DP10
SERIES

OMEGA
ENGINEERING, INC.
An OMEGA Group Company

DP10 SERIES PANEL INDICATORS

Operator's Manual

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of 13 months from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive current, heat, moisture, vibration, or misuse. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

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Direct all warranty and repair requests/inquiries to OMEGA Customer Service Department, telephone number (203) 359-1660. Before returning any instrument, please contact the OMEGA Customer Service Department to obtain an authorized return (AR) number. The designated AR number should then be marked on the outside of the return package.

To avoid processing delays, also please be sure to include:

1. Returnee's name, address, and phone number.
2. Model and Serial numbers.
3. Repair instructions.

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M663/057

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TABLE OF ILLUSTRATIONS

USING THIS INSTRUCTION MANUAL

Use this manual for:

- Connecting the DP10 Series
- Setting up the DP10 Series
- Installing the DP10 Series
- Calibrating the DP10 Series

Each chapter begins with a listing of topics it covers. Front-panel keys you use to Operate, Setup, and Calibrate the DP10 Series are graphically pictured throughout the manual. Illustrations are used, when possible, to show "how to" do something.

A "Parameter Map" graphically details step-by-step instructions for reviewing, changing and selecting setup parameters.

The "Parameter Map" appears on left hand pages and a brief description of what the parameter does appears on right hand pages.

Refer to Publication #16-400458 Installation and Calibration manual for option installations and dual channel calibration. Please note that each option is shipped with installation information.

CHAPTER ONE

DP10 SERIES PANEL INDICATORS

1.0 OVERVIEW

This chapter contains the following:

- Description of the DP10 Series
- Learning about the DP10 Series

1.1 DESCRIPTION

The OMEGA® DP10 Series is a microprocessor-based monitor and controller designed to process one or two isolated inputs from Voltage, Current, Resistance and Temperature devices.

The DP10 Series includes a 17-bit bipolar A/D converter at 20 conversions/s that provides a 2.5:1 internal count-to-display ratio with 4½-digit resolution (± 19999). It has a blue-green, vacuum fluorescent display with 14 segments for displaying alphanumeric characters.

Software programs customize the DP10 Indicators to individual applications. Five front-panel keys easily access the software program to establish or change present input type, span, offset, setpoint, alarms or controls.

Advanced Calculations capability permits input signal scaling to display any desired engineering units. Basic mathematical logarithmic, or trigonometric functions can be performed with the signal.

Four independent digital outputs can be used for control or as alarms. Alarms can be configured at specific values or as deviation (percentage of setpoint). Reset can be auto, manual or failsafe, emulating a latched relay.

Standard RS232C capability provides output to host computers, for external setup and operation of the DP10 Series. An optional RS485 port provides networking of up to 32 DP10 Series Indicators. DC or AC power can be used by connecting to specific points on the rear connector.

1.2 LEARNING ABOUT THE DP10 SERIES

1.2.1 FRONT PANEL DISPLAY and KEYBOARD

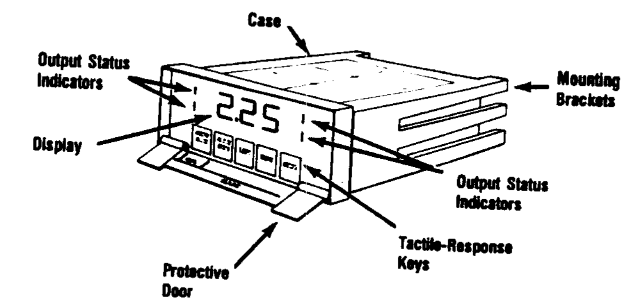


Figure 1-1. Front-Panel Display and Keyboard.

1.2.2 REAR-PANEL INPUT AND OUTPUT CONNECTION

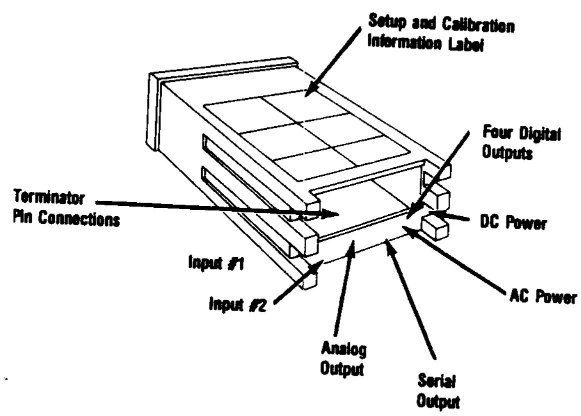


Figure 1-2. Rear-Panel I/O Connections. (refer to Appendix C)

1.2.3 TOP LABEL

Includes the Serial Number, Date of Manufacture, and blanks for the following optional information.

- Model number
- Input 1 (DP11) and 2 (DP12) type, capacity, and wiring connections
- Analog and the four Digital output pin connections
- Serial communication type, address and pin connections
- Type of power, jumper locations for ac power and pin connections for ac or dc power

(See Figure 1-2.)

1.2.4 DP10 SERIES MODES

The DP10 Series has an OPERATION MODE and a SETUP MODE.

OPERATION MODE

When powered up, the DP10 Indicator enters the Operation Mode and does the following:

- Converts measurements into engineering units
- Performs special user-defined computations
- Displays results
- Displays Input 1, Input 2, Peak, Valley, Advanced Cal., Setpoint, and Digital readings when prompted
- Drives analog output, discrete alarm or control outputs, and a serial I/O communications port
- Checks for alarm conditions and transmits results via its communications port

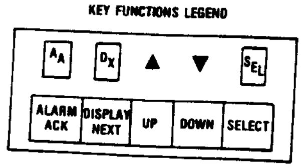
SETUP MODE

In Setup Mode, the operator uses front-panel keys to configure the DP10 Series.

1.2.5 USING the PARAMETER MAP TO SET UP the DP10 SERIES INDICATORS

A "Parameter Map" (flowchart) details the parameters and up to five levels of choices. Also, it illustrates which front-panel keys are pressed to move through the choices. The following portion of the Parameter Map illustrates some of the parameters and choices; the complete Parameter Map and an explanation of each choice are in Chapter Two.

Each parameter begins on Level One and choices to configure the unit appear to the right. You can go through all of the choices for each parameter or you can move down the first level until the parameter you want is displayed.



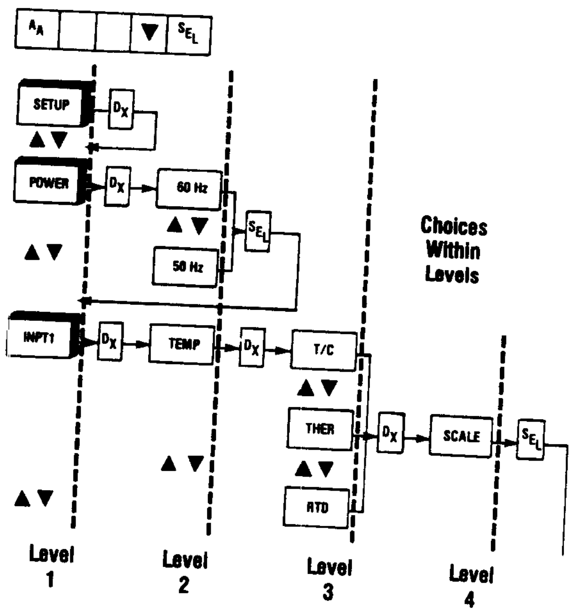


Figure 1-3. Abbreviated Parameter Map.

1.2.6 FRONT PANEL KEYS

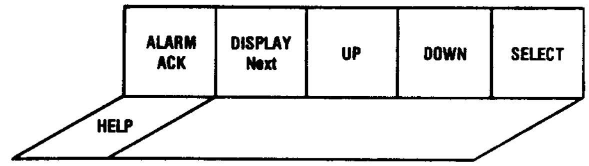


Figure 1-4. Five Front-Panel Keys.

1.2.7 USING THE FRONT PANEL KEYS

The Alarm Acknowledge key has one function in Operation Mode and a different function in Setup Mode.

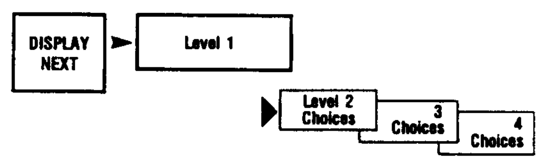
OPERATION FUNCTION

Manually resets or acknowledges alarms.

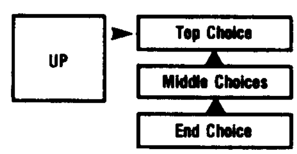
SETUP FUNCTION

Scrolls HELP messages explaining parameter choices or which keys to press.

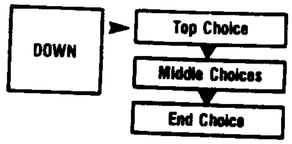
KEY FUNCTIONS FOR SELECTING MENU CHOICES



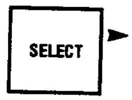
Advances across and down to the next parameter level and sublist of choices. Does not enter changes into memory.



Steps up one choice until the top choice of that level is reached.



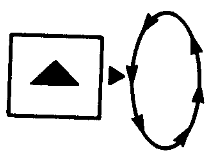
Steps down one choice until the bottom choice of that level is reached.



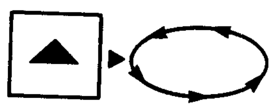
Enters displayed choices into memory at each level of parameter choices.

KEY FUNCTIONS FOR SPECIFYING NUMERIC ENTRIES

Some parameter settings require entry of a numeric value or decimal point location.



Increases value of blinking digit and cycles 0 through 9. Moves decimal location one position left.



Moves blinking digit to the right and cycles around. Moves decimal location one position right.

CHAPTER TWO

POWERING UP AND SETTING UP THE DP10 SERIES PANEL INDICATORS

2.0 OVERVIEW

This Chapter contains the following sections:

- Inspecting the DP10 Series package contents
- Powering up with dc or ac
- Selecting setup parameter choices
- Installing the DP10 Series

2.1 INSPECTING THE DP10 SERIES

Verify that the following were in your DP10 Series shipping carton:

- DP10 Series Indicator
- Panel mounting slides and hardware
- Manual

NOTE: Keep the carton and packing materials for reshipment if necessary.

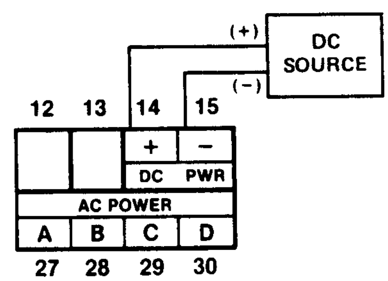
2.2 APPLYING POWER TO THE DP10 SERIES

Connections for dc or ac power are illustrated below. Signal input connections are illustrated in Appendix B.

Before the setup parameters can be reviewed and selected, power must be connected to the DP10 Indicator.

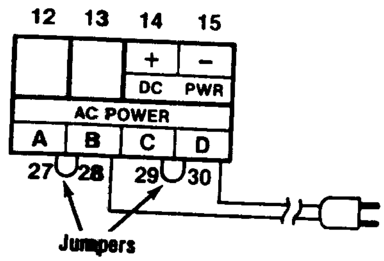
2.2.1 CONNECTING DC

(Use for dc voltages from 12 to 60 Vdc. DC is independent of jumper locations on ac power terminals).



2.2.2 CONNECTING 110 Vac

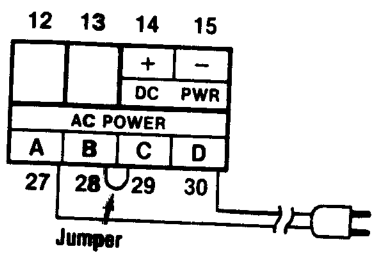
(Use for ac voltage from 85V to 132V. Standard Shipping Configuration.)



2.2.3 CONNECTING 220 Vac

(Use for ac voltages from 170V to 264V.)

WARNING: Connecting 220 Vac with 115 Vac jumper configuration **WILL** damage the power supply.



2.2.4 INITIAL PROCEDURES

When the DP10 Series is powered up, the following happens:

- Five second warm-up period
- Internal self-check
- Illumination of all fourteen segments of each display digit and each status indicator
- Reading of setup parameters into RAM
- Establishment of default output conditions:

Four Digital Alarm

Outputs — Off

Analog Output — 0 mA

and then:

The DP10 Indicator enters the Operation Mode.

2.2.5 ERROR MESSAGES

Diagnostics are performed by the DP10 Series at power up and continuously during operation. When an error is detected, the DP10 Indicator enters a special mode and "ERR", followed by a digit, flashes on the display. The digit indentifies the error type.

Error messages are listed and explained in Appendix E.

Operations are suspended when an error occurs and an Error Number flashes on the screen. Follow the instructions in Appendix E to correct the problem.

If the error has been corrected, the DP10 Indicator returns to the OPERATION MODE.

NOTE: When a detectable error is found, the DP10 Series opens all control and alarm relays and zeros analog output.

2.3 SETTING UP THE DP10 SERIES

The DP10 Series defaults to the Operation Mode when powered up. To review and change the factory default parameters, you must set the DP10 Indicator to Setup Mode.

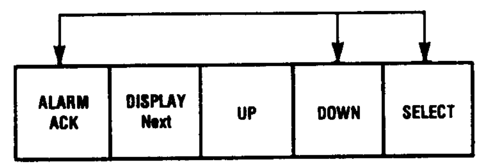
NOTE: **Factory default parameter settings can be reinstalled by pressing SELECT while power cycling the unit.**

(Default settings are listed in Appendix D.)

2.3.1 REVIEWING AND CHANGING SETUP PARAMETERS

Follow these instructions to change the factory default parameters.

STEP ONE — Simultaneously press: 3 keys



SETUP displays

STEP TWO — Press DISPLAY NEXT or DOWN to begin reviewing parameter choices. **POWER**, the first parameter, is displayed.

(Refer to Page 5 for a complete explanation of each key's function.)

STEP THREE — Using the front panel keys, you can review and/or change parameters. The Parameter Map which illustrates the parameters and the choices appear on left-hand pages beginning page 19.

Parameter choice explanations appear on the right-hand pages.

NOTE: Pressing DISPLAY NEXT at the point where SELECT is shown causes SAVE to display. Pressing SELECT saves any changes in non-volatile memory. Pressing DISPLAY NEXT **DOES NOT** save changes.

When **OPER**, the last parameter, displays:
Press SELECT

The DP10 Indicator returns to the Operation Mode.

