DCT6088 Dedicated
Digital Correlation Transit Time
Ultrasonic Flowmeter

DCT6088

Software Versions 3.00 Onwards

Sechang Instruments Co., Lrd.

1.1

DCT6088   POLYSONOCS   .

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            . (.)

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            ,   .

                                          ,   ,   ,   ,   (3   )

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                                                                                    .

            , RS232

                                                  . (A)   ,

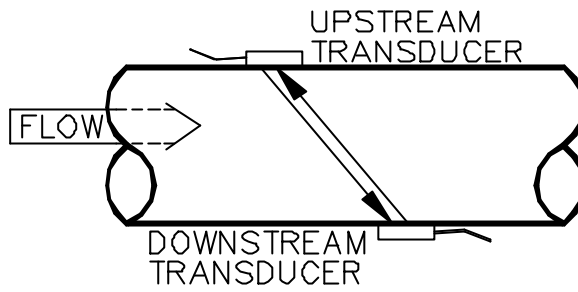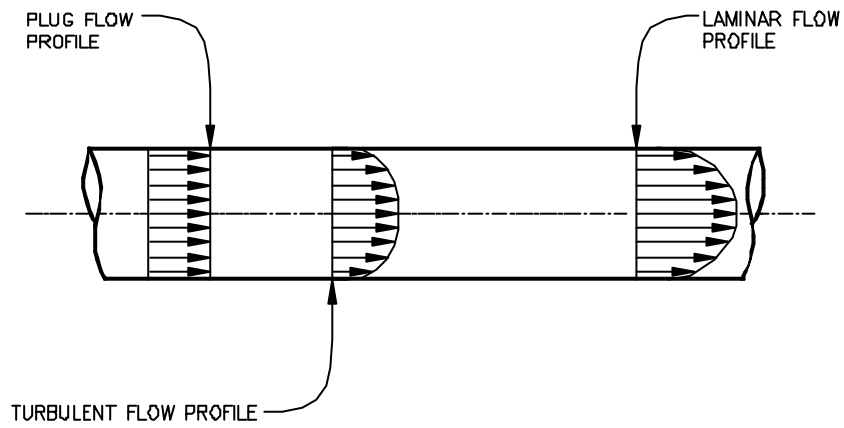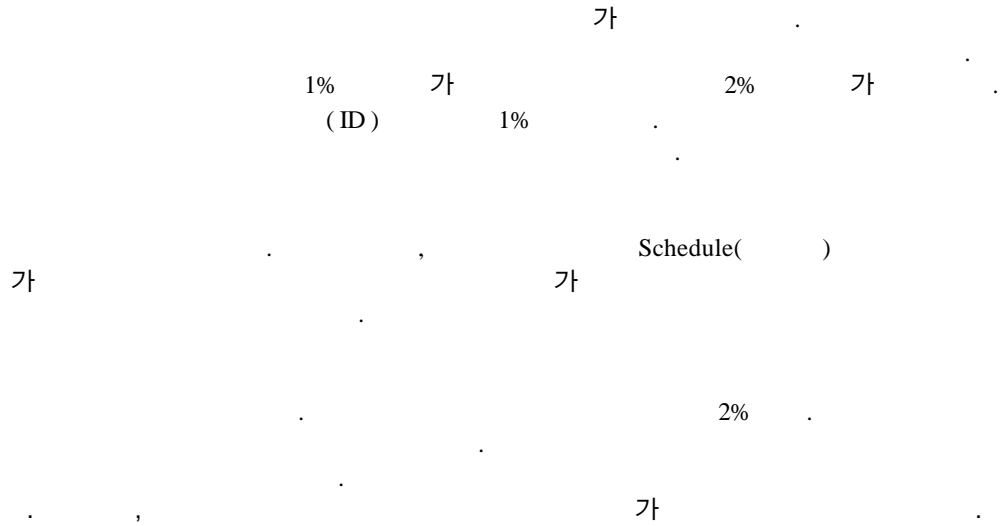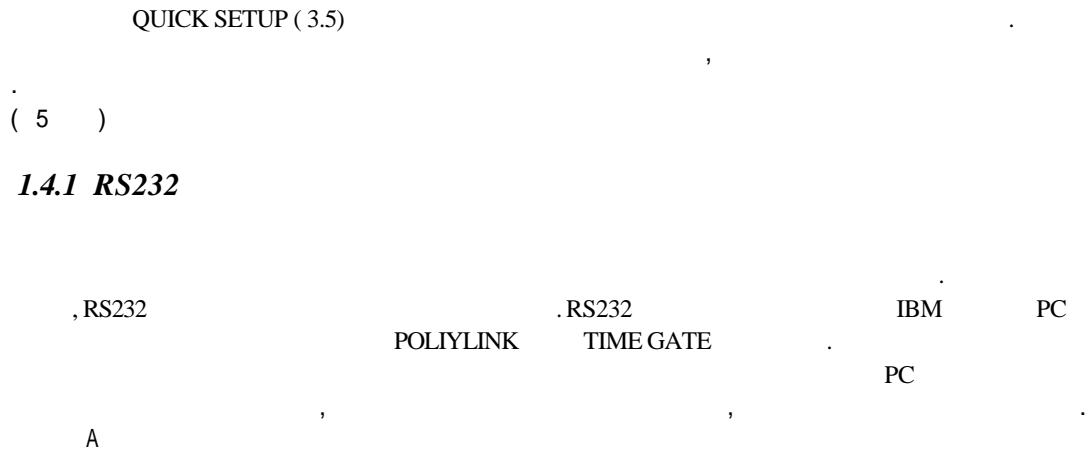   POLYSONICS TIME GATE   .

1.2

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                                    .

DCT6088

                                                  . (1-1)

                        2   .

            ,   .

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                                                                  .

        . (1-2)

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            .

Figure 1-1 *Typical Transit Time System*

Figure 1-2 *Flow Profiles*

1.3

1%   2%   .
  (ID)   1%   .

     .   ,   Schedule(   )   .

            .   2% .

  .   ,

1.4

QUICK SETUP (3.5)

(5)

1.4.1 RS232

, RS232   .RS232   IBM   PC
    POLIYLINK TIME GATE   .   PC   .
    ,   ,
  A

1.5

DCT6088 (1-3)   .

(   )

LCD   .   ,   ...
3.1   .

19   . 3.1   .

RS232   DB25   .

. 2.3   .

110V   220V AC   .
2.2   .

AC

4   .(   ) 2.5
. 2.4.4.
. 3.6.11   .

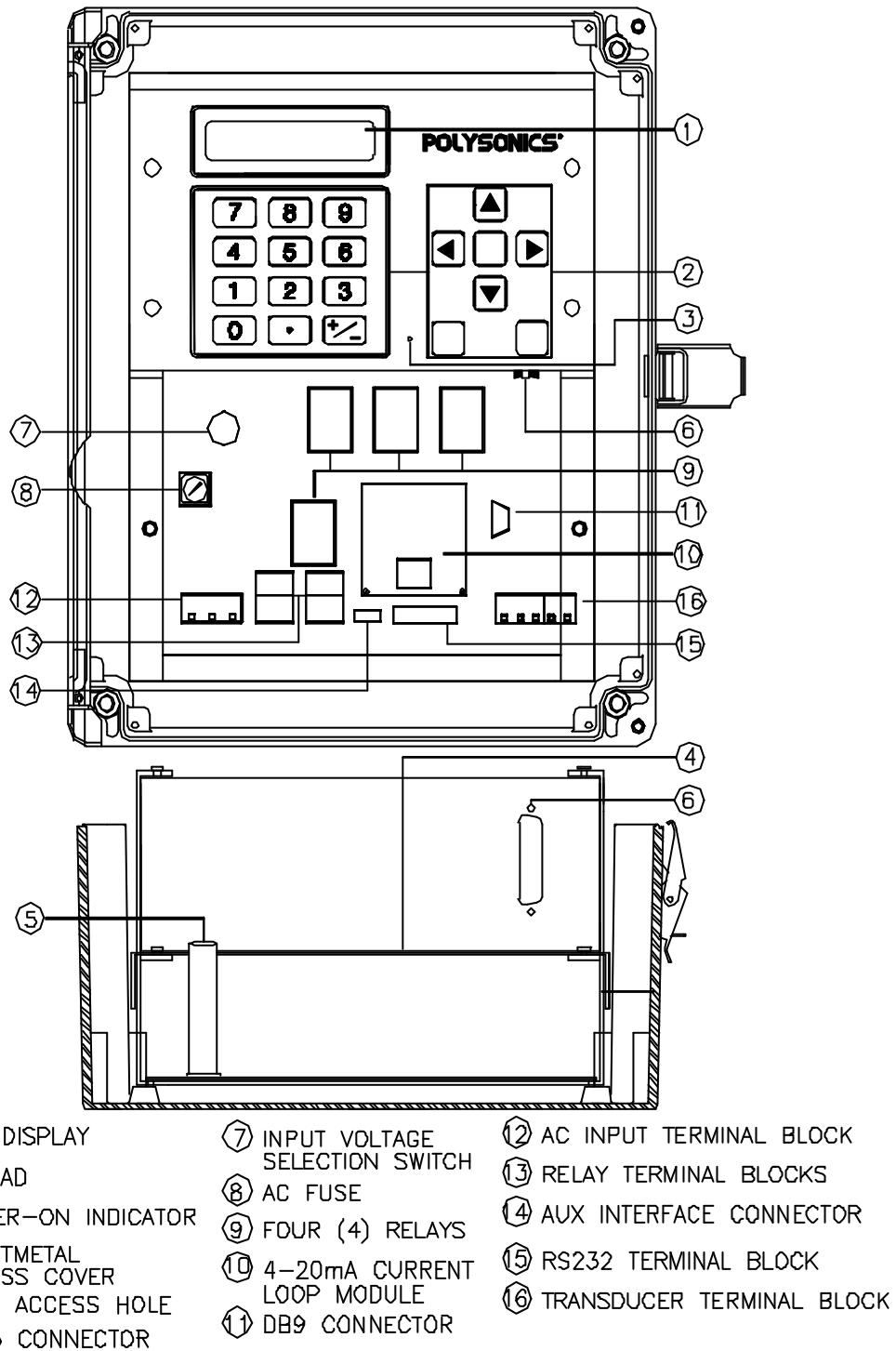4-20mA   .   TTF-
. 2.6   .

DB   .

AC   AC   .

RS232   . RS232   DB9   .

16   .

NOTE: 2.4   .

Figure 1-3 *DCT6088 Physical Layout (door not shown)*

① LCD DISPLAY	⑦ INPUT VOLTAGE SELECTION SWITCH	⑫ AC INPUT TERMINAL BLOCK
② KEYPAD	⑧ AC FUSE	⑬ RELAY TERMINAL BLOCKS
③ POWER-ON INDICATOR	⑨ FOUR (4) RELAYS	⑭ AUX INTERFACE CONNECTOR
④ SHEETMETAL ACCESS COVER	⑩ 4-20mA CURRENT LOOP MODULE	⑮ RS232 TERMINAL BLOCK
⑤ FUSE ACCESS HOLE	⑪ DB9 CONNECTOR	⑯ TRANSDUCER TERMINAL BLOCK
⑥ DB25 CONNECTOR		

1.6

DCT6088   ,

1.7

FLASH   .
(A   F   )   94   .
                                                                              .

1.8.

DCT6088   .
    1-1   .   , DCT6088 B 1 1 1 30A   DCT 6088
                                          .

        WINDOWS 95   TIMEGATE

        LCD

        1

        NEMA 4X

        30

                                              .

