1. Guidelines and Checklists

1.1 General Application Guidelines

The Hydra SX30 Dual Frequency Doppler (DFD) Portable Flowmeter is suited for measuring the flow of fluids with undissolved, entrained solids or

Wastewater	**Food**	**Industrial**
· primary sludge	· dairy	· crude oil
· activated sludge	· fluidized foods	· dredging
· raw sewage	· slurries	· pulp processing

1.2 Standard Equipment Checklist

The following equipment is included with your new Hydra SX30 DFD Flowmeter.

- (1) Hydra SX30 Portable DFD Flowmeter
- (1) battery, fully charged
- (1) carrying case
- (2) **non-submersible** DFD Transducers
- (2) 32 inch pipe straps
- (1) 67 inch pipe strap
- (1) 120 volt AC battery recharger
- (2) 16 foot cables with BNC connectors
- (2) 3.5" disk of datalog software
- (1) tube of sonic coupling compound
- (1) RS 232 Cable

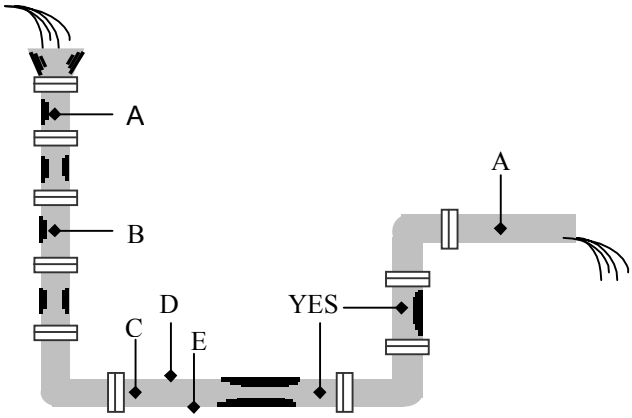


Figure 2.1 – Recommended Installation Locations

Do not install the transducers at the following locations:

A – Pipes may not be full

B – Down flow

C – Too close to the elbow

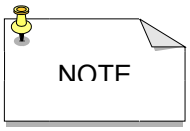
D – Air collects at the top of horizontal pipe

E – Sediment collects at the bottom of horizontal pipe

Conditions existing at these locations can interfere with the transmission of the ultrasonic wave and yield

2. Installation and Operation Procedures

2.1 Select an installation location.

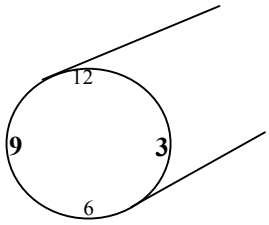


Selecting the proper location to install the transducers is essential to flow measurement reliability. Each application is unique and may require variations in the installation location.

1. Review Figure 2.1 (Recommended Installation Locations), on the facing page.
2. Select an installation location using Figure 2.1

   - full pipe
   - flow in the pipe
   - 10 pipe diameters upstream and 5 pipe
   - diameters downstream from:
     - a direction change on the pipe
     - pipe joints
     - a narrowing or widening of the pipe

HORIZANTAL PIPES



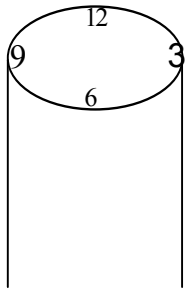
Best: – 3'oclock, 9'oclock

Good: – 2'oclock, 4'oclock
– 10'oclock, 8'oclock

OK: – 3'oclock, 4'oclock

Figure 2. 2a – Transducer Orientations on Horizontal Pipe

VERTICAL PIPES



Best: – 3 o'clock, 9 o'clock
– another directly opposite position

Good: – 2 o'clock, 4 o'clock
– 10 o'clock, 8 o'clock

Figure 2. 2b – Transducer Orientations on Vertical Pipe

2.2 Choose a transducer orientation.

NOTE

Choosing the proper transducer orientation is essential to flow measurement reliability. Each application is unique. You may need to vary the orientation with each application,