POWER Default — 60 Hz

Synchronizes the duration of the input signal integration phase of the A/D converter with the power supply line frequency. Either setting minimizes the effect of primary line frequency noise.

Choices are 60 Hz or 50 Hz.

INPT1 Default — DCV/I 200 mV

Establishes the source for Input One as one of three classes of temperature devices, resistance, or as dc — voltage or current.

TEMPERATURE
- Thermocouple — eleven different types
- Thermistor
- Resistance temperature devices (RTD) — two types with three different connection methods each.

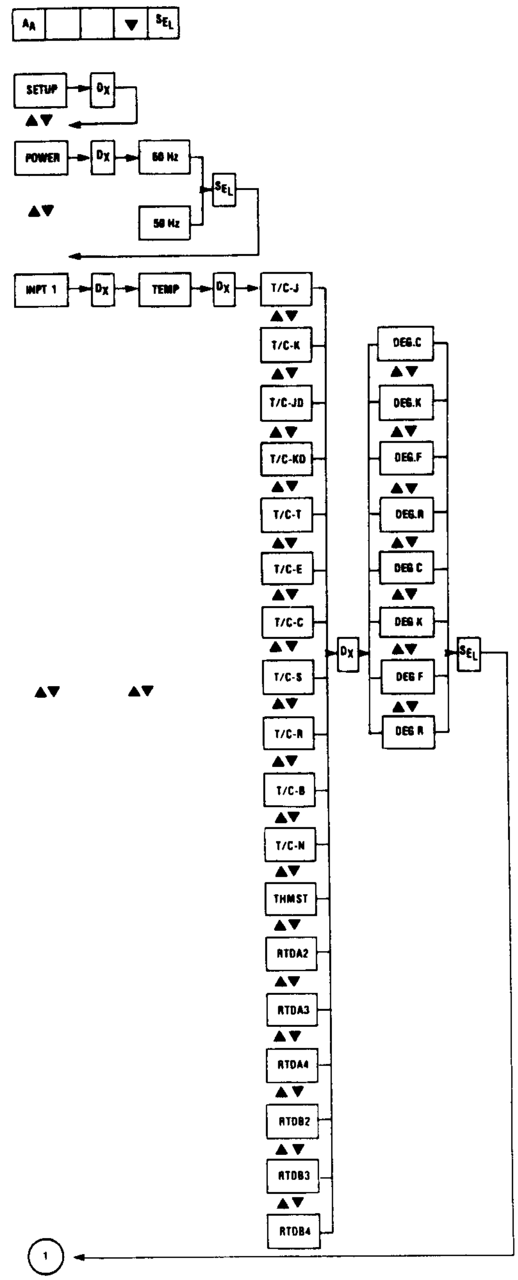
If a temperature input source is selected, the temperature scale of either Celsius, Fahrenheit, Kelvin, or Rankin and the resolution of 0.1° or 1° must be selected.

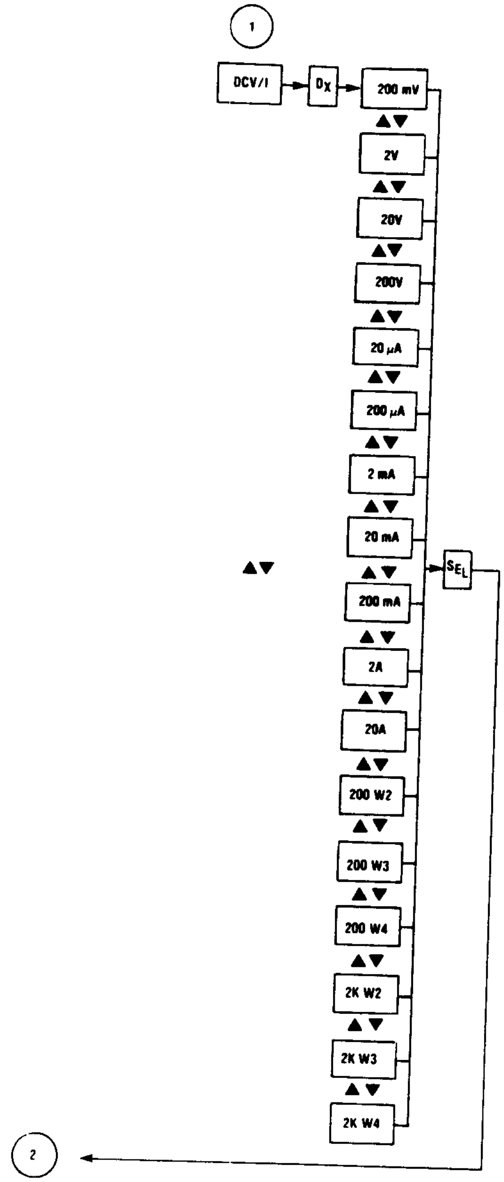
DC — VOLTAGE OR CURRENT
- DC Voltage
- DC Current
- Resistance

Decimal Point Default

The type of input selected determines the location of the decimal point.

0.1°	0000.0
1.0°	00000 (Does not display)





200 mV 200V 200 µA 200 mA	000.00
2V 2 mA 2A	0.0000
20V 20 µA 20 mA 20A	00.000
For 200Ω	000.00
For 2 kΩ	0000.0

When resistance is being measured and the signal exceeds 1999.9, the unit will read "OVER". The full resistance signal can be displayed using Advanced Calculations and multiplying the input by .10; however the resolution is diminished one digit.

INPT2 Default — DCV/I
200 mV

When using the 2 input model (DP12), the selection of the input source as a temperature device, resistance, or as dc — voltage or current is identical to Input 1. The menu of the DP11 (1 input model) will not display INPT 2 selections.

FILTeR Default — TCNST-386
HYSTR-Off

Sets the Time CoNSTant in milliseconds (ms) for the meter's response to an input signal step change. Time Constant choices are 0, 68, 180, 386, 772 or 1568 ms. Shorter Time Constants produce faster responses but filter out less noise than longer time constants.

NOTE: 386 ms TCNST is equivalent to 2.6 Hz single pole filter.

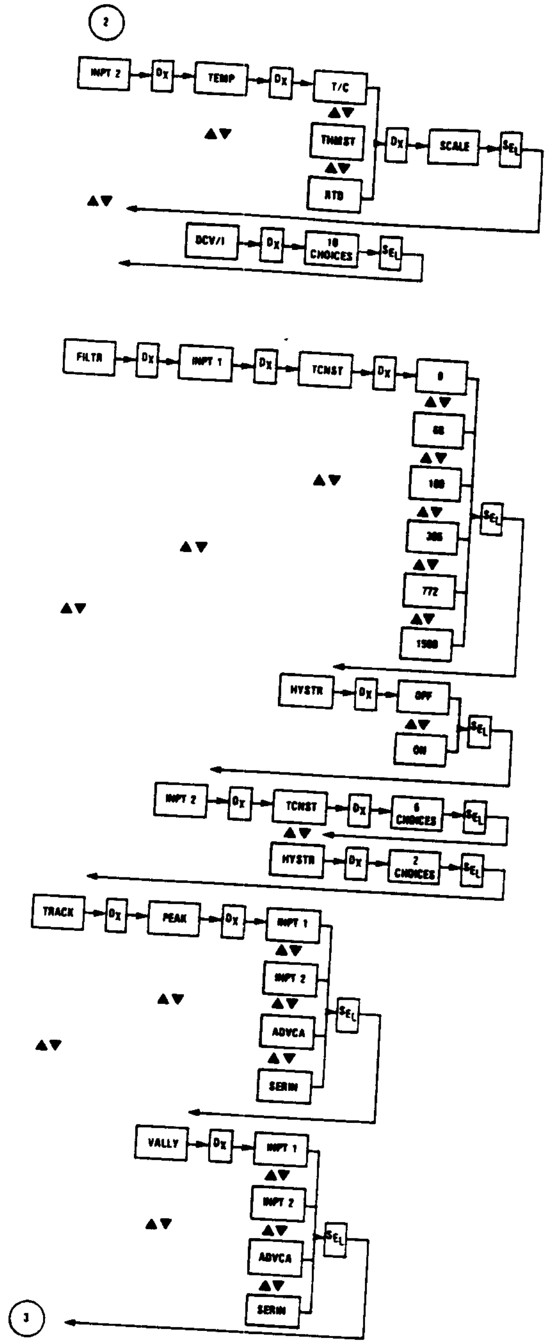
HYSTeResis ON stabilizes the display and minimizes "jitter";

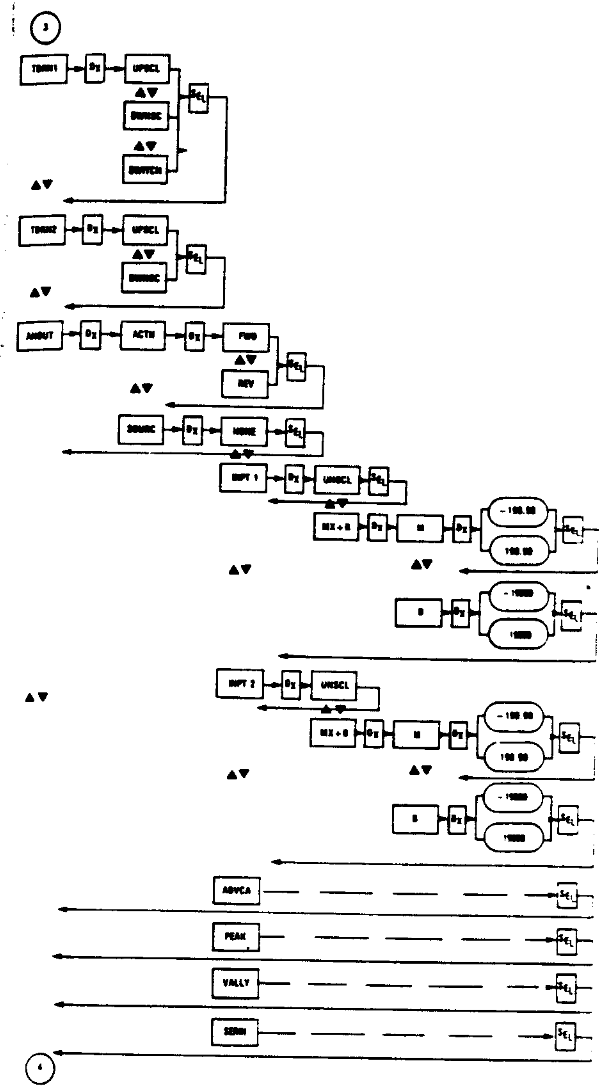
HYSTeResis OFF allows input signals to display and change at each minimal signal increase or decrease.

Each input has independent settings for Time CoNSTant and HYSTeResis.

TRACK Default — PEAK-Input 1,
VALLY-Input 1

Establishes source for tracking PEAK and VALLeY. Choices are Input 1, Input 2, Advanced Calculations results, or Serial Input.


2
INPT 2
TEMP
T/C
THMST
RTD
SCALE
DCV/I
10 CHOICES
FILTR
INPT 1
TCNST
0
66
100
386
772
1500
HYSTR
OFF
ON
INPT 2
TCNST
6 CHOICES
HYSTR
2 CHOICES
TRACK
PEAK
INPT 1
INPT 2
ADVCA
SERIN
VALLY
INPT 1
INPT 2
ADVCA
SERIN
3


3
UPSCL
UPSCL
ACTN
FWD
REV
SOURC
NONE
INPT 1
UNSCL
MX+B
M
B
INPT 2
UNSCL
MX+B
M
B
ADVCA
PEAK
VALLY
SERIN
4

THERMOCOUPLE BuRNout-INPUT 1
Default — Upscale

If the Input One thermocouple burns out or opens:

UPSCaLe: forces a positive response (19999)
DowNSCaLe: forces a negative response (– 19999)
SWiTCH: automatically changes to Input Two Thermocouple as the input source.

NOTE: If a thermocouple is selected as the input source with NO thermocouple connected, the display alternatively flashes OPEN and OVER or UNDER depending on parameter settings. Connect the proper thermocouple and press Alarm Acknowledge to clear the display.

THERMOCOUPLE BURNOUT-INPUT 2
With the Model DP12 (2 input), selection of UPSCALE or DOWNSCALE response is identical to Thermocouple Burnout for the Model DP11 (1 input).

ANALOG OUTPUT
Default — ACTioN-Forward
SOURCe-None

Establishes the slope of the 0 to 20 mA scalable output ACTioN and the input SOURCe of the analog output.

Forward or reverse slope ACTioN which affects the relationship of the input to the output signal is illustrated in Figure 2-1 on the following page.

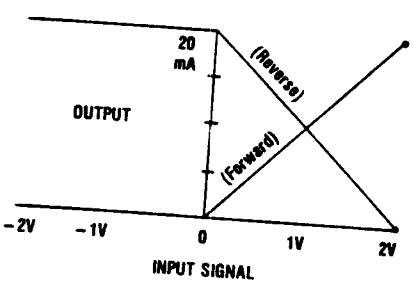


Figure 2-1. Input Slope Action Example

SOURCes for analog output are None, Input 1, Input 2, Advance Calculations' results, Peak, Valley, or Serial Input.

Each input source — Input 1, Input 2, Advanced Calculations, Peak, Valley, and Serial Input — can be UNSCaLed or scaled using the mx + b function.

NOTE: The Parameter Map ONLY illustrates setting M & B for Input 1 and Input 2. Advanced Calculations results, Peak, Valley, and Serial Input are scaled identically.

If UNSCaLed and forward acting, full scales input of 19999 is equivalent to 20 mA; zero input is equivalent to 0 mA. The analog output is scaled using $y = mx + b$.

The m and b numeric values are entered and the DP10 Series automatically computes the value for the analog output.

See Chapter Five for details on determining m and b values.

DiSPLaY
Default — ZROSP-Yes
SOURC-Inpt1

Determines information to be displayed. ZeRO SuPpression determines if leading zeros display.

SOURCe establishes Input 1, Input 2, Advance Calculation results, Peak, Valley or Serial Input as the Display input source.

SERIAL INPUT/OUTPUT
Default — COMm ADdress-0
SOURCe-Inpt1
BAUD-9600
PARITy-None
LINeTeRM-CR LF
DELAY-19999
PASWD-0000

With the standard RS232C or optional RS485 card, serial communications can be received or transmitted. COMmunication ADdress establishes a unique address of 0 through 31 for the DP10 Series.