Table 1-1	
DCT6088 Flowmeter Standard Configuration and Options	
Description	**Model Code Number**
Dedicated Digital Correlation Transit Time Flowmeter [1] Flow range: ±0 to 50 FPS (±0 to 15 MPS) 50,000 point data logger One 5A SPDT fully programmable alarm relay Signal outputs: 4 to 20 mA DC, RS232 Supply voltage: 90 to 132 VAC, 190 to 250 VAC, and 50/60 Hz	TTF-✍
Time*GATE* ™ Configuration and Analysis Program [1] ✍ Windows® 3.11 version [2] ✍ Windows 95® version	A B
Display ✍ 40-character, 2-line, alphanumeric LCD [1] ✍ Vacuum fluorescent display	 1 2
Relays One relay, 5A, SPDT, fully programmable [1] Two relays, 5A, SPDT, fully programmable Three relays, 5A, SPDT, fully programmable Four relays, 5A, SPDT, fully programmable	 1 2 3 4
Transmitter Enclosure NEMA 4X [1] NEMA 7	 1 2
Transducer Cable Length ✍ 30 ft (9 m) [1] ✍ Additional cable length [3]	 30A XXXA

Transducer Hazardous Area Certification
CSA [1]:
  Class I, Div. 2, Groups A, B, C, D
  Class II, Div. 2, Groups E, F, G
  Class III, Div. 2
CSA [4]:
  Class I, Div. 1, Groups C, D, E, F, G - Entity
  Class II, Div. 1, Groups C, D, E, F, G - Entity
  Class III, Div. 1, Groups C, D, E, F, G - Entity
CENELEC (LCIE) [4]:
  Eex ia II B T6	

1 Standard items.

2 The Windows® 3.11 version of Time *GATE* ™ is compatibles with Windows® versions 3.1 and higher.

3 Additional cable is available in increments of 10 feet to a maximum length of 1,000 feet.

4 Intrinsically safe barriers are installed in the transmitter for this certification.

1.9 Technical Specifications

Table 1-2 lists the physical, performance, and functional specifications of the DCT-6088:

Table 1-2 DCT6088 Flowmeter Specifications	
Performance specifications [1]	
Flow range	±0 to 50 FPS (±0 to 15 MPS).
Accuracy	±0.5% of velocity or ±0.05 FPS (0.0152 MPS), typical on a calibrated system/digital output.
Sensitivity	0.001 FPS (0.3 mm per sec) at any flow rate including zero.
Linearity	0.1% of scale, digital output.
Pipe size	1 to 200 in (25 mm to 5 m).
Fluid	Homogeneous liquids without gas bubbles.
Functional specifications	
Outputs	✍ 4 to 20 mA (into 1,000 ohms), 12 bit, 5 kV opto-isolated, loop-or self-powered. ✍ RS232 serial interface.
Power supply	90 to 132 VAC and 190 to 250 VAC, 50/60 Hz, switch-selectable.
Keypad	19-key with tactile action.
Display	40-character, 2-line, alphanumeric, backlit LCD. Screens include present and total flow, velocity, signal strength, and delta T.
Data logger	✍ 50,000 data points, time stamped. Programmable in 1-second intervals.
Relays	5 A, SPDT, fully programmable. 1 standard, up to 4 optional.
Temperature [2]	Transmitter: -40 to +140?F (-40 to +60?C). Transducers: ✍ -40 to +300?F (-40 to +150?C), standard. ✍ -40 to +470?F (-40 to +243?C, when using optional high-temperature transducer blocks.
Humidity	0 to 100% RH.
Physical specifications	
Transmitter	NEMA 4X (IP65), flame-retardant fiberglass, reinforced polyester.
Transducers	Encapsulated design. Standard cable length: 30 ft (5 m).
Transmitter weight	Approximately 12 lbs (5.4 kg).
[1] Performance specifications are established under reference conditions.	
[2] Consult factory for higher operating temperatures than those listed.	

DCT6088

(2.1)

(2.2)

(2.3)

(2.4)

(2.5)

(2.6)

⚠️
WARNING   . (
            .)

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2.1

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,   . (2.1.2)
,   . (2.1.3)

DCT6088   .
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2.1.1

1/4
. 5/16   .

2 1 2

.

1. 4   4/16

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NOTE: .(2-1)
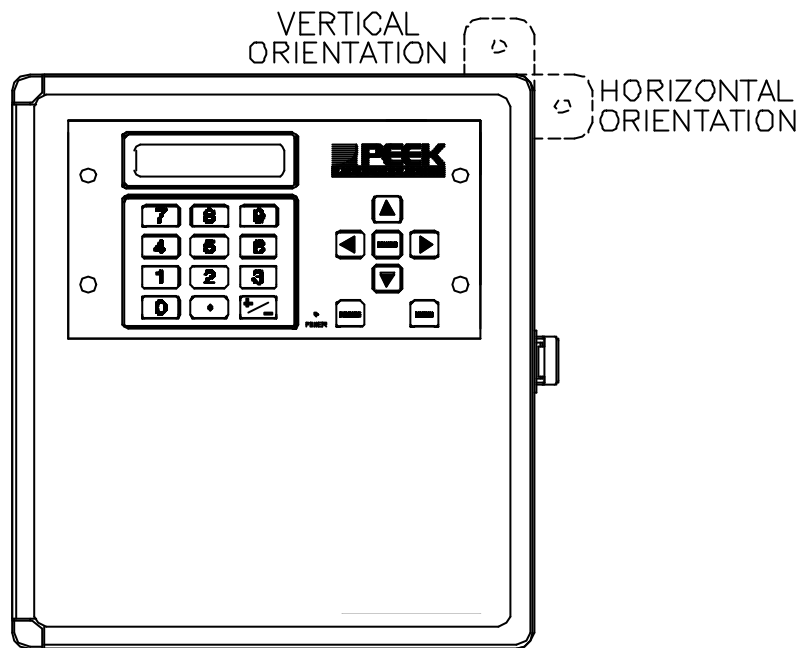
Figure 2-1   Mounting Ear Options

2.   .

2.1.3

.
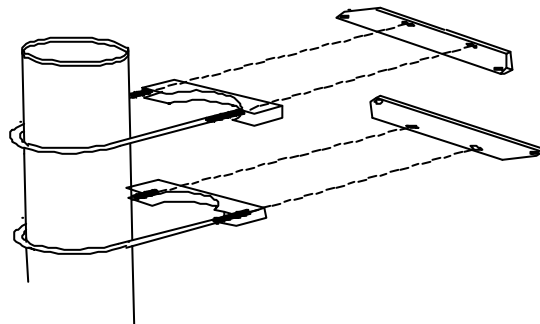
Figure 2-2   Mounting Bracket Kit

.

1.   5/16   .
2.   .
3.   .
4.   .
5.   . (   )
6.   .

.

1.   5/16   .
2.   .

NOTE: 2   4   .

3.   .
4.   .

2.2

                 110V 60Hz   220V 50Hz   .
                 . (1-3)   .
            .
    1/8   .

2.3

1A 250V   . (1-3)
.

1.   .
2.   ,   .
3.   .

     NOTE: . (1-3)
4.   ,   .
5.   ,   .
  (,   .)

2.3

       ,   ,   .
.   .

IMPORTANT: .

,   2   . (1-3)
. (2-3)

AC

4   20mA

RS 232

Figure 2-3   DCT6088 Wiring Connections (example)

2.4.1 AC

AC   AC   L1, GND
(2-3)   .
(110VAC 60Hz,   220VAC 50Hz)

110 V 60Hz

 AC 110   .

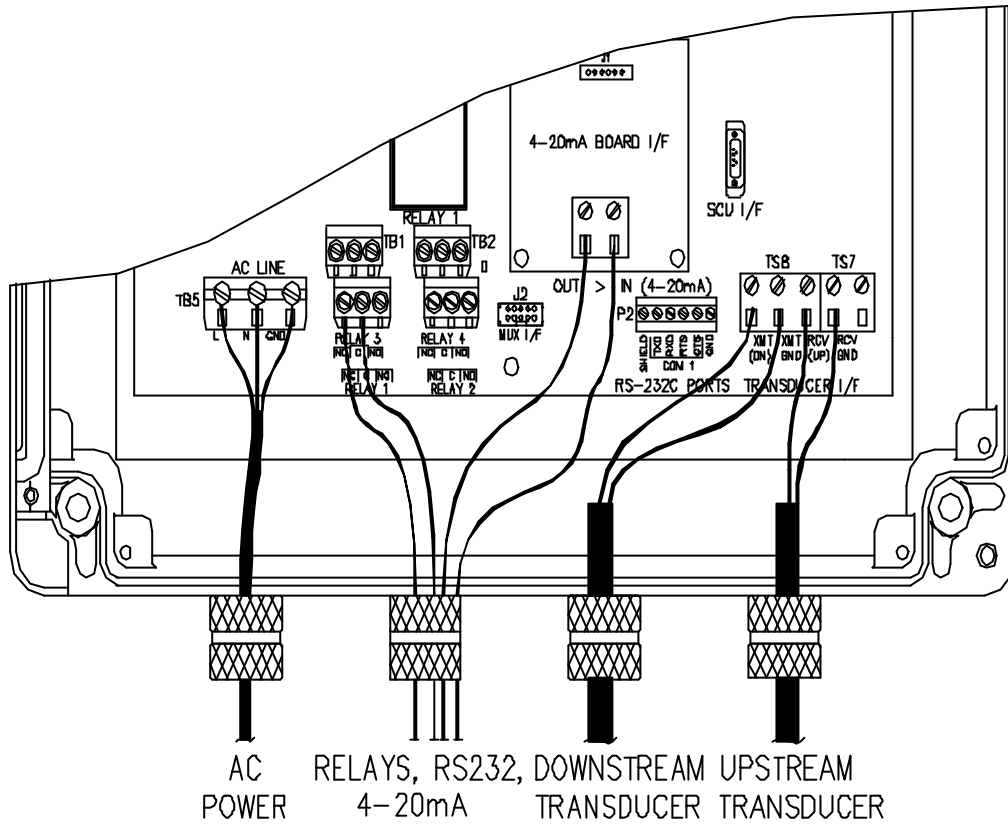1.   . (2.2)
2.   L   .
3.   N   .
4.   GND   .

220V 50Hz

AC 220   .

1.   . (2.2   )
2.   L   .
3   N   .
4   GND   .

2.4.2

.(4- 2)

,

.   ..

TRANSDUCER I/F   ,

.

1.   . (2.2)
2.   L   .
3.   N   .
4.   GND

.

XMT (DE)
XMT GND
RCV (UP)
RCV GND

(2-4)

1.   XMT (DN)   .
2.   XMT GND   .
3.   RCV (UP)   .
4.   RCV GND   .

IMPORTANT: 8
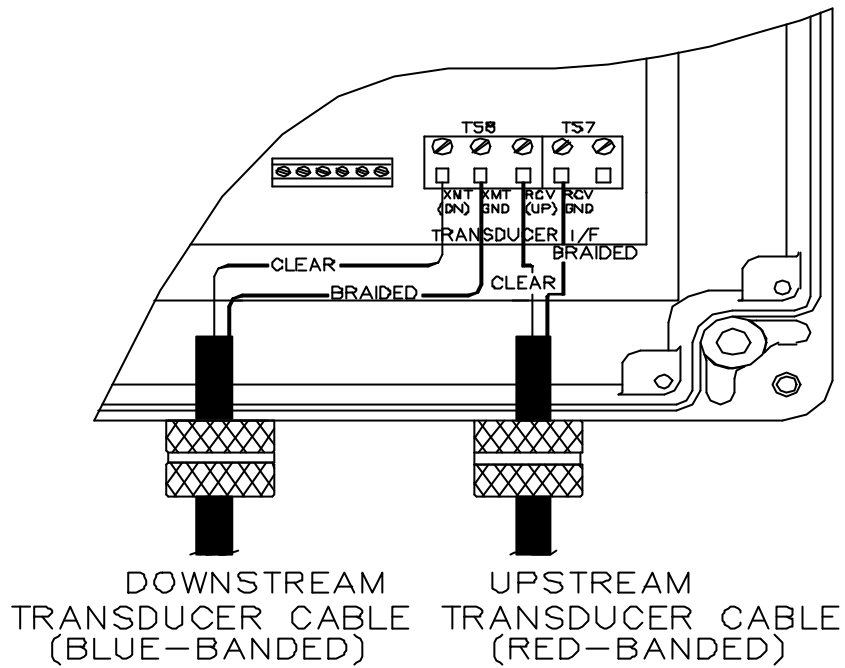
Figure 2-4   *Transducer Terminal Block Connections*

2.4.3 RS232

RS232   (RS-232 PORTS   )   RS232
      .