1. Review Figures 2.2a,b (Transducer Orientations on Horizontal and Vertical Pipe), on the facing page.
2. Meet the following guidelines to ensure optimum meter performance:

   · 3'oclock and 9'oclock orientation
   · transducers parallel to one another along the pipe circumference
   · generous amounts of coupling compound
   · secure cable connections
   · tight pipe strap

3. IF your application does not enable you to mount the transducers at the recommended "Best" orientation, THEN choose a "Good"

2.3 Attach the transducers to the pipe strap.

1. See Figure 2.3 (Attach Transducers to the Pipe Strap), below.
2. Loosen the mounting screw on each transducer using a screwdriver.
3. Slide the lock back on each transducer.
4. Place the pipe strap across the mounting.

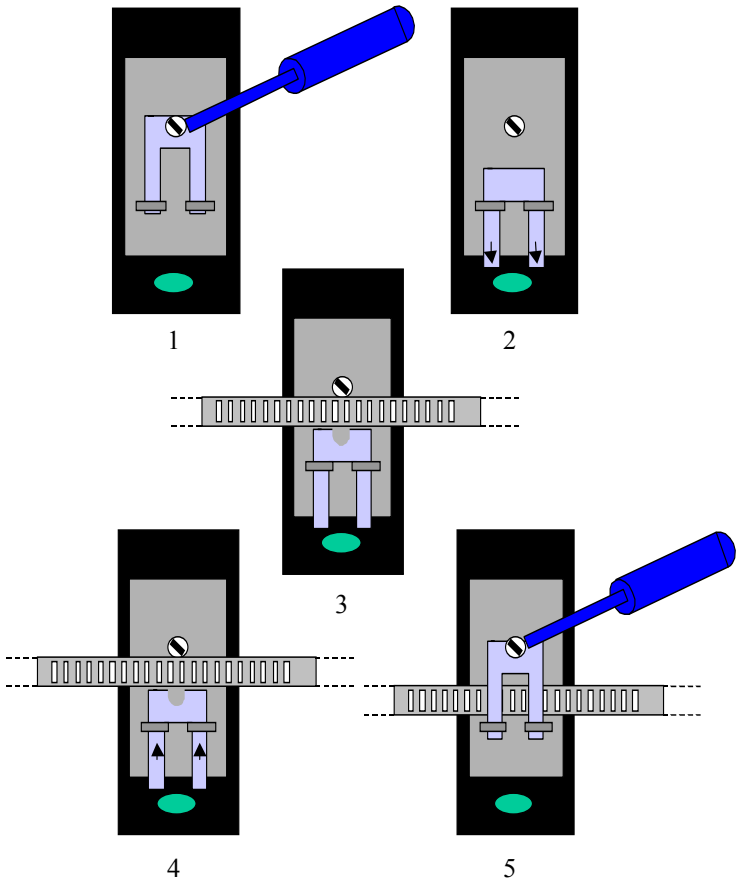
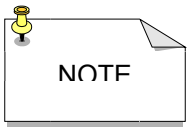


Figure 2.3 – Attach Transducers to the Pipe Strap

2.4 Mount the transducers on the pipe.

1. Wrap the pipe strap around the pipe.
2. Slide the pipe strap end through the tension nut assembly.
3. Pull the strap tight **AND** clamp the tension nut down to secure the pipe strap to the pipe.
4. Loosen the mounting screw of one transducer.
5. Mount the transducer at the 3'oclock position on the pipe（See Figures 2.2a,b Transducer Orientations on Horizontal and Vertical Pipe, page 4).
6. Tighten the mounting screw to secure the transducer in place.
7. Repeat steps 4－6 for the second transducer, now at the 9'oclock position.
8. Remove the pipe strap from the pipe **AND** generously apply sonic coupling compound to each transducer surface.
9. Re-position the pipe strap on the pipe,