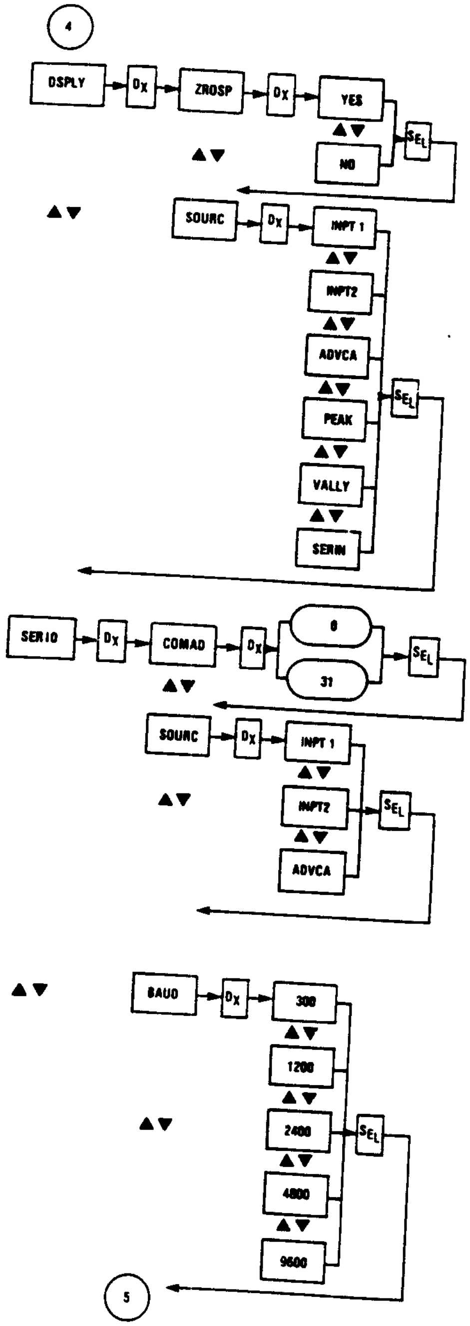
SOURCe establishes the source of the serial output as Input 1, Input 2, or Advanced Calculations' results.

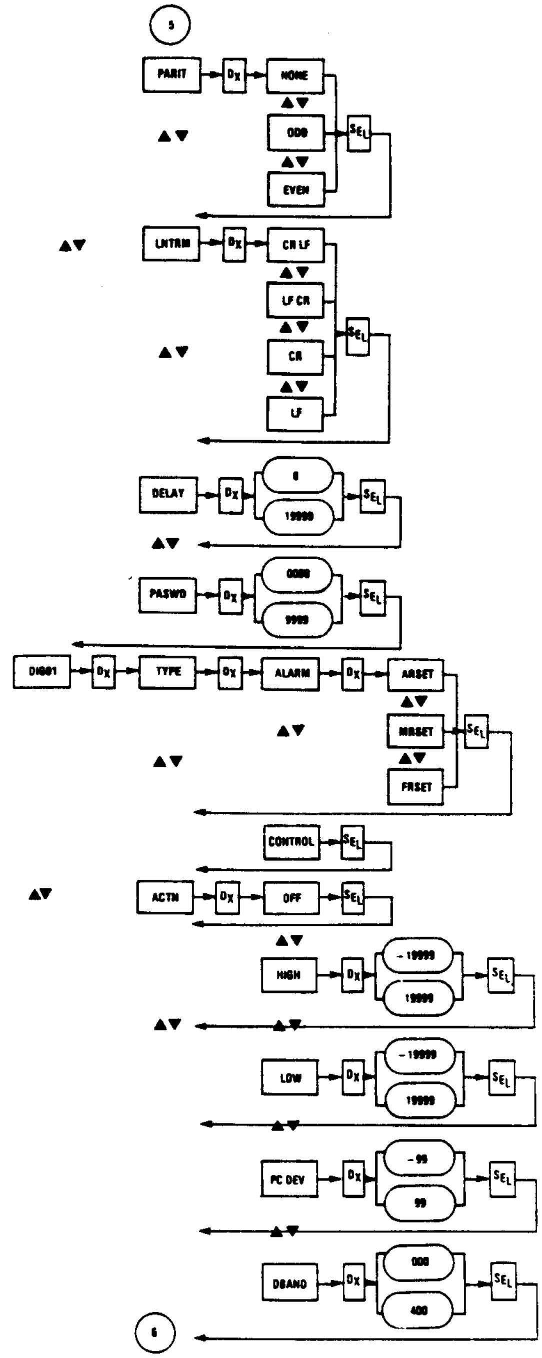
BAUD establishes communication rate as 300, 1200, 2400, 4800 or 9600.

PARITy establishes the parity bit as None, Odd or Even required for serial communication with peripheral devices.

LiNe TeRMinator establishes the transmission line terminator as either carriage return/line feed (CR LF); line feed/carriage return (LF CR); carriage return only (CR); or line feed only (LF).

DELAY establishes the number of seconds between automatic transmissions. 0 (zero) establishes continuous transmission; 19999 causes no transmission; 120 is 2 minutes.


4
DSPLY
ZROSP
YES
NO
SOURC
INPT 1
INPT2
ADVCA
PEAK
VALLY
SERIN
SERIO
COMAD
0
31
SOURC
INPT 1
INPT2
ADVCA
BAUD
300
1200
2400
4800
9600
5


5
PARIT
NONE
ODD
EVEN
LNTRM
CR LF
LF CR
CR
LF
DELAY
0
19999
PASWD
0000
9999
TYPE
ALARM
ARSET
MRSET
FRSET
CONTROL
ACTN
OFF
HIGH
-19999
19999
LOW
-19999
19999
PC DEV
-99
99
DBAND
000
400
6

PASSworD establishes a four digit password of any value between 0000 and 9999. Prevents unauthorized changes to SETUP parameters over the serial communications link.

DIGITAL OUTPUT

Default — TYPE — ALARM
ARSET
ACTioN OFF
DeadBAND 000

Each of the four Digital Outputs can be independently set as either a Control or as an Alarm. When used for control, the DP10 Series initiates on and off operations. A status indicator lights when the control operation initiates. When used as an alarm, the DP10 Series flashes "ALARM #" and lights the appropriate status indicator. An alarm can be set as: Auto ReSET, Manual ReSET or Failsafe ReSET. (See diagram next page). ACTioN for both Alarms or Controls is set as OFF, HIGH, LOW, or % (Percent) Deviation. The digital output alarm relays are normally in a de-energized (open) state. Power failure causes all digital outputs to de-energize.

NOTE: A detectable ERROR condition also causes all digital outputs to de-energize (OPEN).

If HIGH action is set, the relays energize (close) when the input increases beyond a specified value; they de-energize (open) when the input returns below the specified value.

If LOW action is set, the relays energize (close) when the input declines below a specified value; they de-energize (open) when the input returns above the specified value.

	ALARM CONDITION				ALARM CONDITION CORRECTED	
	Display	Stat. Ind.	Operator		Display	Status Indicator
AUTO	Flashes Alarm #	Lights for Alarm #	None [A] Inactive		Stops Flashing Returns To Normal Operation	Turns Off Operation
[illegible]			Press [A]	Display Stops Flashing Status Indicator Starts Flashing	Status Indicator Starts Flashing	Turns Off
FAILSAFE			[A] Inactive Until Alarm Condition Corrected		Remains Flashing Until the Alarm Condition Corrected [A] And Pressed	

Figure 2-2. Discrete Output Reset Chart

If % DEViation action is set, the relays energize when the monitored value exceeds the setpoint by the deviation percentage selected. Positive deviations cause relays to close on rising values. Negative deviations cause relay closure on falling values.

DeadBAND establishes a "deadband" from 0 to 400 that minimizes relay "chatter" when a signal fluctuates right at the setpoint value.

SOURCe establishes Input 1, Input 2, Advance Calculations results, or a Serial Input as the source for each of the four digital outputs.

NOTE: Parameter Settings for Digital Outputs 2, 3, and 4 are set identically to Digital Output 1.

SETPointT Default — 0

Establishes one setpoint value that triggers the outputs. This setpoint is used when % DEViation is used as the action for one or more of the four discrete outputs.

ADVANCED CALCULATIONS Default — NONE

See Chapter Five for a detailed description of the Advanced Calculations.

Scales Input 1 or Input 2 independently using an MX + B equation or computes SIN, COS, TAN, SQuareRoot, X to the N power, Log, or Natural Log of the input.

In addition, advance calculations can add, subtract, divide, or multiply Input 1 by Input 2. Also, they can subtract Input 2 from Input 1 and then divide the results by Input 1.

Finally, a second, optional, MX + B equation can scale the calculations.

DECimal PoinT sets one of five decimal point choices.

0.0000
00.000
000.00
0000.0
00000
(Does not display)

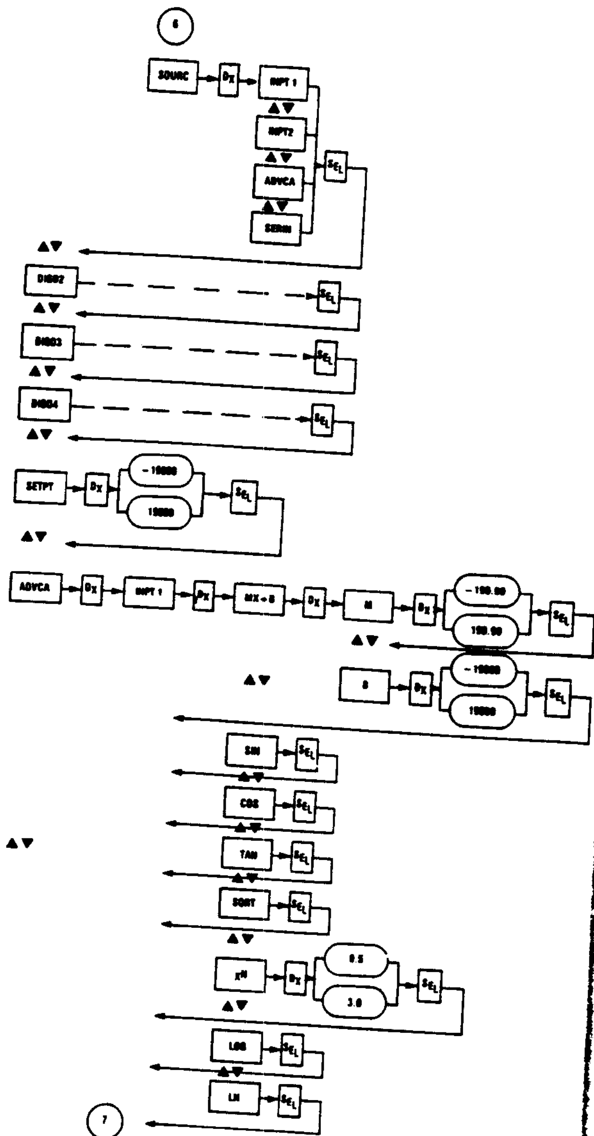
OPERATION COMMAND

Default — Alarm-Yes
SetPt-Yes

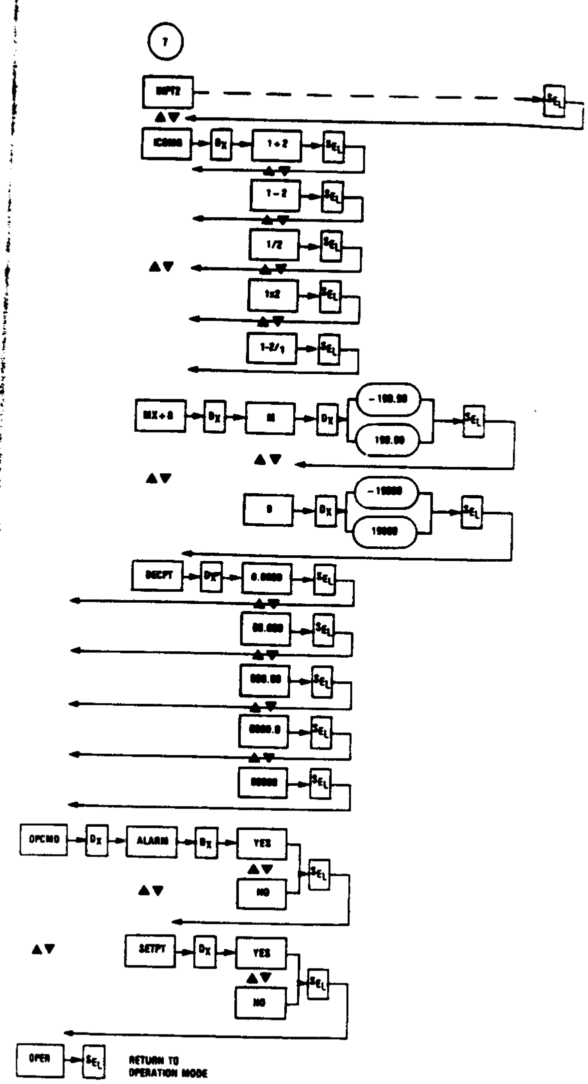
Permits changing of numeric values of ALARM conditions and SETPOINT in the OPERATION MODE.

OPER

Exits SETUP MODE and returns to the OPERATION MODE.



SOURC
ADVCA
SETPT
ADVCA
MX+B
SIN
COS
TAN
SQRT
LOG
LN



ICOMB
1+2
1-2
1/2
1x2
MX+B
DECPT
OPCMD
ALARM
YES
NO
SETPT
YES
NO
OPER
RETURN TO
OPERATION MODE

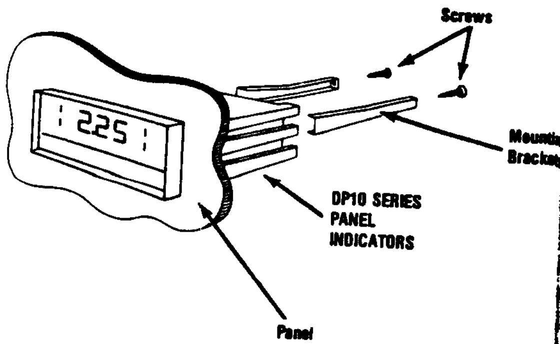


Figure 2-3. Installing the DP10 SERIES INDICATORS

Follow these steps:

NONE	Power down the unit and disconnect input, output and power lines.
TWO	From the front of the panel, place the DP10 Series in the standard DIN panel cutout.
THREE	Slide the mounting brackets forward in the side grooves until they press against the inside of the panel.
FOUR	Insert the two screws through the slide brackets and carefully tighten them.
FIVE	Re-connect input, output, and power lines to the DP10 Indicator.