RS232   :
1.   PIN OUT   .
2   . (   )

     ✍ SHIELD   ✍ RTS

     ✍ TXD   ✍ CTS

     ✍ RXD   ✍ GND

NOTE: A   F   RS 232   **TIME GATE**   .

2.4.4

DCT6088   4   .(   )   5A
250VAC   .   1   4   .
(2-5)   (NO)   (NC)   .
    2- 5   1   (NC)
.
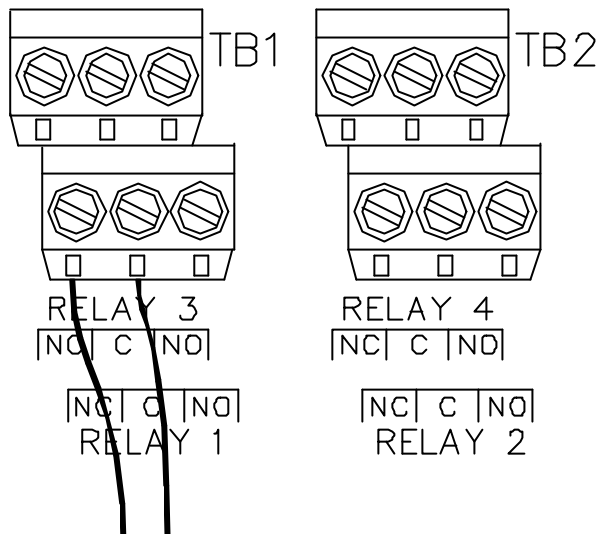
Figure 2-5 *Normally Closed Relay Circuit (example)*

    NO   NC   .
    ,   (COMMON)   NO   .
C   NC   . (2- 6)
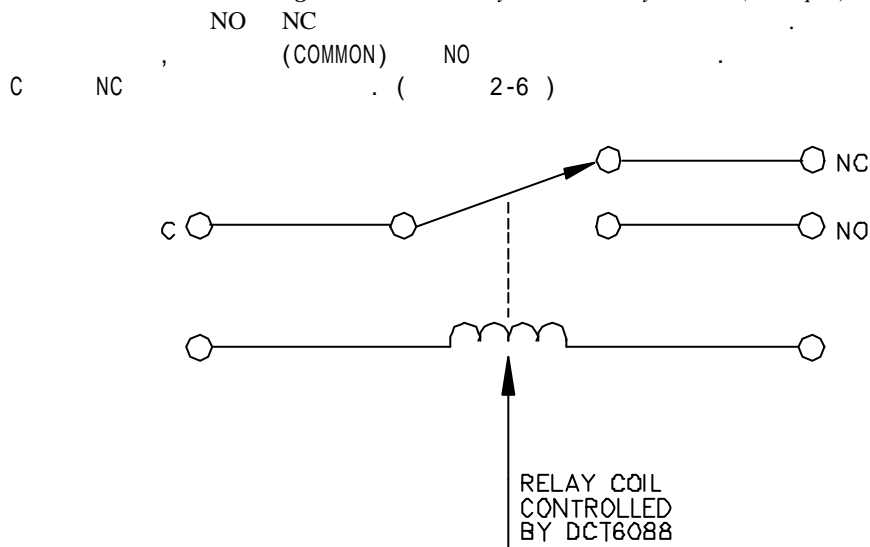
Figure 2 -6 *Relay Schematic*

NOTE: 2.5   , 3. 6. 11

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2.4.5

,   .

(2.6)   2-7(SELF POWER)   2-8 (LOOP-POWER)

.

NOTE: (IN)   (OUT)   DB25   .

Figure 2-7   *Wiring Diagram for Self-Powered Current Loop*
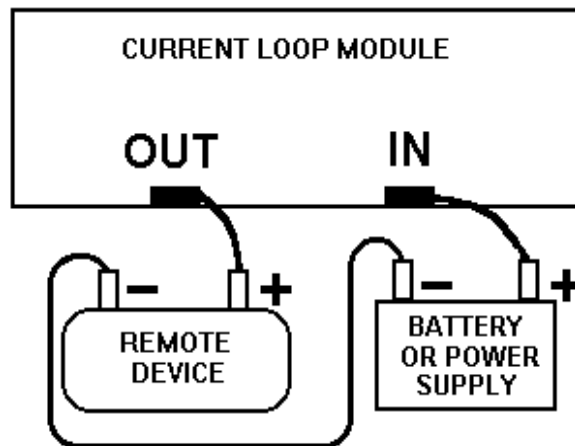
Figure 2 -8   *Wiring Diagram for Loop-Powered Current Loop*

NOTE: 4-20mA   6   . 2 6

2.5

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RELAY 1 RELAY 4 . (2-3)

2. 4. 4 , 3. 6. 11

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2.6

DCT6088 4-20mA .

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6 . 2. 4. 5

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NOTE: : 4-20mA 1000 5KV .

2.6.1

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1. .
2. .
3. .
4. 2 .
5. . (2-9)
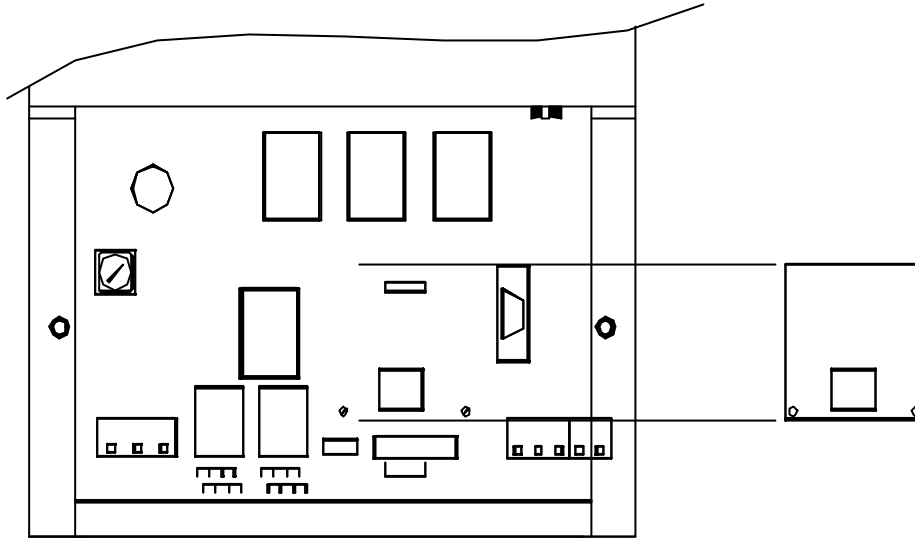
Figure 2-9 *Removing the 4 to 20 mA Current Loop Module*

CAUTION: ,

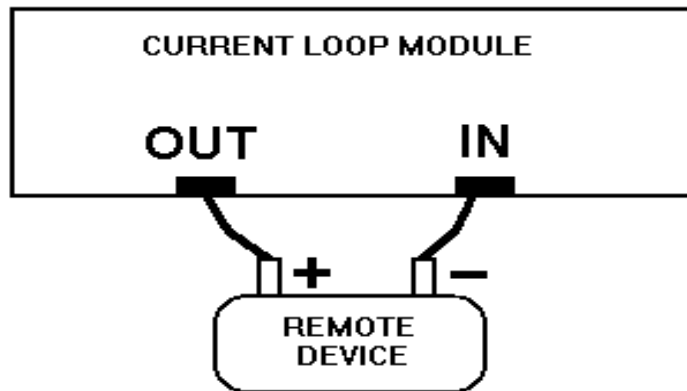6.   .
        ,   .
    (.)
7. 2   .
8.   . (2.6.2)
9.   . (2,4,5)
10.   .
11.   . (6   )

2.6.2

                                                            (2-7)   (2-8)
                                . DCT6088   .
                                                                                            .
        (**2**   .)

DB25   . (2-10   )

```
┌──────────────────────────────────────┐
│ ┌──────────────┬───┬───┬───┐   ┌────┐ │
│ │   4-20mA     │   │   │   │   │ JP3│ │
│ │ANALOG OUTPUT │JP1│JP2│JP3│   └─┐  │ │
│ ├──────────────┼───┼───┼───┤  ┌─┘  │ │
│ │LOOP POWERED  │ON │OFF│OFF│  │    │ │
│ ├──────────────┼───┼───┼───┤  └────┘ │
│ │SELF POWERED  │OFF│ON │ON │  JP2 JP1│
│ └──────────────┴───┴───┴───┘         │
│                                      │
│                                      │
│   TO REMOVE OR REPLACE PCB:          │
│   REMOVE BOTH SCREWS AND PULL        │
│   STRAIGHT UP AND AWAY.              │
│                                      │
│                                      │
│            OUT    IN                 │
│          ┌──────────┐                │
│          │          │                │
│          │          │                │
│   ◯      │          │        ◯       │
│          └──────────┘                │
└──────────────────────────────────────┘
```

Figure 2-10   *Current Loop Power Jumper Settings*

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,   .(4   )

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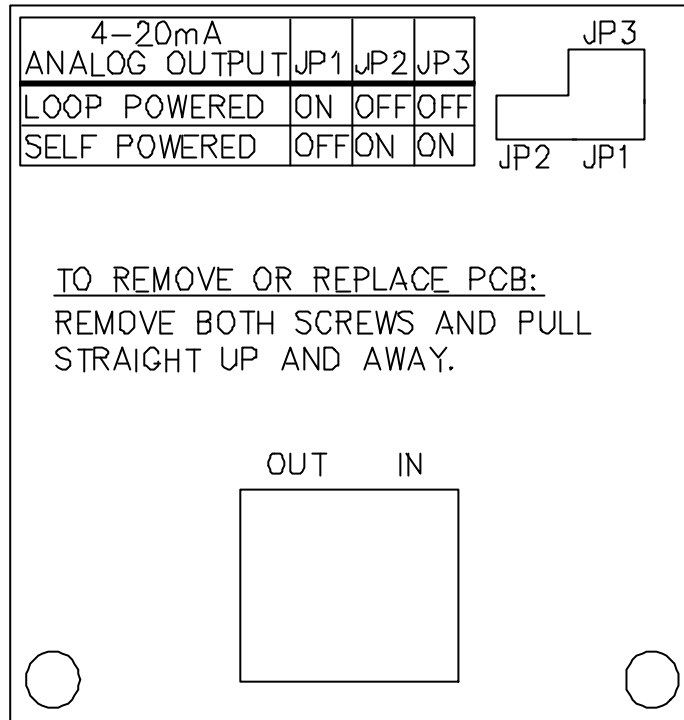**NOTE:** IBM   PC   POLYLINK   TIME GATE   ,
RS232

3.1

.

40   LCD   .
.

,   .

3.1.1

.

LDC
, 0   9   (   )   .
, , ,   .
ENTER   ,   ENTER   .
ERASE   BACKSPACE   . ERASE
.   ,   ERASE
. ERASE   00   .
(   )
[T   . (3. 3   )
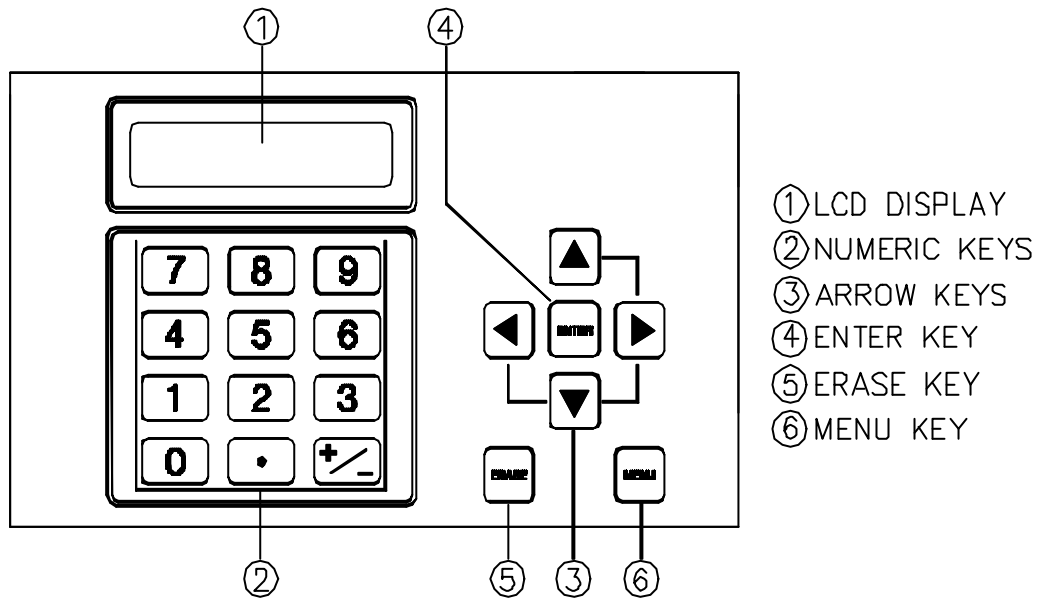
Figure 3-1   Keypad and Display

3.1.2

                                        .