Increasing the pipe strap tension improves

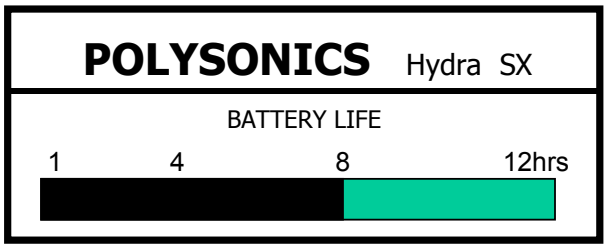


Figure 2.5a – Polysonics Hydra SX Screen

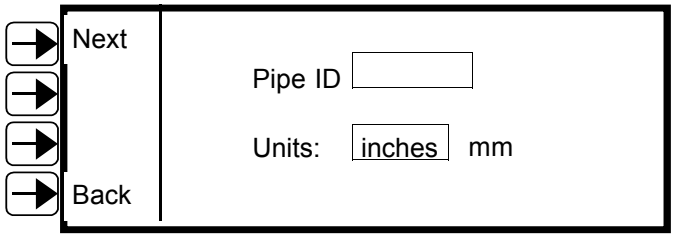


Figure 2.5b – Pipe ID Screen

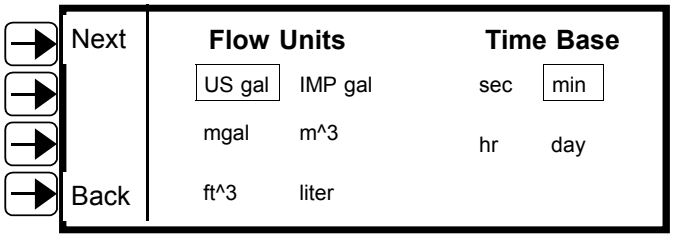


Figure 2.5c – Flow Units Screen

2.5 Obtain a flow reading.

NOTE

You must know the pipe internal diameter to ensure reliable flow measurements **AND** there must be flow in the pipe when you

1. IF you do not know the pipe ID, THEN go to section 6.1 Pipe ID on page 34.
2. Press **ON** to start the meter.

You are now in Start Up Mode

3. Wait for the Polysonics Hydra SX screen to appear. (See Figure 2.5a-Polysonics Hydra SX Screen, on facing page).
4. Check the battery life gauge when the Polysonics screen appears in the meter window (appears for 5 seconds).
5. IF battery life is less than the anticipated hours of use, THEN see Procedure 2.9 (Recharge the battery) OR Procedure 2.10 (Connect an auxillary DC Power Source) on

NOTE

Use the **BACK-SPACE** key, to the right of the number keys, for correcting errors when

7. Enter the Pipe ID using the number keys.
8. Press ENTER.
9. Press SCROLL until the cursor moves to the correct pipe ID units.
10. Press ENTER.
11. Press the Menu à key to the left of Next.
12. Wait for the Flow Units screen to appear. (See Figure 2.5c-Flow Units Screen, on facing page.)
13. Press SCROLL until the cursor moves to the correct volume units.

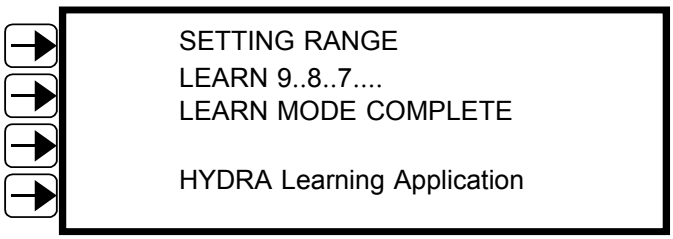


Figure 2. 5d – Learn Mode Screen

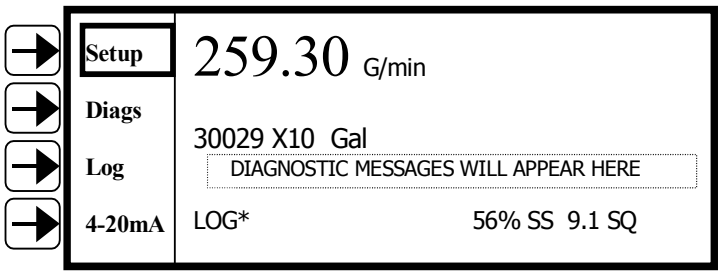


Figure 2. 5e – Flow Screen

(procedure 2.5 Obtain a flow reading continued.....)