The DP10 Indicator "warms up" and enters the OPERATION MODE.

CHAPTER THREE
OPERATING THE DP10 SERIES PANEL INDICATORS

3.0 OVERVIEW

This chapter contains the following:

- Reviewing Parameter Settings and Readings
- Changing Alarm, Setpoint, Peak and Valley values

The DP10 Series goes into the Operation Mode when Powered Up or after leaving the Setup Mode.

3.1 REVIEWING PARAMETER SETTINGS

In the Operation Mode, the following parameter settings and their present numerical values can be displayed in the following order:

- Input 1
- Input 2 (if installed)
- Advanced Calculations
- Peak
- Valley
- Digital Output 1
- Digital Output 2
- Digital Output 3
- Digital Output 4
- Serial Input
- Setpoint

To display the parameter settings and the present value do the following:

STEP ONE — PRESS: **DISPLAY NEXT**

"INPT1" displays and then the reading displays.

NOTE: If a front-panel key is not pressed within 3 seconds, the DP10 Series returns to the OPERATION MODE.

STEP TWO — PRESS: **DISPLAY NEXT**

The next parameter setting and its reading displays.

Continue pressing: **DISPLAY NEXT**

to review each of the parameters and its reading.

3.2 CHANGING NUMERIC VALUES

If "Yes" was selected during Setup to permit changing of alarm and setpoint numeric values in the Operation Mode, new values can be temporarily stored.

NOTE: These values can be permanently changed ONLY in the Setup Mode. If power is cycled, they reset to values previously selected in the Setup Mode.

Peak and Valley values can also be changed in the Operation Mode.

To change Alarm, Setpoint, Peak, or Valley numeric values, do the following:

STEP ONE — press either UP, DOWN or SELECT to begin changing the numeric value.

The sign or first digit blinks.

STEP TWO — Press UP to change the sign or increase the value of the digit and scroll through the digits.

or

Press DOWN to move right to the next digit and scroll around to each digit.

When the desired value displays,

STEP THREE — Press SELECT to temporarily store the value until the unit is powered off/on or a different value is entered.

When the SETPointT value is changed, ERROR temporarily displays. Disregard this reading.

Press: DISPLAY NEXT to review the parameter settings and readings.

CHAPTER FOUR
SERIAL INPUT/OUTPUT

4.0 OVERVIEW

This chapter contains the following:

- Connecting peripheral devices
- Setting Serial Parameters
- Data Transmission
- Bidirectional Serial Interface
- Requesting specific process variable information
- Requesting values of current parameter settings
- Changing parameter settings
- Sourcing the display from the serial input

CONNECTING PERIPHERAL DEVICES

To connect host computers, or dumb terminals, a three-conductor cable is wired to a 25-pin, D style connector.

Typical Host Computer 25 Pin Connections	DP10 SERIES Rear Connection
Pin #	
# 2 TXD	#26 RXD Receive Data
# 3 RXD	#25 TXD Transmit Data
# 7 GND	#13 GND Ground (Signal Return)

Note: Check peripheral device connections, these are typical Host Computer Connections.

SETTING SERIAL PARAMETERS

The following serial communication default parameter settings are factory selected.

COMM ADDRESS	00
SOURCE	Input 1
BAUD RATE	9600
PARITY	None
LINE TERM	CR/LF
DELAY	19999 (transmission disabled)
PASSWORD	0000

If the peripheral device requires different parameter settings, enter the SETUP MODE in the DP10 Series (See Chapter 2) and set them accordingly.

After serial parameter settings are established and the DP10 Series is properly connected, each conversion is transmitted as fast as the "delay" parameter allows.

Note: There is no output for a delay setting of 19999.

4.3 DATA TRANSMISSION

4.3.1 CHARACTER TRANSMISSION

Each character including status is transmitted in the following ASCII bit sequence.

1 start bit, 7 data bits, 1 parity bit, 2 stop bits. The parity bit is defined as even, odd, or none during setup.

When the "time delay" parameter for serial transmission is set at zero, the DP10 Series will transmit new data at every conversion (approximately every 50 ms) or as fast as the baud rate will allow. This data can be sourced as input 1, input 2 (if installed), or advanced calculation defined during setup. Each transmission consists of the following 6 fields, totaling 12 or 13 characters.

Field:	1	2	3						4	5		6	
Char.#:	1	2	3	4	5	6	7	8	9	10	11	12	13
Char.:	STX	SIGN	X	X	X	.	X	X	SP	N	N	LT	LT

Field	Character#	Description
1	1	STX: Start of transmission (ASCII: Control B Hex: 02)
2	2	Sign: a positive sign character is transmitted as a space, a negative sign is transmitted as a "-"
3	3-8	XXX.XX: A six character field for transmitting the process variable data. Includes 4 1/2 digit (±20,000) resolution and decimal point. Leading zeros are not suppressed.
4	9	SP: Space
5	10-11	NN: Status characters, a two digit character field for decoding process variable types and status for digital outputs.
6	12-13	LT: Line terminator, choices are: carriage return (CR), Line Feed (LF), CR & LF, or LF & CR.

4.3.2 STATUS CHARACTER LISTINGS

A two character status code is transmitted with every conversion. The first character defines the process variable type, the second character decodes the status for the digital outputs.

The first digit of the code represents the following process variable type.

Code	Process Variable Type
0	Celsius
1	Kelvin
2	Fahrenheit
3	Rankin
4	DC mV
5	DC V
6	DC mA
7	DC mA
8	DC A
9	AC mV
A	AC V
B	AC mA
C	AC mA
D	AC A
E	Resistance
F	Advanced Calculations

The second digit of the code represents the condition of the four discrete alarms or controls.

Code	Digital Output Status
0	No alarms or controls energized
1	#1 energized
2	#2 energized
3	#1 & 2 energized
4	#3 energized
5	#1 & 3 energized
6	#2 & 3 energized
7	#1, 2, & 3 energized
8	#4 energized
9	#1 & 4 energized
A	#2 & 4 energized
B	#1, 2, & 4 energized
C	#3 & 4 energized
D	#1, 3, & 4 energized
E	#2, 3, & 4 energized
F	#1, 2, 3, & 4 energized

Example: a 24 code would indicate a fahrenheit signal and an energized #3 discrete output

4.4 BIDIRECTIONAL SERIAL INTERFACE

The bidirectional serial interface can be utilized for three main purposes:

- requesting specific process variable information
- requesting values of current parameter settings
- changing parameter settings

On initial power up or when changing from the setup mode to the operation mode, the DP10 Series will begin to transmit the serial output (unless the "delay" parameter is set for 19999). During this time the DP10 Indicator will ignore all serial requests until this output is suspended. The command to suspend this output and ready the unit for bidirectional communication is:

EX <CR>

Note: If delay = 19999 this command is not necessary.

The command to place the DP10 Indicator back into the continuous output only mode is:

SX <CR>

All commands **must be** in upper case characters for the DP10 Series to accept them. The DP10 Series will respond with either an "OK" or with the pertinent information when the command is acknowledged. The DP10 Series will respond with "??" when a command is not acknowledged.

4.5 REQUESTING SPECIFIC PROCESS VARIABLE INFORMATION

The following commands terminated with a carriage return will give specific process variable information.

Note: If a communication address is specified other than 00 then that address followed by the password and the characters "EP" must be entered first.

Command	Description
XS	Transmit status (the source of the serial output)
XP	Transmit Peak Value
XV	Transmit Valley Value
X01	Transmit Digital Output 1 Status
X02	Transmit Digital Output 2 Status
X03	Transmit Digital Output 3 Status
X04	Transmit Digital Output 4 Status
XI1	Transmit Input 1
XI2	Transmit Input 2 (if installed)
XR	Transmit Revision of Software Used
XD	Transmit Display
XA	Transmit All; all variables that can be viewed with the "Display Next" key. These variables include: Input 1, Input 2 (if installed), Advanced Calculations, Peak, Valley, Digital Output 1, Digital Output 2, Digital Output 3, Digital Output 4, Serial Input, and Set Point

Note: An "XA" command can be simulated from the front panel by pressing the "alarm ack" key, "up" key, and "select" key simultaneously.

Format of Responses: The following table outlines the response for the commands listed above.

Command	Response
XS	xxxxx nn Where: xxxxx = The process variable value (decimal point is not transmitted) nn = Status Code
XP	xxxxx PEAK zzz
XV	xxxxx VALLY zzz Where: xxxxx = Stored Value zzz = CH1 (Channel 1) = CH2 (Channel 2) = SER (Serial Input) = ADV (Advanced Cal.)
X01	xxxxx h ii jj kkk
X02	
X03	
X04	Where: xxxxx = Setpoint Value h = Digital Output #(1-4) ii = CT (Control Output) = AA (Alarm Output, Automatic Reset) = AM (Alarm Output, Manual Reset) = AF (Alarm Output, Fail Safe) jj = Hi (Hi going trip) Lo (Low going trip) % (% deviation from set pt.) kkk = CH1 (Source) CH2 SER ADV
XI1	xxxxx CH 1 yyyyyyyy
XI2	xxxxx CH 2 yyyyyyyy Where: xxxxx = Process variable value

yyyyyyyy = Input type ie:
200 mVdc
20 mAdc
TC J . C

XR VER p.pp
Where:
p.pp = Current version software number

XD xxxxx DISP
Where:
xxxxx = Current Display Value

4.6 REQUESTING VALUES OF CURRENTLY STORED PARAMETER SETTINGS

Values of all parameter settings can be viewed over the serial link. To view parameter values the following steps must be observed.

1. The continuous output must be suspended with an: EX <CR> Command
2. A privilege code must first be entered which takes the format of:
   nnxxxxEP <CR>
   Where:
   nn = Communication Address
   xxxx = The four digit password
   EP = The ASCII characters "EP" (which stands for enter privilege)
3. Type "XEnn" followed by a carriage return.
   Where:
   nn = A 2 digit integer code associated with each parameter (see TABLE A for each specific parameter with its associated code)
   XE = The ASCII characters "XE", transmit from EAROM as a signed number

Response Format:

The response the DP10 Series issues after a XEnn <CR> command takes on the following format:

mmmmm EAROM

Where:

mmmmm = The integer code for the particular parameter selection.

EAROM = Where the information is stored.

Examples:

1. To determine the source for the PEAK reading:

Command:	XE12 <CR>
Response:	00003 EAROM
Translation:	The source which the PEAK value (parameter 12) is tracking is driven by the serial input (03).

2. To determine the trip value for digital output #1:

Command:	XE33 <CR>
Response:	01500 EAROM
Translation:	The trip value for digital output #1 (Parameter #33) is 1500 (01500).

4.7 CHANGING PARAMETER SETTINGS

Values of all parameter settings can be changed over the serial link. To change the parameter values the following steps must be observed:

1. The continuous output must be suspended as previously outlined.
2. A privilege code must be entered as previously outlined.
3. Type "mm yy nn" followed by a carriage return where:
   mm = An integer code corresponding to specific parameter values (see TABLE A).
   yy = CE: The ASCII characters "CE" indicating the new parameter value will be stored in temporary RAM.
   yy = SE: The ASCII characters "SE" indicating the new parameter value will be stored in permanent EAROM.
   nn = A two digit integer code corresponding to specific parameter types (see TABLE A).

Responses Format:

The response from the DP10 Series when a parameter change is accepted is "OK". A "??" is echoed when the parameter change is not accepted.

Temporary Changes:

Temporary settings immediately change the DP10 Series operation. If a temporary change is made and the unit is powered down or restarted, the unit returns to factory default settings or previously established operating parameters.

Permanent Changes:

After all permanent changes (SE commands) have been made, a new check sum must be written to the EAROM with the following command:

WC1 <CR>
Response: OK

The unit must then be restarted using the command:

RS <CR>

Note: After restarting the unit, any changes made using CE commands are lost!

Response: The DP10 Series does not echo a response, however all of the front panel display segments will illuminate for [illegible] seconds. During this time the unit loads the new parameters in EAROM.

Examples:

1 To temporarily change the filter hysteresis from off to on:

Command:	01CE08 <CR>
Response:	OK

2 To permanently change the analog output source to advanced calculation and to change the analog output to be unscaled:

Command:	03SE17 <CR>
Response:	OK
Command:	00SE18 <CR>
Response:	OK

And:

Command:	WC1 <CR>
Response:	OK
Command:	RS <CR>

TABLE A

PARAMETER: SELECT POWER

Code (nn)	Value	Value Code (mm)
01	60 Hz	00
	50 Hz	01

PARAMETER: SELECT INPUT AS TEMP OR DCV/I

	Code (nn)	Value	Value Code (mm)
Input 1:	02	Temp	00
Input 2:	05	DCV/I	01

PARAMETER: SELECT TEMP INPUT TYPE

	Code (nn)	Value	Value Code (mm)
Input 1:	03	T/C J	00
Input 2:	06	T/C K	01
		T/C J DIN	02
		T/C K DIN	03
		T/C T	04

		T/C E	05
		T/C C	06
		T/C S	07
		T/C R	08
		T/C B	09
		T/C N	10
		THER-MISTOR	11
		RTDA2	12
		RTDA3	13
		RTDA4	14
		RTDB2	15
		RTDB3	16
		RTDB4	17

PARAMETER: SELECT DCV/I INPUT TYPE

	Code (nn)	Value	Value Code (mm)
Input 1:	03	200 mV	00
Input 2:	06	2V	01
		20V	02
		200V	03
		20 μA	04
		200 μA	05
		2 mA	06
		20 mA	07
		200 mA	08
		2A	09
		20A	10
		200W2	11
		200W3	12
		200W4	13
		2KW2	14
		2KW3	15
		2KW4	16

PARAMETER: SELECT DEGREES

	Code (nn)	Value	Value Code (mm)
Input 1:	04	.C	00
Input 2:	07	.K	01
		.F	02
		.R	03
		C	04
		K	05
		F	06
		R	07

PARAMETER: SELECT FILTER HYSTERESIS

	Code (nn)	Value	Value Code (mm)
Input 1:	08	OFF	00
Input 2:	10	ON	01

PARAMETER: SELECT FILTER TIME CONSTANT

	Code (nn)	Value	Value Code (mm)
Input 1:	09	ZERO	00
Input 2:	11	68 ms	01
		180 ms	02
		386 ms	03
		772 ms	04
		1568 ms	05