.   .

1. MENU   .
2, +/-   .
                       .

```
┌──────────────────────────────────────┐
│                                      │
│          LCD Contrast                │
│                                      │
│                                      │
└──────────────────────────────────────┘
```

3.   ,   .

4.   ENTER   .

3.2   MENU

                  .

1. MENU   .
               M

```
┌──────────────────────────────────────┐
│                                      │
│                                      │
│                                 M    │
└──────────────────────────────────────┘
```

2.   .

NOTE: M   . (4   ).
           M   MENU
                . .

3-1　　　　　　　　　　(　　　　　) :

Table 3-1
Menu Addresses

PRIMARY DISPLAYS:
    Flow/Net Totalizer (Menu 00)
    Flow/Velocity (Menu 01)
    Flow/Positive Totalizer (Menu 02)
    Flow/Negative Totalizer (Menu 03)
    Signal Strength/Low Signal Cutoff (Menu 04)

PIPE:
    Pipe OD (Menu 10)
    Pipe Wall Thickness (Menu 11)
    Pipe ID (Menu 12)
    Pipe Material (Menu 13)
    Pipe Sound Speed (Menu 14)
    Pipe Inside Roughness (Menu 15)

LINER:
    Liner Material (Menu 16)
    Liner Thickness (Menu 17)
    Liner Sound Speed (Menu 18)
    Liner Inside Roughness (Menu 19)

FLUID:
    Fluid Type (Menu 20)
    Fluid Sound Speed (Menu 21)
    Fluid Viscosity (Menu 22)

TRANSDUCER:
    Transducer Type (Menu 23)
    Transducer Mounting (Menu 24)
    Transducer Spacing (Menu 25)

FLOW:
    Flow Units (Menu 30)
    Max Flow Range (Menu 31)
    Min Flow Range (Menu 32)
    Damping (Menu 33)
    Low Flow Cutoff (Menu 34)
    Low Signal Cutoff (Menu 35)

TOTALIZER:
    Totalizer Units (Menu 36)
    Totalizer Multiplier (Menu 37)
    Net Totalizer (Menu 38)
    Positive Totalizer (Menu 39)
    Negative Totalizer (Menu 40)
    Totalizer Reset (Menu 41)

OPTIONS:
    Measurement Units (Menu 42)
    Site Parameters (Menu 43)
    RS232 Configuration (Menu 46)
    Change System Password (Menu 47)
    Change Scale Factor Password (Menu 48)
    Unit ID (Menu 49)

CALIBRATION (Menu 50):
    Zero Set (Menu 51)
    Scale Factor (Menu 52)
    Sound Speed Compensation (Menu 53)
    Date and Time (Menu 54)

CURRENT LOOP (Menu 56):
    Current Loop Span (Menu 57)
    Current Loop Calibration (Menu 58)
    Current Loop Test (Menu 59)

RELAYS (Menu 70):
    Program Relays (Menu 71)
    View Relays (Menu 72)
    Test Relays (Menu 73)

DATA LOG (Menu 80)
    Data Log Interval (Menu 81)

DIAGNOSTICS:
    Signal Strength/Margin (Menu 90)
    Delta Time/Fluid Sound Speed (Menu 91)
    Reynolds #/Profile Factor (Menu 92)
    Current Loop Output (Menu 93)
    Software/Firmware Rev. Level (Menu 94)

3.3   •

(3.2)_

          •

MAIN MENU
SUB-MENU (   )
PRIMARY DISPLAYS, SETUP MENUS, AND DIAGNOSTIC MENUS
(,   ,   )
             •
    •

3.3.1

            •

1. MENU   •
         •   ,
    4   ( )   •

```
        Main Menu
  ✍Pipe       ✍Liner
```

,   :

```
  ✍Pipe       ✍Liner
  ✍Fluid      ✍Xducer
  ✍Flow       ✍Total.
  ✍Options    ✍Calibr.
  ✍4-20mA     ✍Relays
  ✍DataLog.   ✍Diagn
```

2.   ,   •
3   , ENTER   •
               •   FLOW
        •

```
┌─────────────────────────────┐
│        Flow Units           │
│ *Gallons                    │
└─────────────────────────────┘
```

3.3.2   ,

                    ,   ,   ,
                                                      . DOWN
                              , UP   .

3.4

                                                          .
                              . 3 6
          .
                                  .

```
┌─────────────────────────────┐
│         PIPE ID             │
│       4.02 INCHES           │
└─────────────────────────────┘
```

                                              .
                .

```
┌─────────────────────────────┐
│       Pipe Material         │
│      *CARBON STEEL          │
└─────────────────────────────┘
```

                              .
    1.   (3 2)
                                        . (3 3)

        IMPORTANT: QUICK SETUP (3.5)   .

    2.   ,   ENTER   .
        (, ERASE   .)

    3.   .

            ENTER   .   .
                                      .

                                        , ENTER   .

4.   ,   . (MENU 00-04)

IMPORTANT:

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3.5   (QUICK SETUP)

3.6

,   ,

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1. 4.1   .
2.   . (10)
3.   . (12)
4.   . (13)
5.   . (16)
6.   . (17)
7.   . (20)
8.   . (23)
9.   . (24)
                 ,   .
           25   .
10.   (30)
11.   ,   ,
                 .
12.   ,   . (00 - 04)

IMPORTANT: ,
                (00-04)
.

3.6   ,   ,   .

      (   )   . '   (, PIPE   LINER)

                        (3.3)   .

                     .

               ,   .

                  ,   .

IMPORTANT: .

               . 3.5.8   47   48   .

3.6.1

           ,   , '

         (00-04) '

      .

       . (.)

NOTE: 3.6.7

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Flow/Net Totalizer (Menu 00)

            .

   ,   .

       ,

     .

```
Flow=      0.00 GPM
Net     0   x0.1Gal
```

Flow/Velocity (Menu 01)

            .

     (FPS)   .   (ENGLISH)

     ,   (METERIC)

   42   .

```
Flow=      0.00 GPM
Vel =      0.00 FPS
```

Flow/Positive Totalizer (Menu 02)

/

.   39

.

```
┌─────────────────────────┐
│ Flow=     0.00 GPM      │
│ Pos       0   x0.1Gal   │
└─────────────────────────┘
```

Flow/Negative Totalizer (Menu 03)

/ -   -

.

40   .

```
┌─────────────────────────┐
│ Flow=     0.00 GPM      │
│ Neg       0   x0.1Gal   │
└─────────────────────────┘
```

Signal Strength/Low Signal Cutoff (Menu 04)

/

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NOTE: 35

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```
┌─────────────────────────┐
│ SigStr =            0   │
│ Cutoff =            2   │
└─────────────────────────┘
```

3.6.2 PIPE SETUP MENUS

PIPE

,   (ID)

..

(ID),   (OD),

. 2

.

(   )   ,

.

.

Pipe OD (Menu 10)

(OD)   .

.

3-**9**

OD　　　:

1.　　 10　　　　　　.

```
┌─────────────────────────┐
│      Pipe OD            │
│     13.87 inches        │
└─────────────────────────┘
```

2　　　　　　　　　　ENTER　　　.

3 DOWN　　　　　　　　.
　　　　　　　　　　　　.

```
┌─────────────────────────┐
│     Select Option       │
│  ✎Actual    ✎Circum     │
└─────────────────────────┘
```

4　　.　　　　　　　　　　　　.

　　　　ACTUAL　　　　　　　　　.

　　　　CIRCUM　　　　　　　　　.

Pipe Wall Thickness (Menu 11)

　　　　　　　　　　　　　　　.

```
┌─────────────────────────┐
│   Pipe Wall Thickness   │
│      0.38 inches        │
└─────────────────────────┘
```

Pipe ID (Menu 12)

　　　　　　　　　　　.(ID)

```
┌─────────────────────────┐
│       Pipe ID           │
│     13.12 inches        │
└─────────────────────────┘
```

Pipe Material (Menu 13)

　　　　　　　　　　　　　.

```
┌─────────────────────────┐
│     Pipe Material       │
│    *CARBON STEEL        │
└─────────────────────────┘
```

- ✎ CARBON STEEL
- ✎ STAINLESS STEEL
- ✎ CAST IRON
- ✎ DUCTILE IRON
- ✎ COPPER
- ✎ PVC
- ✎ PVDF LOW DENSITY
- ✎ PVDF HI DENSITY
- ✎ ALUMINUM
- ✎ ASBESTOS
- ✎ FIBERGLASS-EPOXY
- ✎ OTHER

NOTE: OTHER   .
        OTHER   ,   14
             15   .

Pipe Sound Speed (Menu 14)

             13   OTHER
     . OTHER

                 .

OTHER

            .

              .

```
┌─────────────────────────┐
│  Pipe Sound Speed       │
│    10440   FPS          │
└─────────────────────────┘
```

Pipe Inside Roughness (Menu 15)

             13   OTHER   .
OTHER
            .   **CARMERON**
HYDRAULIC
   DATA BOOK   .
OTHER

           .

            .

```
┌─────────────────────────┐
│  Pipe Roughness         │
│    0.000150 Ft          │
└─────────────────────────┘
```

NOTE:
                 .
          19   .

3.6.3 LINER SETUP MENUS

        LINER

             .

Liner Material (Menu 16)

∴
```
Liner Material
*POLYETHYLENE
```

- ✍ NONE (no liner)
- ✍ TAR EPOXY
- ✍ RUBBER
- ✍ MORTAR
- ✍ POLYPROPYLENE
- ✍ POLYSTYROL
- ✍ POLYSTYRENE
- ✍ POLYESTER
- ✍ POLYETHYLENE
- ✍ EBONITE
- ✍ TEFLON
- ✍✍ OTHER

  ✍✍
NOTE: OTHER   .
          OTHER
                  . (18)
                            . (19)

Liner Thickness (Menu 17)

                              .

```
Liner Thickness
0.00 Inches
```

Liner Sound Speed (Menu 18)
                16   OTHER
                  . OTHER

```
Liner Sound Speed
8203.00 FPS
```

                              .

OTHER

                              .

Liner Inside Roughness (Menu 19)

16   OTHER

.

OTHER

```
┌─────────────────────────────┐
│    Liner Roughness          │
│       0.001000              │
└─────────────────────────────┘
```

.   **CAMERON**

HYDRAULIC DATA BOOK   .
OTHER   ,

.

.

3.6.4 FLUID SETUP MENUS

FLUID

.

Fluid Type (Menu 20)

.
```
┌─────────────────────────────┐
│       Fluid Type            │
│      *GASOLINE              │
└─────────────────────────────┘
```

- ✍ WATER

- ✍ SEA WATER

- ✍ KEROSENE

- ✍ GASOLINE

- ✍ FUEL OIL #2

- ✍ CRUDE OIL

- ✍ PROPANE (-45℃)

- ✍ BUTANE (0℃)

- ✍ OTHER

NOTE: OTHER   .
    OTHER   (21)
         (21)
      . .

Fluid Sound Speed (Menu 21)

20   OTHER
. OTHER

```
┌────────────────────────┐
│  Fluid Sound Speed     │
│    4863.33 FPS         │
└────────────────────────┘
```

.

OTHER   ,
.

.

Fluid Viscosity (Menu 22)

20   OTHER
. OTHER

```
┌────────────────────────┐
│  Fluid Viscosity       │
│    1.130 cSt           │
└────────────────────────┘
```

.

OTHER   ,
.

.

3.6.5 TRANSDUCER SETUP MENUS
XDUCER
.

Transducer Type (Menu 23)

,   :

```
┌────────────────────────┐
│  Transducer  Type      │
│ *Standard    Hi-Temp   │
└────────────────────────┘
```

? STANDARD

? HI-TEMP

STANDARD   (4.5)

Transducer Mounting (Menu 24)

:

```
┌─────────────────────────────┐
│      Transducer Mount       │
│ *V Mt.   Z Mt.   W Mt.      │
└─────────────────────────────┘
```

 ✎ V

 ✎ W

 ✎ Z

4.4

Transducer Spacing (Menu 25)

.   QUICK SETUP

       . 4 2

```
┌─────────────────────────────┐
│     Transducer Spacing      │
│        5.93 Inches          │
└─────────────────────────────┘
```

.

3.6.6 FLOW SETUP MENUS

.

Flow Units (Menu 30)

.