16. Press the Menu à key to the left of Next.

You are now in Learn Mode.

17. Wait for the Learn Mode screen to appear. (See Figure 2.5d-Learn Mode Screen, on

NOTE

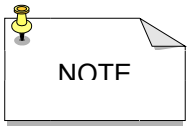
IF you are operating the meter without installing it, THEN press the ENTER key four

18. Review the diagnostic information that appears in the Learn Mode screen (appears for 60 secs.).
19. IF any of the following warnings appear:
    - Invalid Signal, Can't Learn
    - No Flow, Can't Learn
    - Warning Low S Strength
    - Warning Poor S Strength

    THEN see section 4.2 (Learn Mode Warnngs), on page 24.

You are now in Operating Mode.

20. Wait for the Flow screen to appear. (See Figure 2.5e-Flow Screen, on facing page.)
21. Read the flow.
22. IF the flow reading is not accurate, AND you can verify the flow from a calibrated flowmeter or other certified source, THEN see procedure 5.3 (Perform an on-site calibration), on page 32.
23. IF any of the following warnings appear:
    - Warning



The Hydra SX30 menu tree appears on the last page of this manual. You may find it useful to reference this tree while

2.6 Set the totalizer units.

1. Press the Menu à key to the left of Diags in the Flow Screen.
2. Wait for the Limits screen to appear.
3. Press the Menu à key to the left of Totalz.
4. Wait for the Totalizer screen to appear.
5. Press SCROLL until the cursor moves to the correct volume units.
6. Press ENTER.

2.7 Reset the totalizer.

1. Press the Menu à key to the left of Diags in the Flow Screen.
2. Wait for the Limits screen to appear.
3. Press the Menu à key to the left of Totalz.
4. Wait for the Totalizer screen to appear.
5. Press SCROLL until the cursor moves to RESET.
6. Press ENTER.

2.8 Change the screen contrast.

1. Press the +/− key on the number key pad.
2. Wait for the adjust contrast bar to appear.
3. WHEN the screen reaches the desired contrast, THEN press the +/− key once more.
4. Click the SCROLL and BACK-SPACE keys to fine adjust the contrast.

2.9 Recharge the battery.

NOTE

You can recharge the battery while you are operating the meter, even under low

STOP!

Over charging will degrade the battery. Do not charge the battery for more than eight hours. The battery is fully charged at the

1. IF you need to run the meter at one location for more than 12 hours, THEN use an auxiliary DC power source.（See procedure 2.10 Connect an auxiliary DC power source, below.）
2. Plug the power supply cable into the CHARGE socket on the meter face, to the right of the display window.

2.10 Connect an auxiliary DC power source.

NOTE

The battery will not charge while operating

1. Use a minimum 10.5-volt power supply that supplies 0.25 amps to power the flowmeter.
2. Plug the power supply cable into the appropriate socket on the side of the meter.

STOP!

DO NOT use power supplies greater than

2.11 Set the data logger time and date.

1. Press the Menu à key to the left of Log in the Flow Screen
2. Wait for the Log screen to appear. (See Figure 2.12 –Log Screen, on page 15.)
3. Press the Menu à key to the left of Time.
4. Wait for the Time screen to appear. (See Figure 2.11-Time Screen, below.)
5. Type the correct hour using the number keys.

NOTE

Use the **BACK-SPACE** key, to the right of the number keys, for correcting errors when

9. Type in the day using the number keys.
10. Press ENTER.
11. Press SCROLL until the correct month appears.
12. Press ENTER.
13. Type in the correct year using the number keys.
14. Press ENTER.