PARAMETER: TRACK PEAK SOURCE

Code (nn)	Value	Value Code (mm)
12	INPUT1	00
	INPUT2	01
	ADVCA	02
	SERIN	03

PARAMETER: TRACK VALLEY SOURCE

Code (nn)	Value	Value Code (mm)
13	INPUT1	00
	INPUT2	01
	ADVCA	02
	SERIN	03

PARAMETER: THERMOCOUPLE BURNOUT

	Code (nn)	Value	Value Code (mm)
Input 1:	14	UPSCALE	00
Input 2:	15	DOWN-SCALE	01
		SWITCH (only for input 1)	02

PARAMETER: ANALOG OUTPUT ACTION

Code (nn)	Value	Value Code (mm)
16	FORWARD	00
	REVERSE	01

PARAMETER: ANALOG OUTPUT SOURCE

Code (nn)	Value	Value Code (mm)
17	NONE	00
	INPUT1	01
	INPUT2	02
	ADVCA	03
	PEAK	04
	VALLEY	05
	SERIN	06

PARAMETER: ANALOG OUTPUT SCALING

Code (nn)	Value	Value Code (mm)
18	UNSCALED	00
	MX + B	01

PARAMETER: ANALOG OUTPUT M VALUE

Code (nn)	Value	Value Code (mm)
19	− 199.99 to + 199.99	− 19999 to + 19999

PARAMETER: ANALOG OUTPUT B VALUE

Code (nn)	Value	Value Code (mm)
20	− 19999 to + 19999	− 19999 to + 19999

PARAMETER: DISPLAY ZERO SUPPRESSION

Code (nn)	Value	Value Code (mm)
21	YES	00
	NO	01

PARAMETER: DISPLAY SOURCE

Code (nn)	Value	Value Code (mm)
22	INPUT1	00
	INPUT2	01
	ADVCA	02
	PEAK	03
	VALLEY	04
	SERIN	05

PARAMETER: SERIAL COMMUNICATIONS ADDRESS

Code (nn)	Value	Value Code (mm)
23	0 To 31	0 To 31

PARAMETER: SERIAL COMMUNICATIONS SOURCE

Code (nn)	Value	Value Code (mm)
24	INPUT1	00
	INPUT2	01
	ADVCA	02

PARAMETER: SERIAL COMMUNICATIONS BAUD RATE

Code (nn)	Value	Value Code (mm)
25	300	00
	1200	01
	2400	02
	4800	03
	9600	04

PARAMETER: SERIAL COMMUNICATIONS PARITY

Code (nn)	Value	Value Code (mm)
26	NONE	00
	ODD	01
	EVEN	02

PARAMETER: SERIAL COMMUNICATIONS LINE TERMINATOR

Code (nn)	Value	Value Code (mm)
27	CR/LF	00
	LF/CR	01
	CR	02
	LF	03

PARAMETER: SERIAL COMMUNICATIONS DELAY

Code (nn)	Value	Value Code (mm)
28	0 to 19999	0 to 19999

PARAMETER: SERIAL COMMUNICATIONS PASSWORD

Code (nn)	Value	Value Code (mm)
29	0000 to 9999	0000 to 9999

PARAMETER: SETTING DISCRETE OUTPUTS

	Code (nn)	Value	Value Code (mm)
Output 1:	30	ALARM	00
Output 2:	36	CONTROL	01
Output 3:	42		
Output 4:	48		

PARAMETER: ALARM TYPE (Ignored if configured as a control output)

	Code (nn)	Value	Value Code (mm)
Output 1:	31	AUTO RESET	00
Output 2:	37	MANUAL RESET	01
Output 3:	43	FAIL SAFE	02
Output 4:	49		

PARAMETER: ACTION

	Code (nn)	Value	Value Code (mm)
Output 1:	32	OFF	00
Output 2:	38	HIGH	01
Output 3:	44	LOW	02
Output 4:	50	%DEV.	03

PARAMETER: HIGH/LOW SETPOINT VALUE

	Code (nn)	Value	Value Code (mm)
Output 1:	33	−19999 to 19999	−19999 to 19999
Output 2:	39		
Output 3:	45		
Output 4:	51		

PARAMETER: DEADBAND

	Code (nn)	Value	Value Code (mm)
Output 1:	34	000 to 400	000 to 400
Output 2:	40		
Output 3:	46		
Output 4:	52		

PARAMETER: SOURCE

	Code (nn)	Value	Value Code (mm)
Output 1:	35	INPUT1	00
Output 2:	41	INPUT2	01
Output 3:	47	ADVCA	02
Output 4:	53	SERIN	03

PARAMETER: % DEVIATION SETPOINT VALUE

Code (nn)	Value	Value Code (mm)
54	−99 to +99	−99 to +99

PARAMETER: ADVANCED CALCULATIONS TYPE

	Code (nn)	Value	Value Code (mm)
Input 1:	55	MX+B	00
Input 2:	58	SIN	01
		COS	02
		TAN	03
		SQRT	04
		X	05
		LOG	06
		LN	07

PARAMETER: ADVANCED CALCULATIONS M VALUE

	Code (nn)	Value	Value Code (mm)
Input 1:	56	−199.99 to 199.99	−19999 to 19999
Input 2:	59		

PARAMETER: ADVANCED CALCULATIONS B VALUE

	Code (nn)	Value	Value Code (mm)
Input 1:	57	−19999 to 19999	−19999 to 19999
Input 2:	60		

PARAMETER: ADVANCED CALCULATIONS COMBINING INPUTS

Code (nn)	Value	Value Code (mm)
61	1+2	00
	1−2	01
	1÷2	02
	1 x 2	03
	(1-2)÷1	04

PARAMETER: ADVCA OUTPUT M VALUE

Code (nn)	Value	Value Code (mm)
62	−199.99 to 199.99	−19999 to 19999

PARAMETER: ADVCA OUTPUT B VALUE

Code (nn)	Value	Value Code (mm)
63	−19999 to 19999	−19999 to 19999

PARAMETER: ADVANCED CALCULATIONS DECIMAL POINT LOCATION

Code (nn)	Value	Value Code (mm)
64	0.0000	00
	00.000	01
	000.00	02
	0000.0	03
	00000	04

PARAMETER: PERMIT ALARM CHANGE IN OPERATION MODE

Code (nn)	Value	Value Code (mm)
65	YES	00
	NO	01

PARAMETER: PERMIT SETPOINT CHANGE IN OPERATION MODE

Code (nn)	Value	Value Code (mm)
66	YES	00
	NO	01

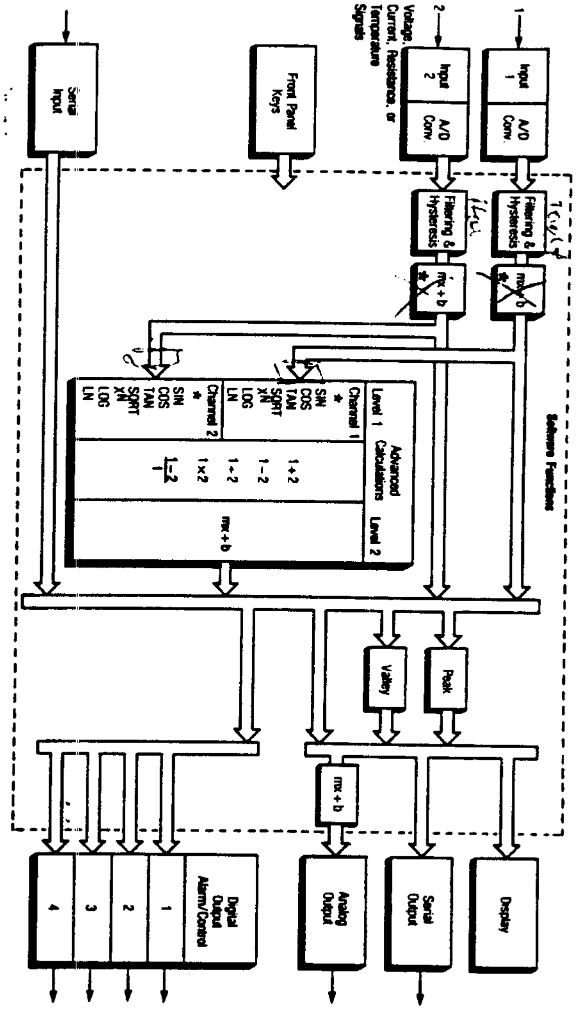
PARAMETER: LOCKOUT DISPLAY/KEYBOARD

Code (nn)	Value	Value Code (mm)
67	Neither Locked Out	00
	Keyboard Only Locked Out	01
	Display Only Locked Out	10
	Both Locked Out	11

Where 0.01 would be entered for M1 (the first location; level 1 of MX + B scaling levels) and 2.7 for M2 (the second MX + B; level 2).

Meanwhile B, (level 1) would be zero and B2 (level 2) would be determined by the formula B2 = YH − (M * XH) where M would be 0.027.

The DP10 Series Panel Indicators



Example #2

With a 0-20 mA full scale range suppose the desired scaling is such that:

4 mA = 0
20 mA = 100.0

Therefore:

YH = 1000 (the decimal point is not acknowledged by the unit) XH = 20000
YL = 0 XL = 4000

Then:

$$M = \frac{1000-0}{20{,}000-4{,}000} \qquad M = 0.0625$$

But:

M = 0.0625 is factored into:
M1 = 0.01
M2 = 6.25

And:

B1 = 0 (This is always true if the desired M is factored into two levels)
B2 = 1000 − (0.0625 * 20,000)
B2 = + 1250

Note: If the value of B is calculated as a fraction (not a whole number), then rounding off will have relatively little effect on the scaling.

CONSIDERATIONS FOR CURRENT INPUTS:

The scaling of current inputs is identical to voltage inputs because the current is routed through a shunt resistor and read as a voltage. This procedure is fine for an "ideal" resistor, however, this is not the case in "real world" situations. Even 1% precision resistors can cause slight errors in scaling.

To rectify this problem, the same scaling procedure is utilized with one small deviation. Instead of using display counts for XH and XL, the display counts should be read from the display. The easiest method for reading the display counts is to input YL (the low input signal) and press the "Display Next" key during the normal mode of operation. This will display input #1 in display counts. The same procedure should be utilized with YH (the high input signal). Once these display counts have been read for YL and YH then the remaining scaling procedure remains the same.

Example #3

With a 0-20 mA full scale range suppose the desired scaling using the recommended 10Ω shunt is such that:

4 mA = 1500
20 mA = 8000

5.1 MX + B

Determining Span (M) and Offset (B) for use in the Y = MX + B equation in scaling the analog output or advanced calculations is accomplished by answering these simple questions!

1. What is the HIGH value of the INPUT SIGNAL (X_H) in displayed counts
2. What is the LOW value of the INPUT SIGNAL (X_L) in displayed counts
3. What is the HIGH value to DISPLAY (Y_H)?
4. What is the LOW value to DISPLAY (Y_L)?

	INPUT	OUTPUT
HI	COUNTS X_H	20000 Y_H
LO	X_L	4.000 Y_L

DETERMINATION OF HIGH AND LOW SIGNAL COUNTS:

Values of XH and XL are referenced in total display counts. The DP10 Indicator is a 4½ digit meter capable of displaying ±20,000 counts of full scale. Therefore, the full scale input selected for input 1 and/or input 2 is equivalent to 20,000 count (0 to 19,999).

Example:

Range	Low Reading	Equiv. Display Counts
0-2V	0 =	00000
0-200 mV	0 =	00000
0-20 mA	0 =	00000

Range	High Reading	Equiv. Display Counts
0-2V	2V =	20,000
0-200 mV	200 mV =	20,000
0-20 mA	20 mA =	20,000

Range	½ Full Scale Reading	Equiv. Display Counts
0-2V	1V =	10,000
0-200 mV	100 mV =	10,000
0-20 mA	10 mA =	10,000

The equivalent display counts should be used in calculations for XH and XL values.

The Scaling Formula

The following formulas calculate M & B.

$$M = \frac{Y_H - Y_L}{X_H - X_L}$$

$$B = Y_H - (M * X_H)$$

Example #1

With a 0-2 Vdc full scale range suppose the desired scaling is such that:

0 Vdc = 1000
1 Vdc = 5000

Therefore:

YH = 5000 XH = 10,000
YL = 1000 XL = 00000

Then:

$$M = \frac{5000 - 1000}{10000 - 0} \qquad M = 0.4$$

B = 5000 − (0.4 X 10,000) B = + 1000

LIMITATIONS IN VALUES OF M & B

The maximum and minimum values that M and B can obtain is:

M = ±199.99
B = ±19999

Suppose a desired M is calculated such that M = 0.027. This number cannot be completely entered forcing the user to round off the entry to a point where M = 0.03. This round off could cause slight errors in the display. However by following the signal flow diagram below one can see that two levels of scaling (MX + B) occur. Now 0.027 can be broken down into:

0.027 = 0.01 * 2.7

4.8 SOURCING THE DISPLAY FROM THE SERIAL INPUT:

The display on the DP10 Series can be driven (sourced) from the Serial Input. The intent of this design was to combine multiple DP10 Indicators in cascade control. Therefore, if the serial input comes from any device other than a DP10 Series, the device's output must be identical to the output of a DP10 Series. Remember the output is as follows:

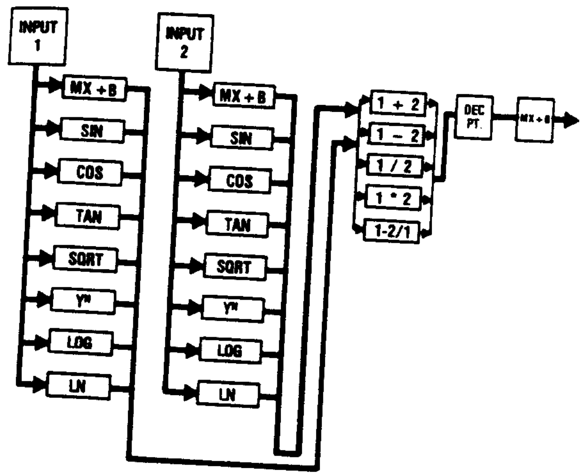
```
S S
T I X X X . X X S N L L
X G             P N T T
  N
```


CHAPTER FIVE
USING ADVANCED CALCULATIONS

5.0 OVERVIEW

This chapter contains the following:

- Scaling Input using the MX + B equation
- Using Trigonometric and Logarithmic functions
- Combining Input 1 and Input 2
- Setting Decimal Point Location



Either Input 1 or Input 2 can be scaled using the Y = MX + B equation, or other advanced mathematical calculations. As illustrated on the preceding page, Input One or Input Two, independently, can be calculated. Following these calculations or without using them, both inputs can be combined and further mathematical calculations completed. The MX + B equation can be applied to the independent or combined input signals. Finally, the position of the decimal point can be selected.