```
┌─────────────────────────────┐
│         Flow Units          │
│         *Gallons            │
└─────────────────────────────┘
```

        ,

    .

     :

1.   :

  ✎ GALLONS

  ✎ LITERS

  ✎ MGAL (million gallons)

  ✎ CUBIC FT

  ✎ CUBIC METERS

  ✎ ACRE FT

  ✎ OIL BARRELS

  ✎ LIQUOR BARRELS

  ✎ FEET

  ✎ METERS

2. DOWN   .

```
┌─────────────────────────┐
│   Flow Units Per        │
│                         │
│  Sec    *Min    Hour    │
└─────────────────────────┘
```

4.   :

    ✍ SEC

    ✍ MIN

    ✍ HR (million gallons)

    ✍ DAY

Max Flow Range (Menu 31) and
Min Flow Range (Menu 32)

```
┌─────────────────────────┐
│     Max Flow            │
│                         │
│   2000.00 GPM           │
└─────────────────────────┘
```

     .

       .

NOTE: ID   ,

         .

```
┌─────────────────────────┐
│     Min Flow            │
│                         │
│  -2000.00 GPM           │
└─────────────────────────┘
```

          + 9.76   - 9.76   .
    (M/sec)

Damping (Menu 33)

              .

```
┌─────────────────────────┐
│     Damping             │
│                         │
│   5 secs                │
└─────────────────────────┘
```

           .

  4-20mA   N
   , N   .
           ,   .
    1   99   1
  .
    .   ,
   .

Low Flow Cutoff (Menu 34)

O   (

)   ,   ,

       O

     .   .

    . (   )

        O

   .   (   )

         O

   ,   .

    ,   0. 1 ft/sec (0. 03M sec)

     ,   +   -

0. 1 ft/sec   O   . (3- 2)

```
Low Flow Cutoff
   0.00 GPM
```

-0.3   -0.2   -0.1   0   +0.1   +0.2   +0.3

Zero flow
displayed here
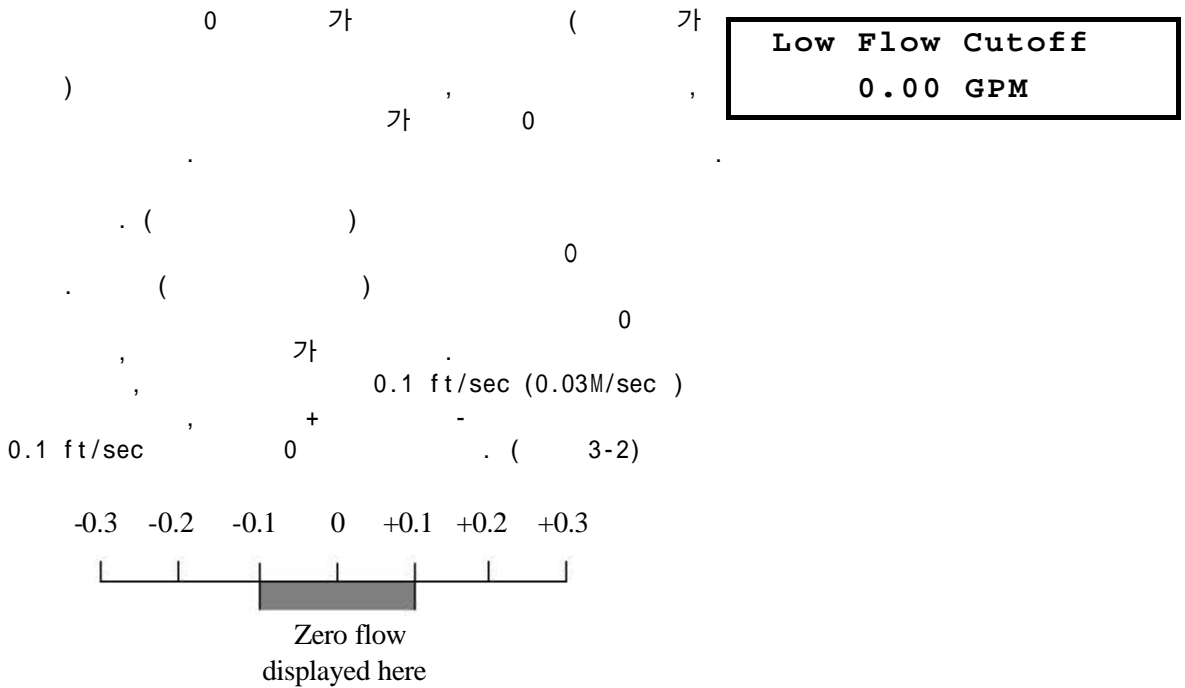
Figure 3-2   *Low Flow Cutoff (example)*

NOTE: 1.0   .

Low Signal Cutoff (Menu 35)

               ,   ,   ,

     ,   .

        .

           (

)   LOSS - OF- SI GNAL(LOS)   .

LCS

. :

O .

.

( )

, . (3.6.11)

:

1. 35

```
┌─────────────────────────┐
│ Low Signal Cutoff       │
│            0%           │
└─────────────────────────┘
```

2 ENTER

.

.

3 .

ZERO (LCS O)

HOLD (LCS

)

```
┌─────────────────────────┐
│ Low Signal Action       │
│ *Zero          Hold     │
└─────────────────────────┘
```

3.6.7 TOTALIZER SETUP MENUS

3.6.8

TOTAL

.

3 .

+

-

NOTE:

O

.

.

Totalizer Units (Menu 36)

:

```
┌─────────────────────────┐
│   Totalizer Units       │
│       *Gallons          │
└─────────────────────────┘
```

- ? GALLONS
- ? LITERS
- ? MGAL (million gallons)
- ? CUBIC FT
- ? CUBIC METERS
- ? ACRE FT
- ? OIL BARRELS
- ? LIQUOR BARRELS

NOTE:

.

Totalizer Multiplier (Menu 37)

```
┌─────────────────────────┐
│   Totalizer Mult.       │
│  *x0.01      x0.1       │
└─────────────────────────┘
```

.   700

700   ,
7 X 100   .

:

- ? X 0.01
- ? X 0.1
- ? X 1
- ? X 10
- ? X 100
- ? X 1000
- ? X 10000

Net Totalizer (Menu 38)

```
+              -
        -           1000      ( GALLONS)
+       3000      ( GALLONS)
    2000                    .
    ON ,  OFF            .
```

```
┌─────────────────────────┐
│    Net Totalizer        │
│     *Off   On           │
└─────────────────────────┘
```

Positive Totalizer (Menu 39)

```
        +           -
.
        -           1000      ( GALLONS)
+       3000      ( GALLONS)
    2000                    .
            ON ,  OFF              .
```

```
┌─────────────────────────┐
│    Pos. Totalizer       │
│     *Off   On           │
└─────────────────────────┘
```

Negative Totalizer (Menu 40)

```
        +                          .
+                   +
.
(
        )          -
    . +                 ON  OFF           .
```

```
┌─────────────────────────┐
│    Neg. Totalizer       │
│     *Off   On           │
└─────────────────────────┘
```

Totalizer Reset (Menu 41)

```
                    ,                    .
ENTER          :
```

```
┌─────────────────────────┐
│    Totalizer Reset      │
│  ✎All ✎Net ✎Pos ✎Neg    │
└─────────────────────────┘
```

- ✎ ALL (all totalizers)

- ✎ NET (net totalizer only)

- ✎ POS (positive totalizer only)

- ✎ NEG (negative totalizer only)

3.6.8 OPTIONS SETUP MENUS

.   ,

,

,   , RS232

.

Measurement Units (Menu 42)

:

```
   Measurement Units
*English   Metric
```

? ENGLISH

?? METRIC

ENGLISH

(FPS)   .

METRIC   mm

MPS   .

Site Parameters (Menu 43)

,   ,   (   )   ,

,

```
  Site Parameters
1:3.507 In, PVC
```

.

16   ,

1   16   .

43

(:)   . (1:   1   )

.

. (43

*   .)

.

ENTER

ENTER   .

NOTE:

43

.

RS232 Configuration (Menu 46)

RS232 .
RS232   IBM
         PCLYLINK   TIMEGATE
      .
                     ,

   .

RS 232   :

1. ACCESS   46:

```
RS232 Mode
*TimeGate  PolyLink
```

2.   :

   ✍ TIMEGATE
   ✍ POLYLINK
3. DOWN   (BAUD)
                     RS232
                      (PARITY)

```
RS232 Config
9600,N,8,1
```

   (NONE) CHARACTER   8   , STOP BIT   1
    . (ALL SELECTION   N, 8, 1   )

                       :

   ✍ 1200
   ✍ 2400
   ✍ 4800
   ✍ 9600
   ✍ 19200

Change System Password (Menu 47)

   .
     ,
                .
                .
                  .

NOTE:

                (48)

                     ,

```
+-----------------------+
|                       |
|      Password?        |
|                       |
+-----------------------+
```

     .   0O

                ,   :

1.   47   :

```
+-----------------------+
| New Sys Password?     |
| ?                     |
+-----------------------+
```

2.   **ENTER**   .

NOTE: ,

               0   **ENTER**

    . (

          .)

         0   .

           :

```
+-----------------------+
| Old Syst. Password?   |
| ?                     |
+-----------------------+
```

3   **ENTER**   .

   .

             ,

   .

```
+-----------------------+
|      Password         |
|      Accepted         |
+-----------------------+
```

NOTE:

                48

    .   48

  .

```
+-----------------------+
|      Password         |
| *** Rejected ***      |
+-----------------------+
```

4.   00

      .

Change Scale Factor Password (Menu 48)

.

.

,

.

NOTE: ,

.   (47)

,

. (52):

1.   48   .:

```
New Sc Fact Passwrd?
 ?
```

2.   ENTER

.

NOTE: ,

(

.) 0

.

0   .

```
Old Scale Password?
 ?
```

:

3.   ENTER   .

```
    Scale Password
      Accepted
```

```
    Scale Password
  *** Rejected ***
```

Unit ID (Identification) Number (Menu 49)

.

.   1   60000   ,

.

```
┌─────────────────────────┐
│        Unit ID          │
│          0              │
└─────────────────────────┘
```

3.6.9 CALIBRATION SETUP MENUS
CALIBRATION   ,
           ,   ,
.

NOTE: 6   .

Calibration Group Menu (Menu 50)

               50
.
       (51   54)
.   50
                  ENTER   :

```
┌─────────────────────────┐
│     Calibration         │
│ ✍Set Zero ✍Scale        │
└─────────────────────────┘
```

- ✍ SET ZERO
- ✍ SCALE
- ✍ SS COMP
- ✍ DATE

NOTE: 51~54   .

5   .

Zero Set (Menu 51)

                              0

       :

✍ NO FLOW (0   )

✍ MANUAL (0   )

5. 1   0

        .

```
   Set Zero
✍No Flow   ✍Manual
```

Scale Factor (Menu 52)

      .

       . 5. 2

        .

```
  Scale Factor
     0.9850
```

Sound Speed Compensation (Menu 53)

       .
              .   ,

        .

```
  Sound Speed Comp.
*Enabled   Disabled
```

Date and Time (Menu 54)

        .   24

 -   -   .

         :

1.   54   .

2. ENTER

                , ,   ,
  ,   :

3.   ENTER   .