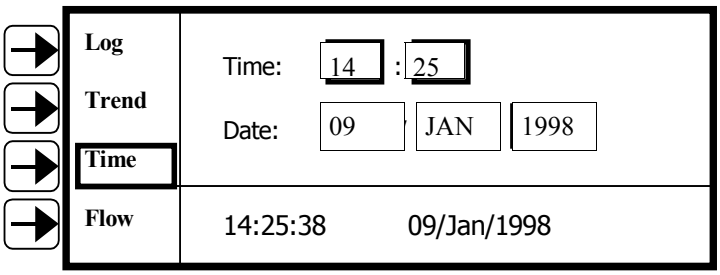


Figure 2.11 – Time Screen

2.12 Set up and start the data logger.

NOTE

You cannot select the file for storing a specific log set. The flowmeter saves data in sequenced files 0 to 9 each time the logger is turned on or a log file goes

1. See procedure 2.11 (Set the data logger time and date) on page 14, to set the time and date.
2. Press the Menu à key to the left of Log in the Flow screen or the Time screen.
3. Wait for the Log screen to appear. (See Figure 2.12 –Log Screen, below)
4. Press SCROLL until the cursor moves to the desired time between data points. (0.5–60 min/point.)
5. Press ENTER.
6. Press SCROLL until the cursor moves to ON, next to Log, at the bottom of the screen.

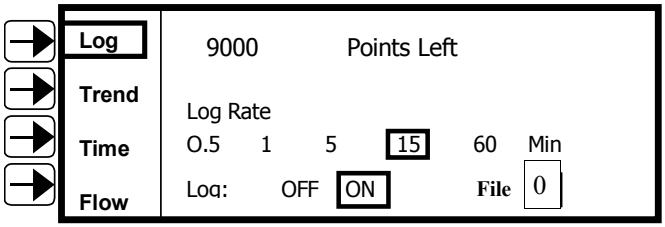


Figure 2.12 – Log Screen

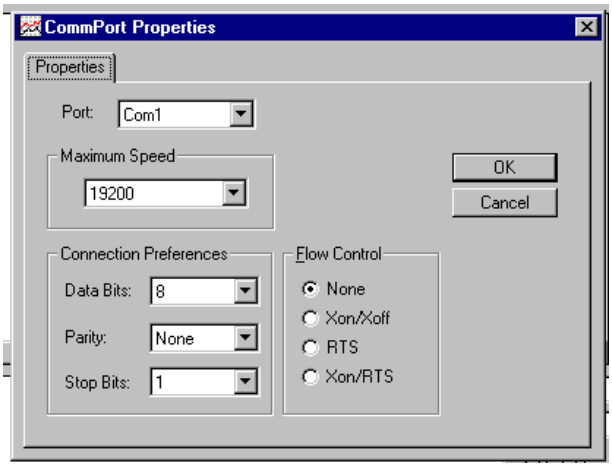


Figure 2.13a – Comm Port Properties

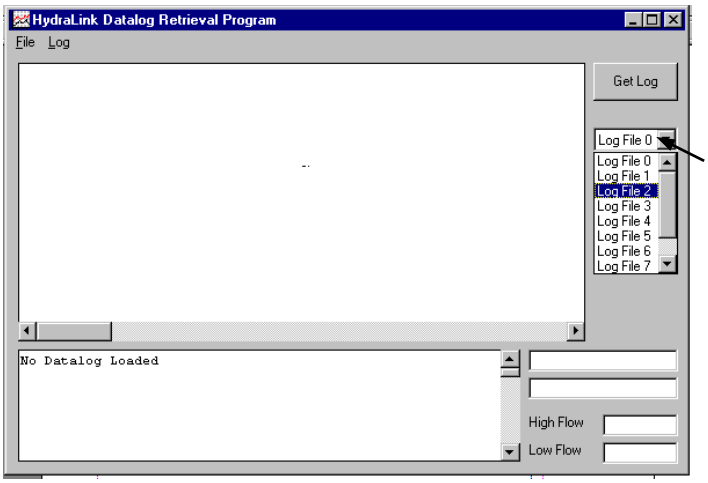


Figure 2.13b – Select Log File

2.13 Download data from the logger.

NOTE

The following procedure assumes:
- HydraLink software is installed
- you have basic operating