Default M = 00000
B = 00000

When using Advanced Calculations, you should set M in the second MX + B equation to 1 and B to 0 if you want unscaled results.

However, the second MX + B equation can be used for additional scaling of the input signal by setting M or B to whatever number is desired.

(X) Counts	Input (V)	SQRT(X) Display
(Second MX + B: M = 100.00 B = 00000) Dec. Pt = 000.00		
1	.0001	1.00
10	.001	3.16
100	.01	10.00
1000	.1	31.62
2500	.25	50.00
5000	.5	70.71
10000	1.0	100.00
20000	2.0	141.42

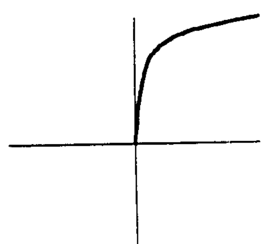
5.6 LOG

The DP10 Indicator displays the log of a positive input signal.

LOG (X) = Y : 10^Y
LOG (100) = 2 : 10^2

The DP10 Indicator interprets Full Scale as 20,000 counts.

(X) Counts	Input (V)	Log(X) Display
(Second MX + B: M = 001.00 B = 00000) Dec. Pt = 00.000		
1	.0001	0.00
10	.0010	1.00
100	.0100	2.00
1000	.1000	3.00
2500	.2500	3.398
5000	.5000	3.699
10,000	1.0000	4.00
20,000	2.0000	4.30



−2V 2V

5.7 NATURAL LOG

The DP10 Series also computes the Natural Log for a positve input signal.

The DP10 Series interprets Full Scale as 20,000 counts.

ln (x) = e^Y l e = 2.71828

Examples:

LN (10) = 2.3026
LN (100) = 4.6052
LN (2.71828) = 1.0

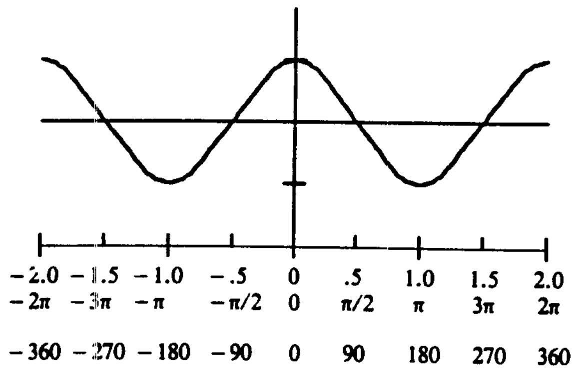
(X) Input (Units)	Input (V)	LN(X) Display
(Second MX + B: M = 001.00 B = 00000) Dec. Pt = 00.000		
1	.0001	0.000
10	.0010	2.303
100	.0100	4.605
1000	.1000	6.908
2500	.2500	7.824
5000	.5000	8.517
10,000	1.0000	9.210
20,000	2.0000	9.903

(X) Counts	Degrees	Radians	Input (V)	Cos (X)
(Second MX + B: M = 001.00 B = 00000) Dec. PT. = 0.0000				
−20000	−360	-2π	−2V	1.0000
−10000	−180	$-\pi$	−1V	−1.0000
−5000	−90	$-\pi/2$	−.50V	0.0000
−2500	−45	$-\pi/4$	−.25V	.7070
0	0	0	0	1.0000
2500	45	$\pi/4$	.25V	.7070
5000	90	$\pi/2$	.50V	0.0000
10000	180	π	1V	−1.0000
20000	360	2π	2V	1.0000

COSINE

− Full Scale

Full Scale



For any standard input range, the DP10 Series interprets the Full Scale value as 360 degrees or 2π radians.

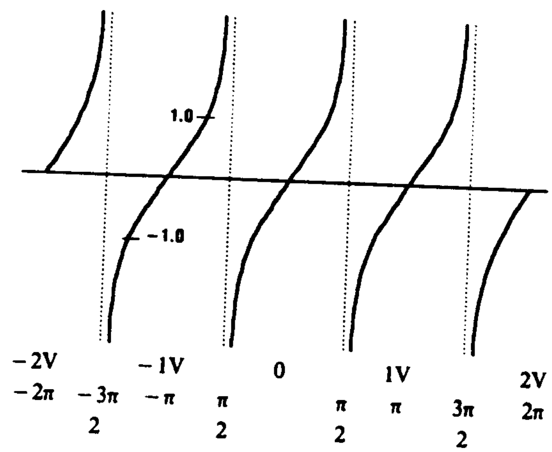
5.4 TANGENT

The DP10 Indicator computes the Tangent for display or use in additional calculations.

For example: INPUT SIGNAL
0 to ±2 Vdc

(X) Counts	Degrees	Radians	Input (V)	Tan (X)
(Second MX + B: M = 001.00 B = 00000 Dec. PT. = 0.0000				
−20000	−360	-2π	−2V	0.0000
−10000	−180	π	−1V	0.0000
−5000	−90	$-\pi/2$	−.50V	*
−2500	−45	$-\pi/4$	−.25V	−1.0000
0	0	0	0	0.0000
2500	45	$\pi/4$	.25V	1.0000
5000	90	$\pi/2$	.50V	*
10000	180	π	1V	0.0000
20000	360	2π	2V	0.0000

*Undefined



5.5 SQUARE ROOT

The DP10 Series calculates the square root of the input signal. Full Scale is interpreted as 20,000 counts and the square root of the number of counts is calculated.

Using a 0 to 2V signal, the following table illustrates how the square root of the input signal is calculated.

Therefore:

		Expected examples as read from the display
YH = 8000	XH = 20000	19985
YL = 1500	XL = 4000	3994

Then:

$$M = \frac{8000 - 1500}{19985 - 3994} = \frac{6500}{15991} \quad M = .406478 = .4065$$

NOTE: This round off will cause relatively little scaling error

M1 = .01 M2 = 40.65

B1 = 0

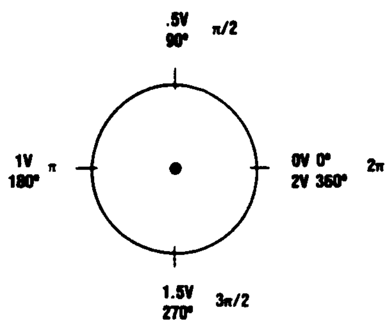
AND:

B2 = 8000 − (.4065 * 19985) B2 = −123.9 ≅ −124

5.2 SIN

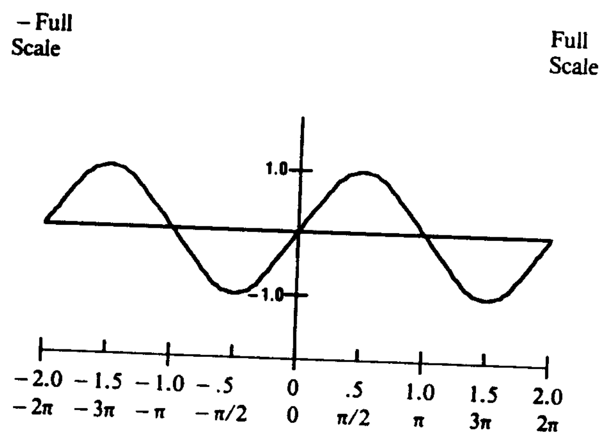
The DP10 Indicator calculates the sine of an input signal for display or use in additional calculations. It interprets 0 as 0 degree of a circle and Full Scale as 360 degrees or 2 π radians or a circle.

For Example: INPUT SIGNAL
0 to ±2 Vdc



(X) Counts	Degrees	Radians	Input (V)	Sin (x)
(Second MX + B: M = 001.00 B = 00000) Dec. PT. = 0.0000				
−20000	−360	−2π	−2.00	0.0000
−10000	−180	π	−1.00	0.0000
−5000	−90	−π/2	−.50	−1.0000
−2500	−45	−π/4	−.25	−.7070
0	0	0	0.00	0.0000
2500	45	π/4	.25	.7070
5000	90	π/2	.50	1.0000
10000	180	π	1.00	0.0000
20000	360	2π	2.00	0.0000

SIN

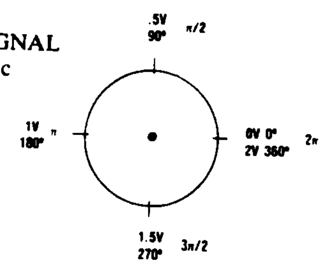


For any standard input range, the DP10 Series interprets the Full Scale Value as 360 degrees or 2π radians.

5.3 COSINE

The DP10 Indicator calculates the cosine of an input signal for display or use in additional calculations. It interprets 0 as 0 degree of a circle and Full Scale as 360 degrees or 2π radians.

For Example: INPUT SIGNAL
0 to ±2 Vdc



APPENDIX A
SPECIFICATIONS

NOTE: Specifications are stated @ 25°C unless otherwise noted.

SIGNAL INPUT

DC VOLTAGES (standard)

RANGES	IMPEDANCE	RESOLUTION
±200 mV	>1000Ω	0.01 mV
±2V	>1000Ω	0.1 mV
±20V	1 MΩ	1.0 mV
±200V	1 MΩ	10.0 mV

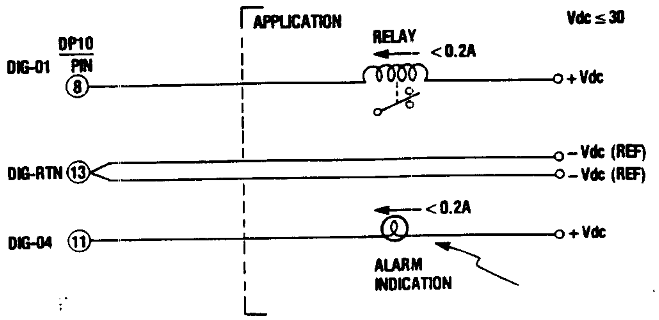
DC CURRENTS (standard)

Recommended Resistor Accuracy: 0.1%

RANGES	SHUNT VALUES (200 mV external shunt)	RESOLUTION
±20 μA	10 kΩ	0.001 μA
±200 μA	1 kΩ	0.01 μA
±2.0 mA	100Ω	0.1 μA
±20 mA	10Ω	1.0 μA
±200 mA	1Ω	10 μA
±2.0A	0.1Ω	100 μA
±20A	0.01Ω	1.0 mA

THERMOCOUPLES (standard)

TYPE	RANGES (Celsius)	MAXIMUM* CONFORMITY ERROR	**RESOLUTION (Celsius)
J	−185 to 1200	.23	0.1
K	−185 to −1372	.23	0.1
J-DIN	−200 to +900	.23	0.1
K-DIN	0 to 1300	.23	0.1
T	−200 to 400	.23	0.1
E	−200 to 1000	.23	0.1
C	−10 to 2300	.52	0.1
S	−10 to 1768	.36	0.1
R	−10 to 1768	.38	0.1
B	600 to 1820	.44	0.1
N	−200 to 1300	.23	0.1

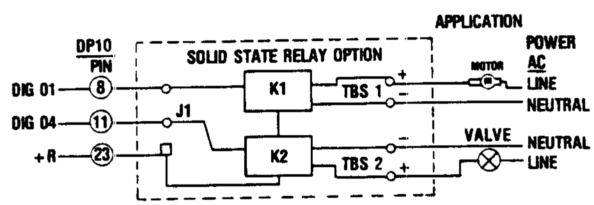


Connect directly to pins of the rear 30 pin screw terminal connector as follows:

Signal	Pin
Digital Output 1	8
Digital Output 2	9
Digital Output 3	10
Digital Output 4	11
Reference	13

6.4 SOLID STATE RELAY (TRIAC)

Optional, dual Opto-isolated solid state relay output for controlling motors, valves and alarms which require switching currents of up to four (4) amps @ 240 Vac, (Option T)..

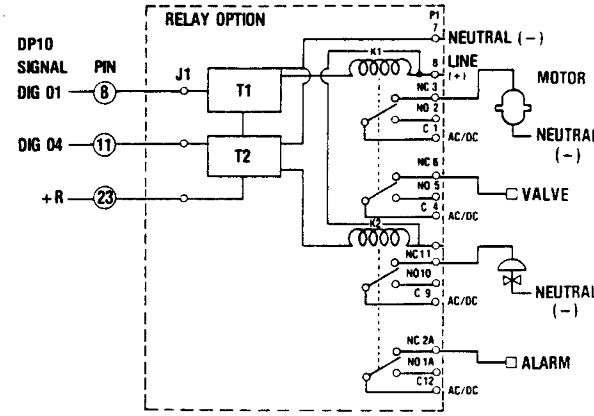


CONNECT

J1, three wire cable, to pin 23 (+R) and any two of the four Digital outputs (pins 8, 7, 10 & 11) for TRIAC control. Power Control connections are to TBS1 and TBS2 as shown.

6.5 ELECTRO MECHANICAL RELAY

Optional, two (2) form C, DP-DT relays with 10 amp contact capacity are controlled by any two of four open-collector transistor outputs. External power to the relay coils is 115 Vac (Option R). Relay contacts can switch up to 10 amps of ac or dc current.



Connect the three wire cable from J1 of Relay board as shown on the installation instructions, to any two of the four Digital Outputs @ the DP10 rear connector.

Motor, valve and alarm loads, and coil power are connected to the fourteen (14) pin Relay Option connector as detailed above.

CHAPTER SIX
PERIPHERAL DEVICE

6.0 OVERVIEW

Three types of output are available for connection to peripheral devices, they are as follows:

Output	# of Channels
Analog Current	one
Digital Control	four
Serial Communications	one

6.1 ANALOG OUTPUT

A scalable 20 mA output will drive a load up to 1,000 ohm. This output is sourced and isolated. Connect load to pin 12 (+) and pin 24 (−) at the 30 pin screw terminal rear connector. Scale independent MX + B for Analog output as required for application.

6.2 DIGITAL OUTPUT

Four channels of independent digital output for setpoint control are available. The peripheral device to be controlled depends on the application and we offer three types of digital outputs. They are:

Digital Output	Load Capacity	
1. Open Collector	0.2A @ 30 Vdc	
2. Solid State Relay	4A @ 240 Vac	
	3A @ 60 Vdc	
3. Electromechanical Relay	**Contact**	**Coil**
	10A @	230 Vac
	10A @	115 Vac

6.3 OPEN COLLECTOR

Standard feature allows independent control of four external loads, for example: small relays or indicators as detailed below for Digital Outputs 1 and 4.