```
   Date and Time
12-01-96  14:07:17
```

```
  Date and Time?
Month?     12
```

NOTE:

ENTER   DOWN

.

.:

3.6.10 CURRENT LOOP SETUP MENUS

4- 20mA   4- 20MA
.   SPAN
.

Current Loop Group Menu (Menu 56)

4- 20mA   56
.   3

.

ENTER   . :

```
   Current Loop
✍Span    ✍Cal.    ✍Test
```

- ✍ SPAN
- ✍ CAL.
- ✍ TEST

NOTE: 57,58,59   .

Current Loop Span (Menu 57)

. 6   .

```
Span? 4 mA
0.00 Gal/S
```

Current Loop Calibration (Menu 58)

.
6   .

```
4 mA Calibrate
<--   -->
```

Current Loop Test (Menu 59)

```
┌─────────────────────────┐
│  Current Loop Test      │
│   <-- 4 mA -->          │
└─────────────────────────┘
```

. 6   .

3.6.11 RELAYS SETUP MENUS
RELAY

       ,   ,

      . 4   ,

                     .

             .   ,

                        .

Relays Group Menu (Menu 70)

                    RELAY

   MENU 70   .

```
┌─────────────────────────┐
│        Relays           │
│ ✍Prog  ✍View  ✍Test    │
└─────────────────────────┘
```

          3

    . (71 ~ 73)

          70   :

- ✍ PROG
- ✍ VIEW
- ✍ TEST

NOTE: 71   73   MENU   2

Program Relays (Menu 71)

          TIF-II   4

      .

     .

                :

1.   71   :

```
┌─────────────────────────┐
│     Prog Relay #        │
│  ✍1    ✍2    ✍3    ✍4  │
└─────────────────────────┘
```

2.   (1   4
)
    ON   .

```
Relay 1 On Condition
 *Flow <
```

3.   ON   :

    NOT PROGRAMMED (OFF)
    FLOW> (ON
                 .
    FLOW< (ON
              .)
    NET TOT > (ON
           .)
    POS TOT > (+   ON
            .)
    POS TOT < (+   ON
            .)
    NEG TOT > (-   ON
            .)
    NEG TOT < (-   ON
            .)
    SIGNAL > (ON
            .)
    SIGNAL < (ON
            .)
    NET TOTAL PULSE (
              .)
    POS TOTAL PULSE (+
            .)
  NEG TOTAL PULSE (-
            .)

(ON) 125 .

1

1

, (37) 1

, / ,
600 / (10 /)
10 .

– . -
+

4. DOWN .
ON .

```
On Cond. Value
16.00 Gal/S
```

5. ON ENTER .
NOTE: 30

.

6. DOWN .
OFF :

```
 Relay 1 Off Cond.
*Flow >
```

7. Select a relay OFF condition.

OFF   ON
. (ON   PULSE
,   OFF   .) OFF
,   ON
" DEAD BAND"   .   ON   OFF   .
ON OFF   .
FLOW 250>   ,   OFF
FLOW< 240   ,
250
,   40
OFF   . .

8. DOWN

OFF   :

```
Off Cond. Value
   24.00 Gal/S
```

9.   OFF   ENTER
.

10.   1   9

.

View Relays (Menu 72)

ON/OF
.

:

1.   72   :

```
   Show Relay #
 ✍1     ✍2     ✍3     ✍4
```

2.   (1   4   .)

ON/OFF   :

```
On = Flow <16
Off = Flow >24
```

3-**31**

Test Relays (Menu 73)

ON/OFF

.

:

1.   73   .
      73   1   4
         .   ,   1   2
OFF   ,   3   T   ON
     .

```
┌─────────────────────────────┐
│       Relay Test            │
│  ✍Off  ✍Off  ✍On  ✍On      │
└─────────────────────────────┘
```

2   ENTER
     . ENTER   ON   OFF
          .   ,   LCD
   ON   .

✍ 3. 1   2   .

✍
   4.   ,
     ERASE   ,

3.6.12 DATA LOG SETUP MENUS
DATA LOG
        80   81   .

     .   50. 000
        .
      .   60
   35   .
           . (   )
50. 000   ,

   .

IBM

ISCII .

, . (

O) PCLYLINK

.

Data Log Setup (Menu 80)

80 INTERVAL .

```
┌─────────────────────────────┐
│        Log Menu             │
│  ✍Interval                  │
└─────────────────────────────┘
```

81

..

Data Log Interval (Menu 81)

81

. 81

, 80 INTERVAL

```
┌─────────────────────────────┐
│      Log Interval           │
│      60 secs                │
└─────────────────────────────┘
```

.

1 .

IMPORTANT:

, ,

.

.

O

.

,

,

.

3.6.13 DIAGNOSTICS DISPLAY MENUS
DIAGNOSTICS
   .

   .

            .

Signal Strength/Margin (Menu 90)

.

```
SigStr =          0%
Margin =          0%
```

              ,
       .   5%

,
3%   .

Delta Time/Fluid Sound Speed (Menu 91)

       DELTA T

```
DeltaT =      0.00 ns
SSpeed = 4863.33 FPS
```

. DELTA T

NANOSECOND   .

Reynolds #/Profile Factor (Menu 92)

        REYNOLDS

```
Reynolds=          0
Factor  =0.750000
```

       .
      ,
     .

Current Loop Output (Menu 93)

```
Current Loop
Output =   4.57 mA
```

     .

Software/Firmware Rev. Level (Menu 94)

(soft vers)   (FPGA VERS.)

```
Soft Vers. = 1.00
FPGA Vers. = A0
```

   .
NOTE: 1

3.7 Master Erase Function and Emergency Override Passwords

.

.

.

3.7.1 EMERGENCY OVERRIDE PASSWORDS

.

42 (System password)
43 (Scale factor password)

.

3.7.2 MASTER ERASE FUNCTION

.

:
1.   .
2. INITIALIZING   ERASE
         .(3   5   )

.
```
Master Erase.
Are you sure?(5=yes)
```

3 5   .
  (3   5   .   .)

:
```
Master Erase.Are you
really sure? (.=yes)
```

4   (PERIOD)
        . (3   5   ,
)

```
Master Erase
Completed
```

.