1. Connect the communication cable from the flowmeter to the RS 232 port on the computer.
2. Start the HydraLink program.
3. Wait for the "Communications Established" window to appear.
4. Click on the "OK" button.
5. IF the “Communications Established window appears, THEN go to step 11.
6. IF the "Communications Failed" window appears, THEN check the security of the cable, AND make sure the flowmeter is on.
7. Click on OK.
8. WHEN the CommPort Properties window appears, THEN make sure the correct comm port number appears in the Port option, AND enter the correct CommPort properties, shown in Figure 2.13a – CommPort Properties, on the facing page.
9. Wait for the "Communication Established" window to appear.
10. IF the Communication Established Window still does not appear, THEN contact your Polysonics service representative.
11. WHEN the HydraLink window appears, THEN

NOTE

The logger saves data in sequenced files 0 through 9. When all the files are full the logger restarts the sequence by overwriting the files beginning with log file 0. Perform procedure 2.16 (Save the log files), on

2.14 Zoom in on data.

1. Click on the Zoom button. (See Figure 2.15b – Zoom Button, below.)
2. Press the scroll buttons at the bottom of the data graph to view data.

2.15 Zoom in on a selection of data.

1. Move the arrow to a point on the screen.
2. Depress the mouse button.
3. Drag the mouse to enclose a range of data you want to zoom in on. (See Figure 2.15a – Data Zoom, below)
4. Release the mouse button.
5. Repeat steps 1-4 until you achieve your desired zoom view.
6. Return to the previous view by double

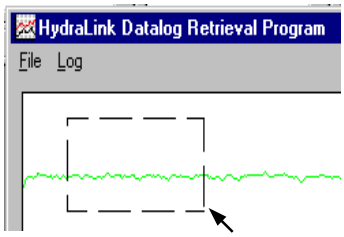


Figure 2.15a – Data Zoom

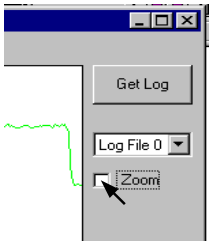


Figure 2.15b – Zoom Button

2.16 Save the log files.

1. Perform procedure 2.13 (Download data from the logger), on page 17.
2. Click on File in the HydraLink window. (See Figure 2.16 – Save Log, below.)
3. Select "Save Log".

NOTE

The logger saves data in sequenced files 0 through 9. When all the files are full the logger restarts the sequence by overwriting

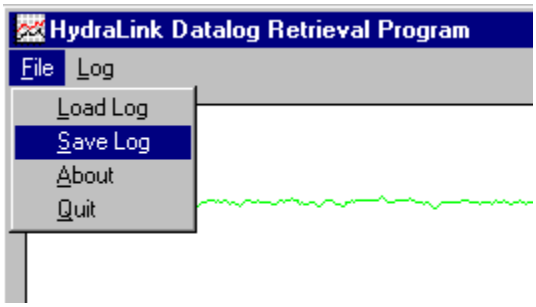


Figure 2.16 Save Log

2.17 Retrieve a saved file.

NOTE

For this procedure only, click on OK in the Communications Failed and Cancel in the

1. Click on File in the HydraLink window. (See Figure 2.17 – Load Log, below.)
2. Select "Load Log".
3. Use standard Windows procedures to retrieve

NOTE

The logger saves data in sequenced files 0 through 9. When all the files are full the logger restarts the sequence by overwriting

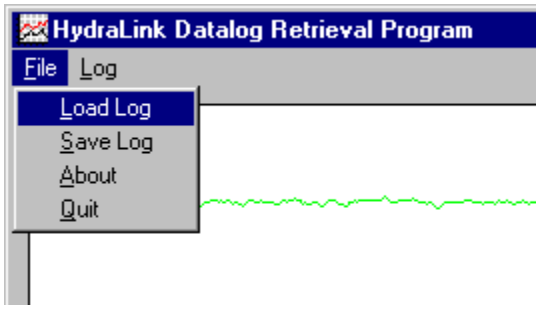


Figure 2.17 – Load Log

2.18 Erase all data in the log files.

STOP!