The customer must provide the external dc power of <30V to the peripheral device and make sure that the current does not exceed 0.2 amp per Digital Output.

APPENDIX B
CONNECTING SIGNAL INPUT

WARNING: Incorrect input connection can damage the DP10 SERIES INDICATORS.

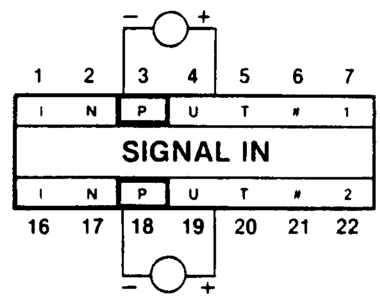
All connections should be clean and tight. Use a shielded, twisted pair of wires to minimize noise pickup.

DO NOT run input signal leads with or near supply, power, or load lines.

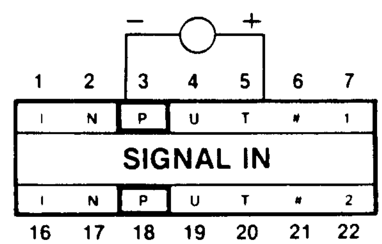
Following are Input 1 and Input 2 connections for each type of input.

NOTE: ALL Input 2 connections correspond vertically to Input 1 connections.

200 mV and 2 Vdc
Voltage or Current
Pins 3 & 4



20 Vdc and 200 Vdc
Pins 3 & 5



Math Combinations with Inputs 1 & 2
1 + 2, 1 − 2, 1 ÷ 2, 1 x 2, (1 − 2) ÷ 1

Math Processing of 1 & 2 Combined
mx + b scaling, decimal point placement

Setup Parameter Memory
Nonvolatile

Peak and Valley Memory
Automatic storage from selected input or calculation

DIGITAL OUTPUTS

Standard Outputs
4 open collector transistors with 200 mA sink capability and 30V breakdown minimum

Output Responses
Each output can be individually configured from setpoint and variable deadband.
Settings are:
Output Type: Alarm or Control
Source: Input, Input 2, or Advanced Calculations
Action: Hi, Low or % deviation
Deadband: 00-99 counts

Option 1
2 - 10 amp relays and 2 transistors

Option 2
2 - solid state relays (Triacs)
240 Vac @ 4A
60 Vdc @ 3A
and 2 transistors

ANALOG OUTPUT

0 to 20 mA, scalable with mx + b

Accuracy
0.01%; 0.1 second 10 to 90% step response

SERIAL COMMUNICATIONS

Standard
Nonisolated 3-wire RS232C compatible

Optional
Isolated RS485 multi-drop configuration.
Software selectable address

Transceiver Characteristics
Twisted pair for transmit and/or receive
External 100Ω terminating resistor at each end
4000 feet (1,200 meters) @ 9,600 baud
32 units per communication link
Baud rates 300, 1200, 4800, 9600 software selectable

ENVIRONMENTAL

Operating Temperature
−10°C to +60°C

Storage Temperature
−40°C to +85°C

Humidity
0 to 95% RH (non-condensing)

Electromechanical Interference (EMI)
Designed to meet noise spec. per FCC-Docket 20780 & VDE 0871 Curve B

POWER REQUIREMENTS

AC: (47 to 63 Hz)
88 to 132 Vac or
187 to 264 Vac
DC: 12 to 50 Vdc
5W maximum, fully configured
2500V minimum isolation between power and any other leads
Surge withstand as per IEEE-472B-1974

PACKAGE

1/8 DIN high impact plastic case with plug-in electronics

Connections
Rear connector with 30 screw contact for 1 AWG 12 or 2 AWG 14 wires. Wiring is fixed and rigid. Electronics can be removed without disturbing field connections.

Cutout Dimensions
H 1.772" (45 mm)
W 3.622" (92 mm)

External Dimensions
H 1.890" (48 mm)
W 3.79" (96 mm)
D 6.00" (152 mm) maximum
7.00" (178 mm) maximum with relay or Triac option

*NBS MN 125 (J, K, T, E, S, R, B)
NBS MN 161 (N)
DIN 43710 (J-DIN K-DIN)

**RESOLUTION

Temperature display is software selectable as degree C, F, R, or K, with Resolution of 0.1 or 1 degree up to the limits of the 4½-digit display.

Accuracy

Thermocouple accuracy is given by the combination of the resolution and the error components of the system while operating on a 100 mV scale. In general the error components of the system will be less than 0.5°C.

Input Impedance

>1000 MΩ

Automatic Cold Junction Compensation

Better than ±0.03°C per °C from +0 to +60°C ambient

Burnout

Open Circuit Detection via 100 MΩ pulldown resistor and automatic T/C backup capability

RESISTANCE TEMPERATURE DEVICE (RTD)

TYPES	RANGES	RESOLUTION
100Ω Platinum per DIN 43760 (alpha = 0.003850) (A)	−200 to 800°C	0.1°C
100Ω Platinum (alpha = 0.003921) (B)	−200 to 800°C	0.1°C

Configuration

2, 3, or 4 wire software selectable

Excitation Current

0.5 mA typical

Accuracy

Better than 0.1° typical, 0.1% of span worst case

THERMISTOR

Type

2-wire type 400 (2252Ω @ 25°C)

Resolution

0.1°C

Accuracy

Better than 0.1°C; 0.1% of span worst case

Range

−40 to 150°C, requires external 400Ω (0.1%) parallel resistor

RESISTANCE

Ranges

200Ω
2000Ω

Excitation Current

0.5 mA typical

Accuracy

±0.05%

ANALOG

A/D CONVERSIONS

Technique

Dual-slope integration, 3-phase conversion with automatic zero correction and line optimization

Rate

20 conversions/second, internally triggered

Input Integration Period

16.6 ms @ 60 Hz
20 ms @ 50 Hz

DISPLAY

4½-digits (±19999), 12 mm high alphanumeric blue-green vacuum fluorescent display, and red output status indicators

A/D ACCURACY

Resolution (+ or − signals)
External — 1 part in 40,000 (4½-digits)
Internal — greater than 1 part in 100,000 (17 bits including sign bit)

Accuracy

0.01% of reading, maximum all dc voltage ranges

Offset Temperature Coefficient

±0.5 μV/°C maximum (200 mV full scale)

Gain Temperature Coefficient

±5 ppm/°C typical (0 to 60°C) (200 mV, +2V scale)

Non-Linearity

±0.0025% FSR, maximum

Warm-Up Time

10 minutes; ±1 display unit

NOISE REJECTION

AC Common Mode Rejection Ratio

160 dB (analog ground to line at 50 or 60 Hz)

AC Normal Mode Rejection Ratio

60 dB (50 or 60 Hz)

Digital Filtering Time Constants

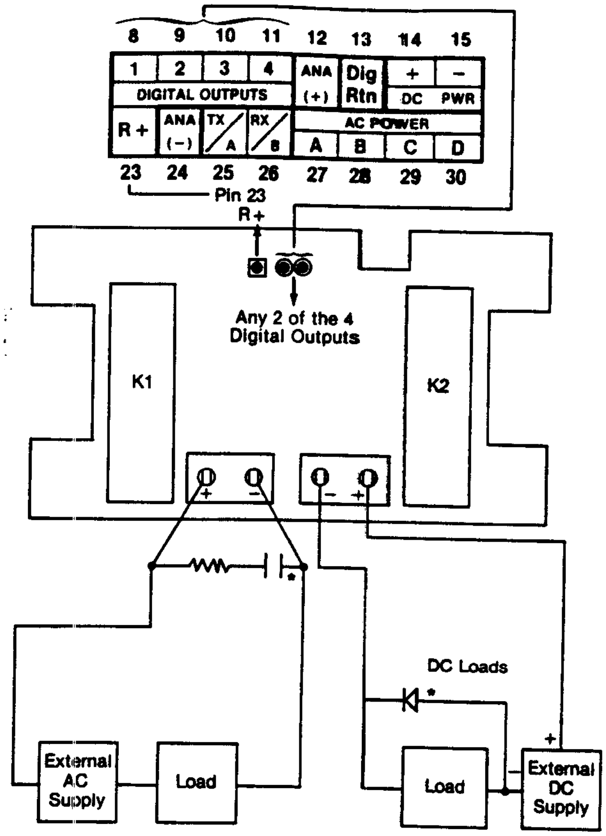
0, 68, 180, 386, 772, 1568 ms

MATH & MEMORY CAPABILITIES

Math Processing of Inputs

mx + b scaling, sin, cos, tan, square root, X^n (n = 0.5, 0.6...3.0) log, ln

SOLID STATE RELAY BOARD CONNECTORS



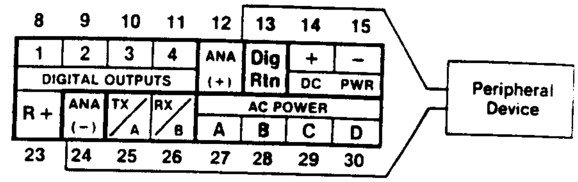
***AC snubber & dc diode to be installed by user when switching inductive loads.**

APPENDIX D
DEFAULT SETTINGS

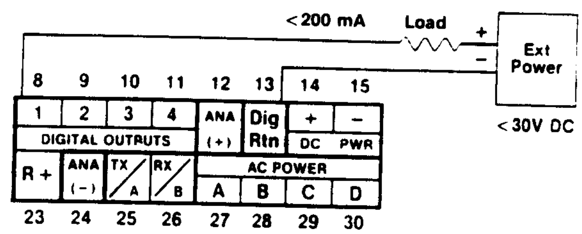
POWER	60 Hz		
INPT1	DC.V/I	200 mV	
INPT1	AC.V/I	200V	
INPT2	DC.V/I	200 mV	
INPT2	AC.V/I	200V	
FILTR	INPT1	TCNST	386
		HYSTR	ON
	INPT2	TCNST	386
		HYSTR	ON
TRACK	PEAK	INPT1	
	VALLY	INPT1	
T.BRN1	UP.SCL		
T.BRN2	UP.SCL		
ANOUT	ACTN	FWD	
	SOURC	NONE	
DSPLY	ZRO.SP	YES	
	SOURC	INPT1	
SERIO	COM.AD	00	
	SOURC	INPT1	
	BAUD	9600	
	PARIT	NONE	
	LN.TRM	CR LF	
	DELAY	19999	
DIG01	PASWD	0000	
	TYPE	ALARM	ARSET
	ACTN	OFF	
	DBAND	000	
	SOURC	INPT1	
DIG02	TYPE	ALARM	ARSET
	ACTN	OFF	
	DBAND	000	
	SOURC	INPT1	
DIG03	TYPE	ALARM	ARSET
	ACTN	OFF	
	DBAND	000	
	SOURC	INPT1	
DIG04	TYPE	ALARM	ARSET
	ACTN	OFF	
	DBAND	000	
	SOURC	INPT1	
SETPT	00000		
ADVCA	INPT1	MX + B	
			M 00000
			B 00000

APPENDIX C
CONNECTING OUTPUT

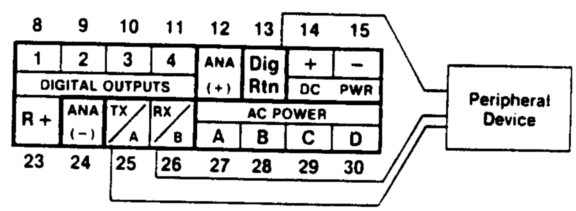
ANALOG



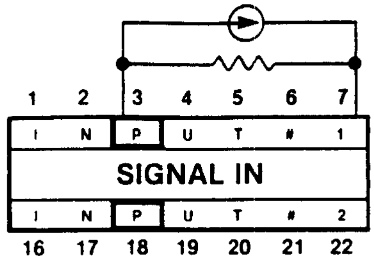
DIGITAL



SERIAL

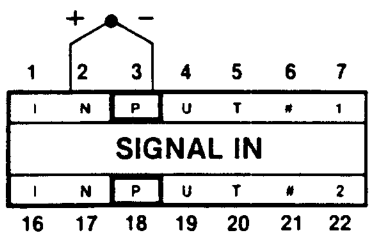


CURRENT
Pins 3 & 7

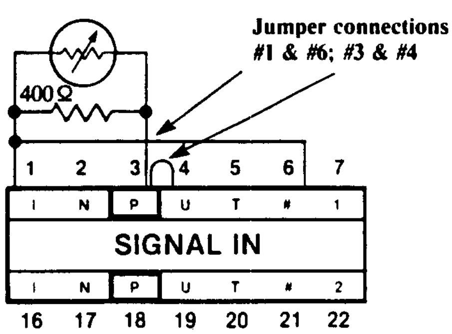


(For ohm values of external shunt resistors for different current ranges, see Appendix A, Page A-1)

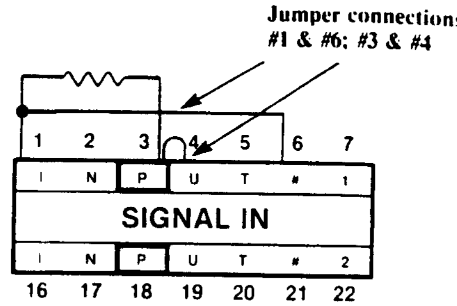
THERMOCOUPLE
Pins 2 & 3



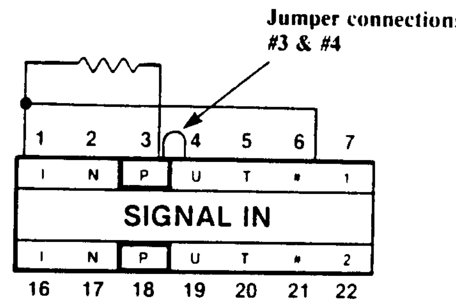
THERMISTOR
Pins 1 & 3



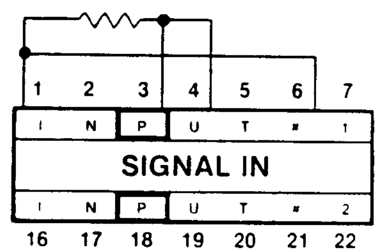
RTD and OHMS
[2-wire]



RTD and OHMS (INCORRECT)
[3-wire]



RTD and OHMS
[4-wire]



SET INPUT ONE DC VOLTS

PRESS	DISPLAY
ALARM DOWN SELECT ACK	SETUP
DOWN repeatedly until:	INPT1 displays.
DISPLAY NEXT	TEMP or DCV/I If TEMP displays, press DOWN.