```
┌─────────────────────────┐
│      Master Erase       │
│        Aborted          │
│                         │
└─────────────────────────┘
```

.

4. 1   ,

4. 2   .   , 3   V, Z, W   4. 4   .

4.1

.   4 1   .

.

.

,   ,   ,   10

5   .

,   ,   ,   30

.   5   .

3   9   .

(,   ,   ,

.   .)

.

(25)   - 40   +150   .

. (4. 5   )

,   .

.

,   .
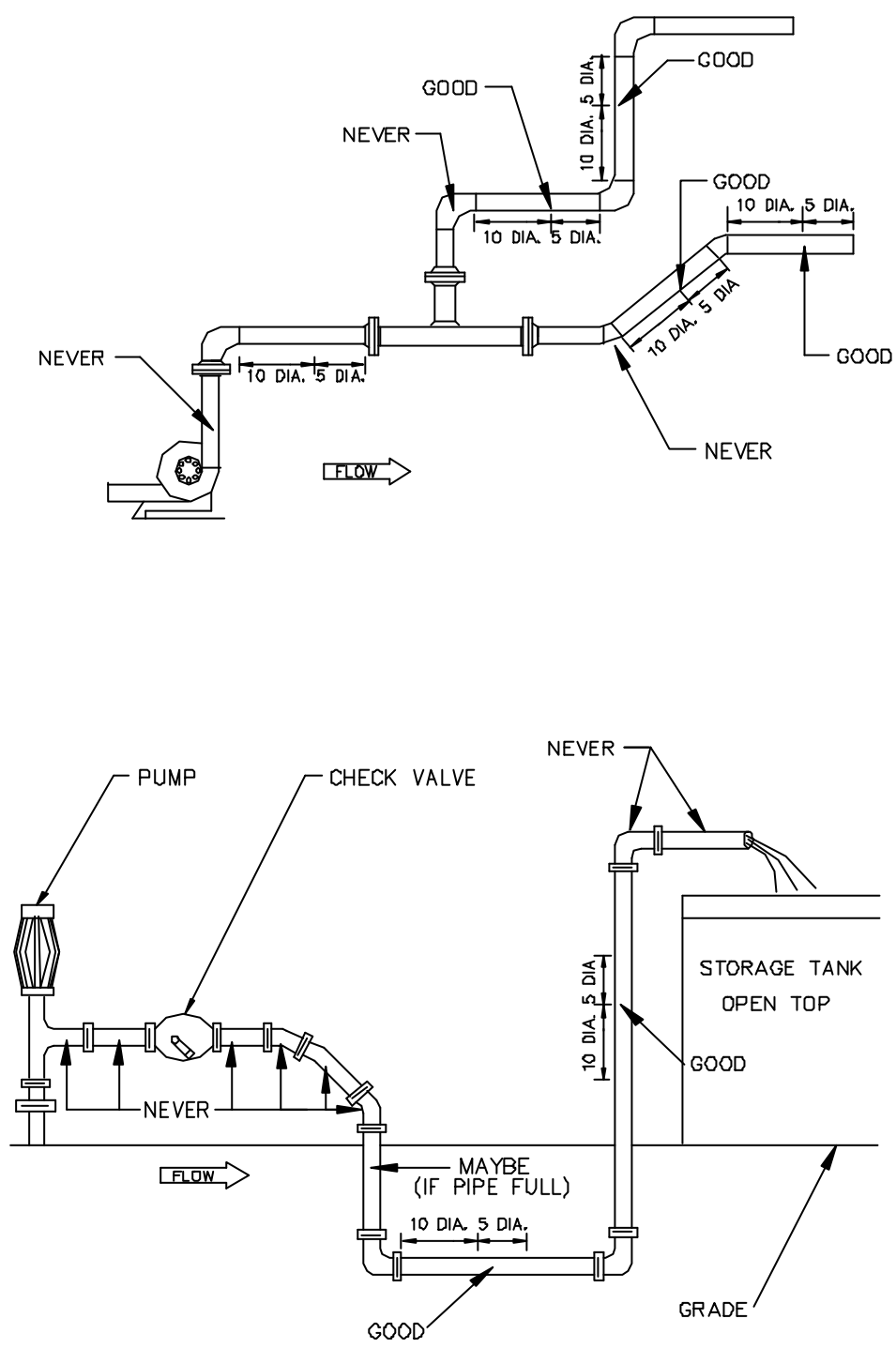
Figure 4-1   Site Recommendations

4.2

.

1. 4. 1 .

2. 3 .

. (3. 5)

> ***NOTE:*** 4. 4
>
> ,
>
> . 25

3. 25 .

4. . :

- ✍ V method: Section 4.4.1

- ✍ W method : Section 4.4.2

- ✍ Z method: Section 4.4.3

5. . .
( )

> ***IMPORTANT:*** 3 9 .
>
> ,
>
> .

6. Pol yGl i de
.

> ***IMPORTANT:***
>
> .
>
> . 4. 6 Pol yGl i de ,
>
> , .

7. .
(4. 7) 4. 3 .

2   . (4 2)
                                                           ,
                                                         .
4- 2   .
                                                     .
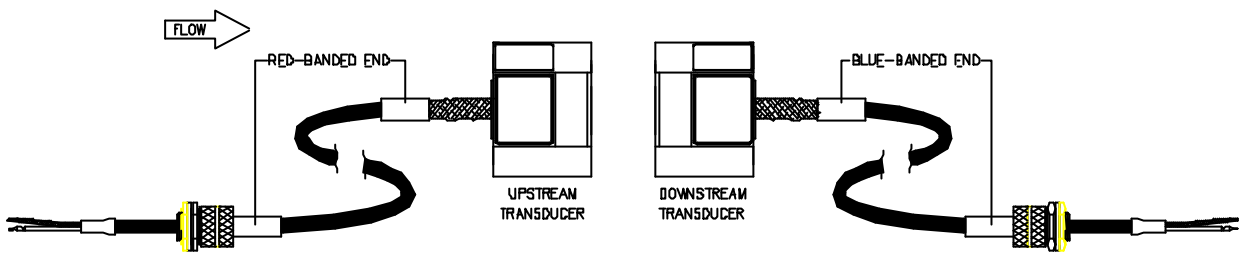
Figure 4-2 *Upstream and Downstream Transducers*

8.   .
9.   . (5   )
10.   00   .   .

4.2   (   )

                                                                 ,
                 .
                 .
                           .

PROPER INSTALLATION   FAULTY INSTALLATION
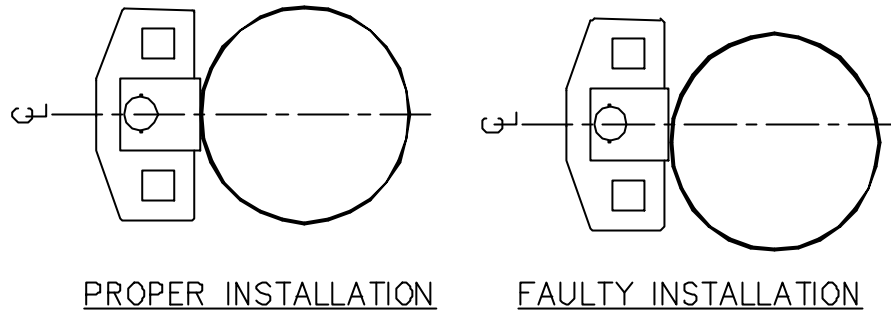
Figure 4-3   *Aligning the Transducers*

.

1.

.

2.   .

3.   ,

.

4.4

3   .   24   .

.

.

  ◿ V method (Section 4.4.1)

  ◿ W method (Section 4.4.2)

  ◿ Z method (Section 4.4.3

4.4.1 V

V   (4- 4)   .   Z

. V   ,   4. 2

.   V

.

UPSTREAM TRANSDUCER

FLOW

DOWNSTREAM TRANSDUCER

SIDE VIEW

END VIEW

ULTRASONIC SIGNAL   ULTRASONIC SIGNAL

FLOW

TRANSDUCER SPACING

DOWNSTREAM TRANSDUCER   UPSTREAM TRANSDUCER
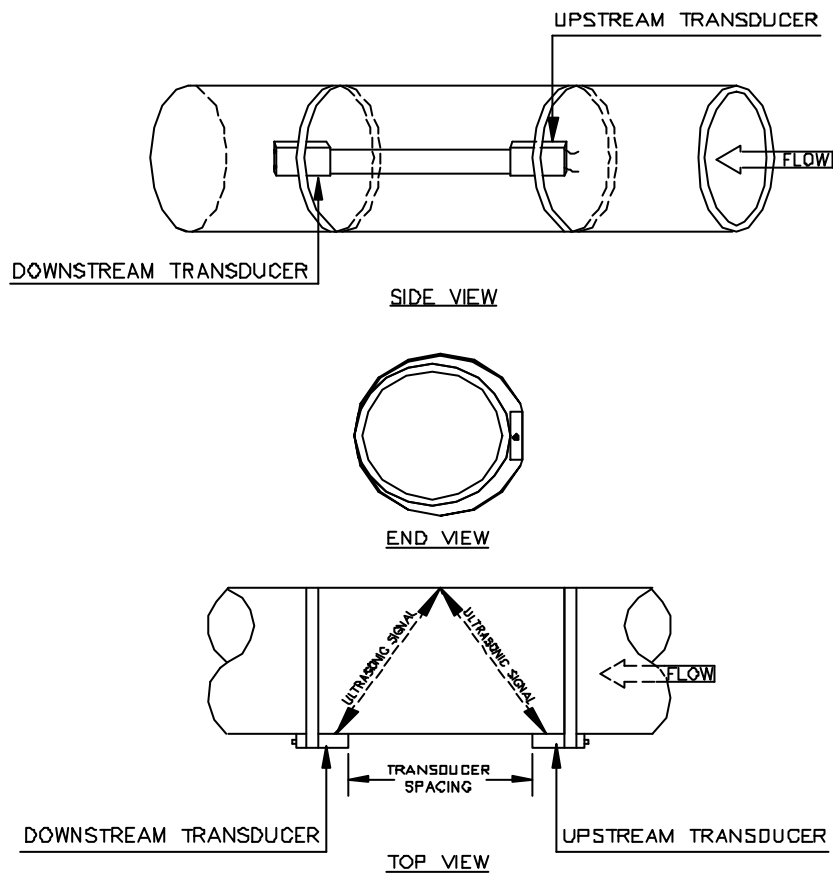
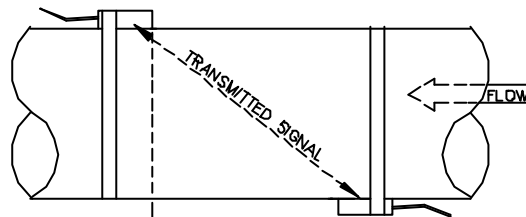TOP VIEW

Figure 4 -4 Mounting the Transducers with the V Method

4.4.2 W

,   2" (51mm)   ,   w
. (4 5) W   3   4
.   V   .
W   .   4. 2   .
                    W   .
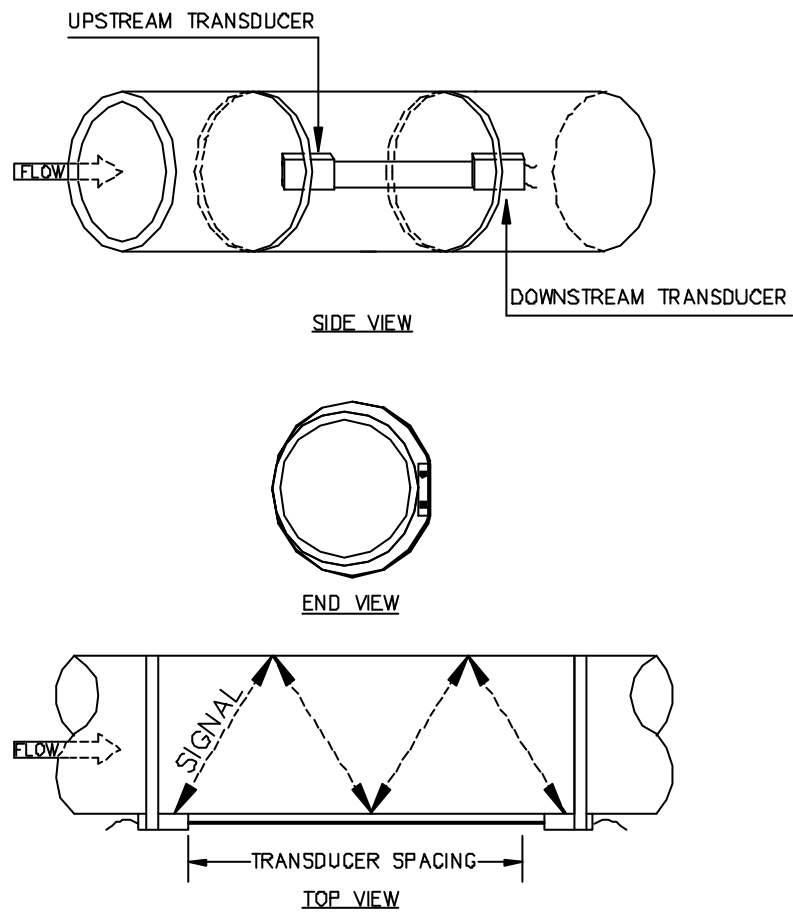
Figure 4 -5   Mounting the Transducers with the W Method

4.4.3 Z

Z   V   .

    Z   .

V   ,   ,   ,

               ,   ,   Z

        .   Z

      .

Figure 4-6   Mounting the Transducers with the Z Method

Z

1. 4. 2   1   4   .
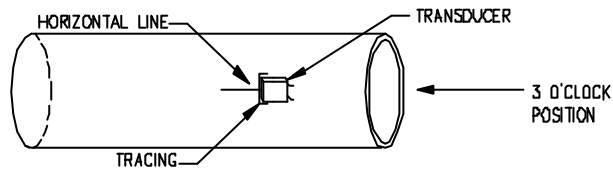2.   3   9   . (4- 7)

TOP

9 O'CLOCK
REFERENCE
POINT

3 O'CLOCK
REFERENCE
POINT

BOTTOM
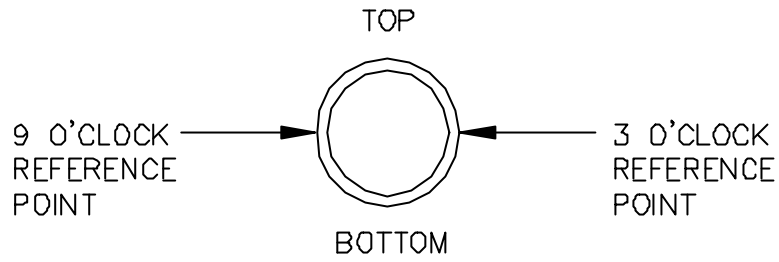
Figure 4-7   *Establishing a 3 O' clock and 9 O' clock Reference (Z Method)*

✍ 3.   3   ,   (4- 8)
✍ 4.   3   .

.   .

NOTE: ,

.   ,   ,

.

HORIZONTAL LINE

TRANSDUCER

3 O'CLOCK
POSITION

TRACING

Figure 4-8   *Tracing the 3 O' clock Transducer (Z Method)*

5.   .

NOTE: .

6.   . (4-9)

7.   .

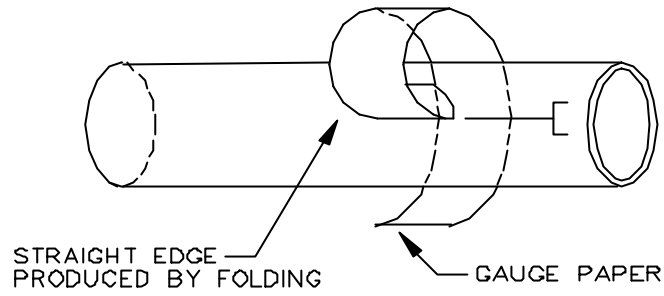*Figure 4-9*   *Wrapping the Gauging Paper Around the Pipe (Z Method)*

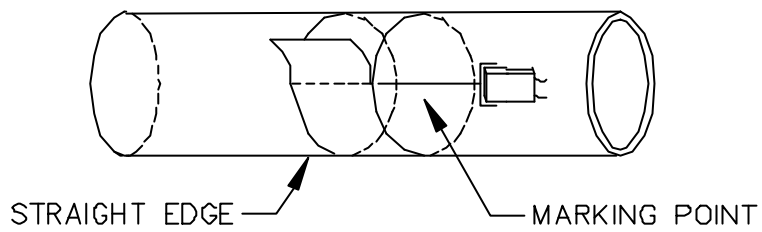8.   . (4-10)

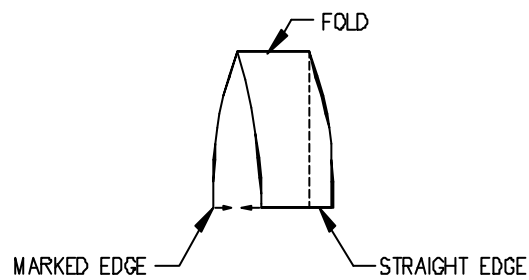*Figure 4-10*   *Marking the Intersection Point on the Paper (Z Method)*

9.   .
        .   (4-11)

Figure 4-11   *Folding the Gauging Paper in Half (Z Method)*

10.   . (4-12)

Figure 4-12   Marking Along the Fold (Z Method)

11. 3

.
       (4 13) .   .

              25   76mm   .
              356mm   432mm   .
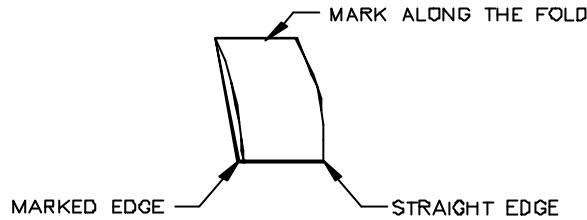

Figure 4-13   Drawing a Horizontal Line at the 3 O' clock Position (Z Method)

12.   (25   ) 3
                    ,   . (4 14)

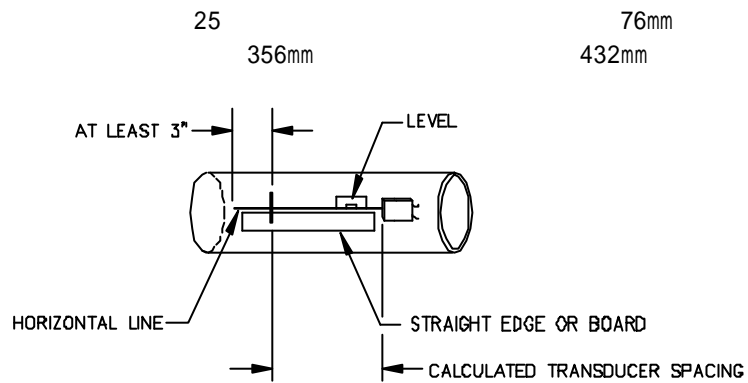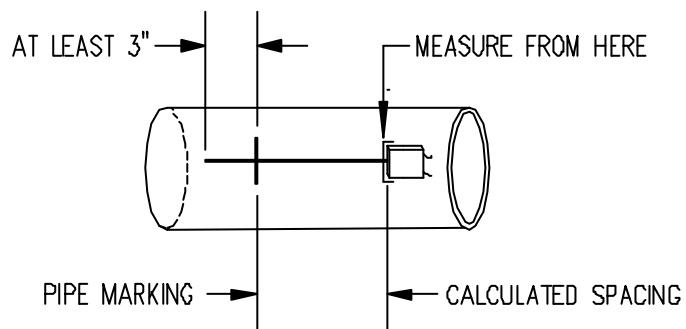*Figure 4-14   Marking the Transducer Spacing (Z Method)*

13.   .   3
                                                      .
                    . (4- 15)
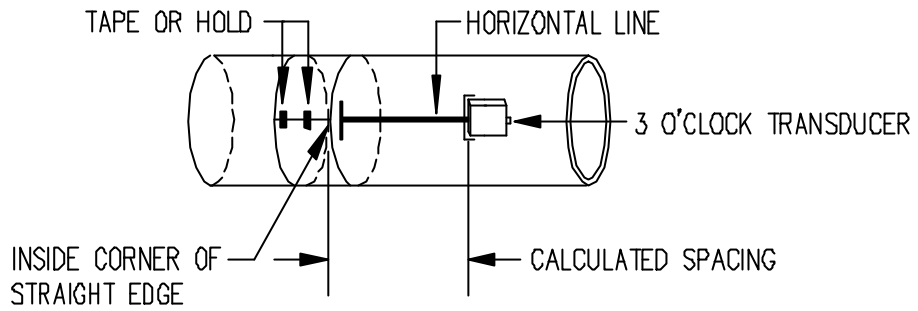
Figure 4-15   *Replacing and Aligning the Gauging Paper (Z Method)*

14.   (9   )   .
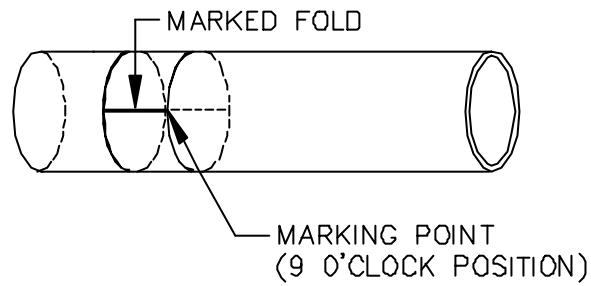
Figure 4-16   *Marking the Intersection Point on the 9 O' clock Side of the Pipe (Z Method)*

15.   9   3
                                    . (4- 17)
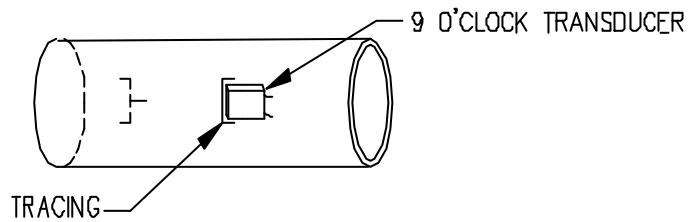
Figure 4-17   *Tracing the 9 O' clock Transducer (Z Method)*

16.   4.2   5   10
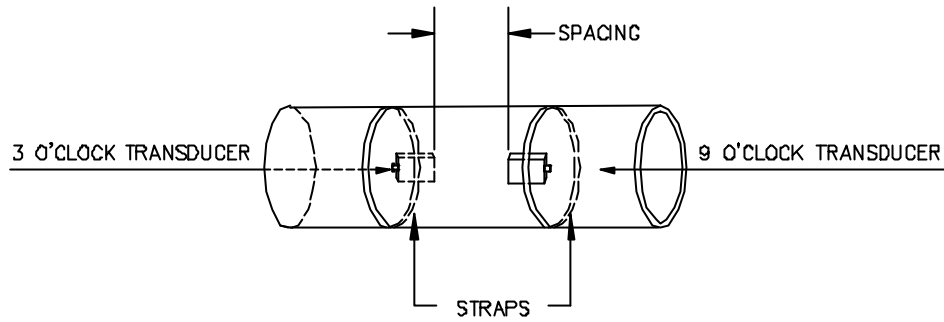
Figure 4-18   Mounting the Transducers with Straps (Z Method)

4-19   Z   .

END VIEW

TOP VIEW
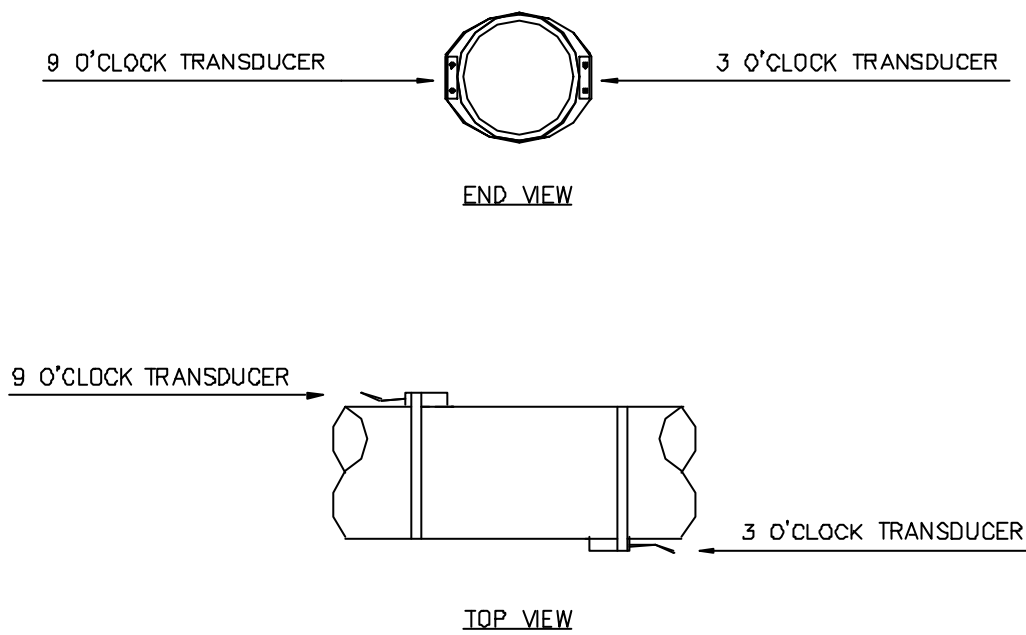
Figure 4-19   Final Z Mounting Method Installation

4.5

150~ 243   .

.

NOTE: PolyGlide   , 121
.

:
1.   23
HI TEMP BLOCK   .
2.   (DOWCORNING 111)   .
(RIV   )
3.   .
4.   .

(4.2   )

4.6

. POLYGLIDE   ,
.

1   .

POLYGLID   :
1.   .
2.   .
3.   ,
✍   4.   ,
.

POLYGLIDE   .
121   .
.
RIV(GE RIV 108)   ,
. (   )
(DOWCORNIGN 111)   .
243
.   RIV
.

IMPORTANT: .

•

.

. .   !   ,

?

:

✍ 0

✍

.

5- 1   . :

Table 5 -1 Selecting the Calibration Method		
Calibration Method	**Function**	**Application**
Zero set calibration		
✍Zero flow set	Zeros the instrument for an actual no flow condition	Installations where flow can be stopped
✍Manual zero set	Applies a manually entered offset to all flow readings	Where an offset is required
Scale Factor	Compensates for manufacturing variations in the transducers	Set by the factory to the value imprinted on the transducers

NOTE: 4~20mA   . 6   .

5.1 0

0   .

. 0

0   .

2   0   51   :   0   ,

.

NOTE: 0   0. 0015m/S   0

0   .

5.1.1 0

0   :

1.   .
2   .
   (.)
3.   .

5.1.2 0

0   .
                                   .

1. 5. 11.   .

2   .

3   51

                            .

