250 VAC resistive load; 1/14 HP (≈ 50 watts) @ 125/250 VAC for inductive loads.

Compliance Information

Safety

UL & C-UL Listed	USA & Canada UL 508 Industrial Control Equipment
UL File Number	E160849
Front Panel	UL Type 4X, NEMA 4X, IP65; panel gasket provided
Low Voltage Directive	EN 61010-1 Safety requirements for measurement, control, and laboratory use

Electromagnetic Compatibility

Emissions	EN 55022 Class A ITE emissions requirements
Radiated Emissions	Class A
AC Mains Conducted Emissions	Class A
Immunity	EN 61326-1 Measurement, control, and laboratory equipment EN 61000-6-2 EMC heavy industrial generic immunity standard
RFI - Amplitude Modulated	80 -1000 MHz 10 V/m 80% AM (1 kHz) 1.4 - 2.0 GHz 3 V/m 80% AM (1 kHz) 2.0 - 2.7 GHz 1 V/m 80% AM (1 kHz)
Electrical Fast Transients	±2kV AC mains, ±1kV other
Electrostatic Discharge	±4kV contact, ±8kV air
RFI - Conducted	10V, 0.15-80 MHz, 1kHz 80% AM
AC Surge	±2kV Common, ±1kV Differential
Surge	1KV (CM)
Power-Frequency Magnetic Field	30 A/m 70%V for 0.5 period
Voltage Dips	40%V for 5 & 50 periods 70%V for 25 periods
Voltage Interruptions	<5%V for 250 periods

Note: Testing was conducted on meters installed through the covers of grounded metal enclosures with cable shields grounded at the point of entry representing installations designed to optimize EMC performance.

EU Declaration of Conformity

For reference, a Declaration of Conformity is available at www.apgsensors.com

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ORDERING INFORMATION

DDD Standard Display Models		
85-265 VAC Model	**12-24 VDC Model**	**Options Installed**
DDD-A00	DDD-D00	None
DDD-A02	DDD-D02	2 Relays
DDD-A10	DDD-D10	4-20 mA Output
DDD-A04	DDD-D04	4 Relays
DDD-A12	DDD-D12	2 Relays & 4-20 mA Output
DDD-A14	DDD-D14	4 Relays & 4-20 mA Output
Note: 24 V Transmitter power supply standard on all models.		

DBD SunBright Display Models		
85-265 VAC Model	**12-24 VDC Model**	**Options Installed**
DBD-A00	DBD-D00	None
DBD-A02	DBD-D02	2 Relays
DBD-A10	DBD-D10	4-20 mA Output
DBD-A04	DBD-D04	4 Relays
DBD-A12	DBD-D12	2 Relays & 4-20 mA Output
DBD-A14	DBD-D14	4 Relays & 4-20 mA Output
Note: 24 V Transmitter power supply standard on all models.		

Accessories	
Model	**Description**
PDA1002	DIN Rail Mounting Kit for Two Expansion Modules
PDA1004	4-Relay Expansion Module
PDA1024-01	24 VDC Power Supply for DIN Rail
PDA1044	4 Digital Inputs & 4 Digital Outputs Module
PDA1232	RS-232 Serial Adapter
PDA1485	RS-485 Serial Adapter
PDA18DINSH	Stainless Steel Sun Hood
PDA7485-I	RS-232 to RS-422/485 Isolated Converter
PDA8232-N	USB to RS-232 Non-Isolated Converter
PDA8485-I	USB to RS-422/485 Isolated Converter
PDX6901	Suppressor (snubber): 0.01 μF/470 Ω, 250 VAC

Upgrade Cards	
Model	**Description**
PD1102	2 Relays
PD1103	4-20 mA Output[1]
PD1104	4 Relays
PD1105	2 Relays + 4-20 mA Output[1]
PD1107	4 Relays + 4-20 mA Output[1]

1. Output calibration required by user.
2. These upgrade cards are intended for customers who already have a meter and want to upgrade its functionality.

PDA2360 Series Control Stations	
Model	**Description**
PDA2360-E	Emergency Stop Button
PDA2361-A	1 Black Ack Button
PDA2361-Q	1 Black Silence Button
PDA2364-MRUE	4 Black Buttons: Menu, Right, Up, Enter

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⚠ WARNING
Cancer and Reproductive Harm - www.P65Warnings.ca.gov

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