WHEN DCV/I DISPLAYS

DISPLAY NEXT	One of the DCV/I choices.
UP or DOWN	Moves up or down to the top or bottom of the DCV/I choices.

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; FILTER displays.
DOWN repeatedly until:	OPER displays.
SELECT	Unit returns to Operation Mode.

SET INPUT ONE AS THERMOCOUPLE SELECT TEMPERATURE SCALE

PRESS	DISPLAY
ALARM DOWN SELECT ACK	SETUP
DOWN repeatedly until:	INPT1 displays.
DISPLAY NEXT	TEMP or DCV/I If DCV/I displays, Press UP.

WHEN TEMP DISPLAYS

DISPLAY NEXT	One of the temperature device choices.
UP or DOWN	Moves up or down to the top or bottom of the TEMP choices.

WHEN YOUR CHOICE DISPLAYS

DISPLAY NEXT	One of the temperature scale choices displays.
UP or DOWN	Moves up or down to the top or bottom of the TEMP choices.

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; FILTER displays.
DOWN repeatedly until:	OPER displays.
SELECT	Unit returns to Operation Mode.

APPENDIX F
CALIBRATING THE DP10 SERIES PANEL INDICATORS

The DP10 Indicator is shipped from the factory calibrated for all ranges. This procedure should only be used if a range is out of specification.

To calibrate a single channel DP10 indicator follow these instructions:

STEP ONE: Power up the DP10 Series.

STEP TWO: Connect the DP10 Series to a dc Voltage Standard.

STEP THREE:

PRESS	DISPLAY
ALARM ACK DOWN SELECT	SETUP
DOWN repeatedly until:	OPER displays
Hold DOWN and	
ALARM ACK SELECT	CALIB
SELECT	CAL 1
SELECT	+FULL
SELECT	Numeric value displays with left most digit blinking. Use UP to increase digit value and DOWN to move right to the next digit.

WHEN 18000 DISPLAYS

Set the Voltage Standard to positive 18000 and press:

SELECT	CALIBRATION RECORDED scrolls;
SELECT	−FULL displays.
	Numeric value displays with left most digit blinking. Use UP to increase digit value and DOWN to move right to the next digit.

WHEN 18000 DISPLAYS

	INPT2	MX + B	
			M 00000
			B 00000
	ICOMB	NONE	
	MX + B	M	001.00
		B	00000
	DECPT	0.0000	
OP.CMD	ALARM	YES	
	SETPT	YES	
OPER			

APPENDIX E
ERROR MESSAGES

ERR01	Checksum Error in Setup Table
ERR02	Checksum Error in Calibration Table
ERR03	Checksum Error in Program Memory
ERR04	Checksum Error in Data Memory
ERR05	Calibration Error

NOTE: If ERR01 is observed, press the "Alarm Acknowledge" key to clear the error and write a new checksum.

TO SET HIGH, LOW OR PCDEV

PRESS	DISPLAY
DISPLAY NEXT	Numeric value displays with left most digit blinking. Press UP to increase digit value and DOWN to move to next digit.

WHEN DESIRED NUMERIC VALUE DISPLAYS

SELECT	ENTRY RECORDED scrolls; DBAND displays.
DISPLAY NEXT	Numeric value displays with left most digit blinking. Press UP to increase digit value and DOWN to move to next digit.

WHEN DESIRED NUMERIC VALUE DISPLAYS

SELECT	ENTRY RECORDED scrolls; SOURC displays.
DISPLAY NEXT	One of the SOURCE choices.

WHEN DESIRED SOURCE CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; DIGO2 displays.
DOWN repeatedly until:	OPER displays.
SELECT	Unit returns to Operation Mode.

SET DIGITAL OUTPUTS AS CONTROLS

PRESS	DISPLAY
ALARM DOWN SELECT ACK	SETUP
DOWN repeatedly until:	DIG01 displays.
DISPLAY NEXT	TYPE
DISPLAY NEXT	ALARM or CONTROL If ALARM displays, press DOWN.

WHEN CNTRL DISPLAYS

SELECT	ENTRY RECORDED scrolls;
DISPLAY NEXT	ACTN displays.
	OFF, HIGH, LOW, or PCDEV Press UP or DOWN to display your choice.

WHEN YOUR CHOICE DISPLAYS

TO SET OFF

SELECT	ENTRY RECORDED scrolls; DBAND displays. Continue first step next page.

TO SET HIGH, LOW OR PCDEV

DISPLAY NEXT	Numeric value displays with left most digit blinking. Press UP to increase digit value and DOWN to move to next digit.

WHEN DESIRED NUMERIC VALUE DISPLAYS

SELECT	ENTRY RECORDED scrolls; DBAND displays.

SET UP THE DISPLAY

PRESS	DISPLAY
ALARM ACK DOWN SELECT	SETUP
DOWN repeatedly until:	DSPLY displays.
DISPLAY NEXT	ZROSP
DISPLAY NEXT	YES or NO Press UP or DOWN to display your choice.

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; SOURCE displays.
DISPLAY NEXT	One of the SOURCE choices.
UP or DOWN	Moves up or down to the top or bottom of the SOURCE choices.

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls;
DOWN repeatedly until:	SERIO displays.
SELECT	OPER displays.
	Unit returns to Operation Mode.

SET DIGITAL OUTPUTS AS ALARMS

PRESS	DISPLAY
ALARM ACK DOWN SELECT	SETUP
DOWN repeatedly until:	DIG01 displays.
DISPLAY NEXT	TYPE
DISPLAY NEXT	ALARM or CONTROL If CNTRL displays, press UP.

WHEN ALARM DISPLAYS

DISPLAY NEXT	ARSET, MRSET, or FRSET Press UP or DOWN to display your choice

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; ACTN displays.
DISPLAY NEXT	OFF, HIGH, LOW, or PC DEV Press UP or DOWN to display your choice.

WHEN YOUR CHOICE DISPLAYS

TO SET OFF

SELECT	ENTRY RECORDED scrolls; DBAND displays. Continue first step next page.

Set the Voltage Standard to negative (–) 18000 and press:

SELECT	CALIBRATION RECORDED scrolls;
	AOCAL displays.
DOWN repeatedly until:	CDONE displays.
SELECT	The DP10 Series returns to the Operation Mode.

Dual Channel Calibration

Please refer to Publication #16-400458, Installation and Calibration manual, which details installation of Options and calibration procedures.

QUICK "HOW TO's"

This chapter contains how to do the following quickly!

Keys you press and what you see on the display are summarized on the following pages.

SET SOURCE FOR PEAK AND VALLEY TRACKING

PRESS	DISPLAY
ALARM DOWN SELECT ACK	SETUP
DOWN repeatedly until:	TRACK displays.
DISPLAY NEXT	PEAK
DISPLAY	One of the Peak source choices.
UP or DOWN	Moves up or down to the top or bottom of the Peak source choices.

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; VALLY displays.
DISPLAY NEXT	One of the Valley source choices.
UP or DOWN	Moves up or down to the top or bottom of the Valley source choices.

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; TBRN1 displays.
DOWN repeatedly until:	OPER displays.
SELECT	Unit returns to Operation Mode.

USE ADVANCED CALCULATIONS TO SCALE INPUT ONE USING MX + B

PRESS	DISPLAY
ALARM DOWN SELECT ACK	SETUP
DOWN repeatedly until:	ADVCA displays.
DISPLAY NEXT	INPT1 If any other choice displays, press UP until INPT1 displays.

WHEN INPT1 DISPLAYS

DISPLAY NEXT	MX + B If any other choice displays, press UP until MX + B displays.
DISPLAY NEXT	M displays.
DISPLAY NEXT	Numeric value displays with left most digit blinking. Press UP to increase numeric value; DOWN to move to next digit.

WHEN DESIRED NUMERIC VALUE DISPLAYS

SELECT	ENTRY RECORDED scrolls; B displays.
DISPLAY NEXT	Numeric value displays with left most digit blinking. Press UP to increase numeric value; DOWN to move to next digit.

WHEN DESIRED NUMERIC VALUE DISPLAYS

SELECT	ENTRY RECORDED scrolls; The second MX + B displays.

SET ANALOG OUTPUT — SCALED using MX + B

PRESS	DISPLAY
ALARM DOWN SELECT ACK	SETUP
DOWN repeatedly until:	ANOUT displays.
DISPLAY NEXT	ACTN
DISPLAY NEXT	FWD (Forward) or REV (Reverse) Press UP or DOWN to display your choice.

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; SOURC displays.
DISPLAY	One of the SOURCE choices.
UP or DOWN	Moves up or down to the top or bottom of the Source choices.

WHEN YOUR CHOICE DISPLAYS

DISPLAY NEXT	UNSCL or MX + B If UNSCL displays, press DOWN.
DISPLAY NEXT	M
DISPLAY NEXT	Numeric value displays with left most digit blinking. Use UP to increase digit value and DOWN to move right to the next digit.

WHEN DESIRED NUMERIC VALUE DISPLAYS

SELECT	ENTRY recorded scrolls; B displays.

PRESS	DISPLAY
DISPLAY NEXT	Numeric value displays with left most digit blinking. Press UP to increase numeric value; DOWN to move to next digit.

WHEN DESIRED NUMERIC VALUE DISPLAYS

SELECT	ENTRY RECORDED scrolls; DSPLY displays.
DOWN repeatedly until:	OPER displays.
SELECT	Unit returns to Operation Mode.

PRESS	DISPLAY
DISPLAY NEXT	Numeric value displays with left most digit blinking. Press UP to increase digit value and DOWN to move to next digit.

WHEN DESIRED NUMERIC VALUE DISPLAYS

SELECT	ENTRY RECORDED scrolls; SOURC displays.
DISPLAY NEXT	One of the 3 SOURCE choices.
UP or DOWN	Move up or down to the top or bottom of the Source choices.

WHEN DESIRED SOURCE CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; DIG02 displays.
DOWN repeatedly until:	OPER displays.
SELECT	Unit returns to Operation Mode.

SET ANALOG OUTPUT — UNSCALED

PRESS	DISPLAY
ALARM DOWN SELECT ACK	SETUP
DOWN repeatedly until:	ANOUT displays.
DISPLAY NEXT	ACTN
DISPLAY NEXT	FWD (Forward) or REV (Reverse) Press UP or DOWN to display your choice.

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; SOURC displays.
DISPLAY	One of the SOURCE choices.
UP or DOWN	Moves up or down to the top or bottom of the Source choices.

WHEN YOUR CHOICE DISPLAYS

DISPLAY NEXT	UNSCL or MX + B If MX + B displays, press UP.
SELECT	ENTRY RECORDED scrolls; DSPLY displays.
DOWN repeatedly until:	OPER displays.
SELECT	Unit returns to Operation mode.

LEAVE SETUP MODE

You can exit SETUP MODE whenever you are on the first level of Parameter Choices:

POWER
INPT1
INPT2
FILTR
TRACK
TBRN1
TBRN2
ANOUT
DSPLY
SERIO
DIG01
DIG02
DIG03
DIG04
SETPT
ADVCA
OPCMD
OPER

PRESS	DISPLAY
DOWN	Until OPER displays.
SELECT	The DP10 Series returns to the Operation Mode.

NOTE: If, by mistake, you press DISPLAY NEXT and advance to the second level:

PRESS	DISPLAY
DISPLAY NEXT repeatedly	Until all of the parameter choices for that parameter display and the next Level One parameter choice displays.
DOWN	Until OPER displays.
SELECT	Unit returns to Operation Mode.

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PRESS	DISPLAY
SELECT	ENTRY RECORDED scrolls; B displays.
DISPLAY NEXT	Numeric value displays with left most digit blinking. Press UP to increase numeric value; DOWN to move to the next digit.

WHEN YOUR NUMERIC CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; DECPT displays.
DISPLAY NEXT	0.0000 displays Press UP to move the decimal point left; DOWN to move the decimal point right.
SELECT	OPCMD
DOWN once	OPER
SELECT	Unit returns to Operation Mode.

SET PERMISSION TO CHANGE ALARM AND SET-POINT VALUES IN OPERATION MODE

PRESS	DISPLAY
ALARM DOWN SELECT ACK	SETUP
DOWN repeatedly until:	OPCMD displays.
DISPLAY NEXT	ALARM YES or NO
DISPLAY NEXT	Use UP or DOWN to display your choice.

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls;
DISPLAY	SETPT displays. YES or NO Use Up or DOWN to display your choice.

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; OPER displays.
SELECT once	Unit returns to Operation Mode.

When the first MX + B function is used, the second M should be set to S/B 001.00 and the B to 00000 so there will be no additional scaling of the input signal. If SINE or one of the other mathematical functions is used, the second MX + B function can be used to scale the signal in Advanced Calculations.

DISPLAY NEXT	M displays.
DISPLAY NEXT	Numeric value displays with left most digit blinking. Press UP to increase numeric value; DOWN to move to next digit.

WHEN DESIRED NUMERIC VALUE DISPLAYS

SELECT	ENTRY RECORDED scrolls; DECPT displays.
DISPLAY NEXT	0.0000 displays Press UP to move the decimal point left; DOWN to move the decimal point right.
SELECT	OPCMD
DOWN once	OPER
SELECT	Unit returns to Operation Mode.

USE ADVANCED CALCULATIONS FOR MATHEMATICAL FUNCTIONS AND MX + B SCALING

PRESS	DISPLAY
ALARM DOWN SELECT ACK	SETUP
DOWN repeatedly until:	ADVCA displays.
DISPLAY NEXT	INPT1 If any other choice displays, press UP until INPT1 displays.

WHEN INPT1 DISPLAYS

DISPLAY NEXT	MX + B
UP or DOWN	Moves up or down to the top or bottom of the advanced calculation choices.

WHEN YOUR CHOICE DISPLAYS

SELECT	ENTRY RECORDED scrolls; the second MX + B displays.

When SINE or one of the other mathematical functions is used, the second MX + B function can be used to scale the signal in Advanced Calculations.

DISPLAY NEXT	M displays.
DISPLAY NEXT	Numeric value displays with left most digit blinking. Press UP to increase numeric value; DOWN to move to next digit.

WHEN DESIRED NUMERIC VALUE DISPLAYS

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