```
        Set Zero
 ✍No Flow   ✍Manual
```

4 NO FLOW   .

                     0   .

```
      Zero Cal Ok
   Flow = 0.00 GPM
```

      0   .

```
      Zero Failed
    V = X.XX FPS
```

5.   0   ,   1   4   .

    .

(-0.076   +0.076m/S   0   .)

5.1.3   0

                                      .

                                     .

5-2   0   10   /   :

Table 5-2 Example of Manual Zero Set		
Uncalibrated Flow Reading (before manual zero offset)	**Manual Zero Offset**	**Calibrated Flow Reading (after manual zero offset)**
250 GPM	10 GPM	240 GPM

              0   :

1.   5.1.1   .

2.   (Menu 32)   (Menu 31)   _
               . (100
      –100   )

3.   51   0.00   10   .

4.   .

5.   .

6.   10   .

7.   10
              P   (   )

8.   .

9.   10

10.   10
             N   ( )·

11.   (Zp)   .

$$Zp = \underline{(P+N)}\,2$$

12.　　　51　　　　　　　MANUAL　　　　　　.

13.11　　　　　　　　　　　51

　NOTE:　　　　　　± key　　　　　　　　.

14. Menu 00　　　　　.

15.　　　　　　　　　　　　　　.

16.　　　,　　　　　　　　　31　32　　　　　　.

17.　　　10　　　　　　　　　　　　　　.

　　　　　　0　　　　　　　　　　　　　.

5.2

0　　　　　,　　　　　　　　　　　　　　　　　.

　　　　　　　　　　　　　.

(　　　　　　　　　　　　　　　　　,　　　　　　0.5

　　2　　　.)

　　　　　　　　　.

　　　　　　52　　　.

5.2.1

　　　　　　　　　　　.

　　　　　　　　　.

　　　　　　　　　.

-　　　　0　　　　.

-

-　　　.

5.2.2

.　　　　　　　　　52　　　　　　　　　　　.

.

.

1.　　52　　　　　:

```
┌─────────────────────────────────┐
│                                 │
│         Scale Factor            │
│            .985                 │
│                                 │
└─────────────────────────────────┘
```

2.　　　　　　　　　ENTER　　　　　　.

.

```
┌─────────────────────────────────┐
│ Scale Fac Password?             │
│ ?                               │
└─────────────────────────────────┘
```

3　　　　　　ENTER　　　　.

　　　　　　　52　　　　　,

IMPORTANT:

　　　　　　48　　　　　　　　　　　　　　.

4~ 20mA   .

.

, 2.6

,

,   :

1.   (IN)   (OUT)   .(2.4   )

2.   58   :

```
+-----------------------------+
|     4 mA Calibrate          |
|     <--    -->              |
+-----------------------------+
```

3   4mA   ,

ENTER   .

.   :

```
+-----------------------------+
|    20 mA Calibrate          |
|     <--    -->              |
+-----------------------------+
```

4. 3   20mA   .

5.   59   :

```
+-----------------------------+
|    Current Loop Test        |
|    <--  4 mA -->            |
+-----------------------------+
```

2   .

6   1

.   .

. (2~ 6   )

7.   57:

```
+-----------------------------+
|     Span? 4 mA              |
|     0.00 Gal/S              |
+-----------------------------+
```

8. 4mA   (MINIMUM ANTICIPATED)   ENTER   .

9. DOWN   :

```
┌─────────────────────────────┐
│      Span? 20 mA            │
│      0.00 Gal/S             │
└─────────────────────────────┘
```

10. 20mA   (FULL SCALE)   ENTER   .

11.   00

URL : http://www.sechang.com