Performing the following procedure will erase ALL the log information stored in the flowmeter. You cannot erase a specific log

NOTE

It is not necessary to create space in log files for new logger information by erasing data. The logger saves data in sequenced files 0 through 9. When all the files are full the logger restarts the sequence by overwriting the files beginning with log file 0. Perform procedure 2.16 (Save the log files),

1. Click on Log in the HydraLink window. (See Figure 2.18 – Erase All, below.)
2. IF you are sure you want to erase all 10 log files, THEN click on the Yes button in the Erase All window.
3. Wait while the logger erases all the files.
4. IF you do not want to erase all 10 log files THEN click on the No button in the Erase All

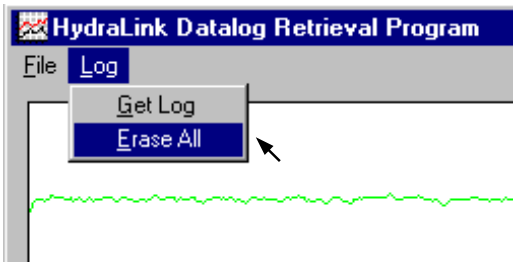


Figure 2.18 – Erase All

2.19 Range the 4-20 mA loop.

1. Press the Menu à key to the left of 4-20 MA in the Flow Screen.
2. Wait for the 4-20 mA Range Screen to appear. (See Figure 2.19 – 4-20 mA Range

NOTE

Use the **BACK-SPACE** key, to the right of the number keys, for correcting errors when

3. Enter the minimum flow using the number keys.
4. Press ENTER.
5. Enter the maximum flow using the number keys.
6. Press ENTER
7. Press the Menu à key to the left of Flow to

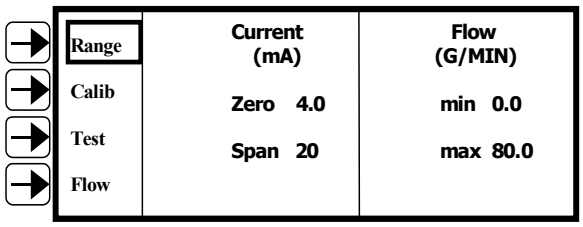


Figure 2.19 – 4-20 mA Range Screen

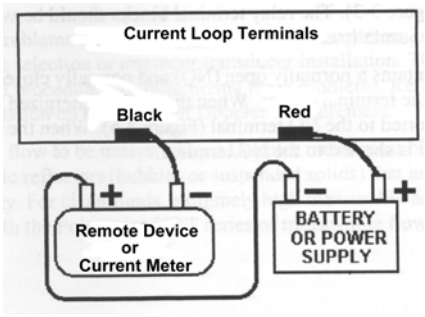


Figure 2.20a – Current Loop

2.20 Calibrate the 4-20 mA loop.

NOTE You need a calibrated current meter and a separate power source to perform this procedure.

1. Set up a calibration current loop. (See Figure 2.20a- Current Loop, on page 22.)
2. IF the meter is not on a pipe with flow, THEN press the Menu à key to the left of Next two times, AND press the ENTER key four times to access the flow screen.
3. Press the Menu à key to the left of 4-20 mA in the Flow Screen.
4. Wait for the Range screen to appear. (See Figure 2.19 – 4-20 mA Range Screen, on page 22.)
5. Press the Menu à key to the left of Calib.
6. Wait for the Calibration screen to appear. (See Figure 2.20b – Calibration Screen, below.)
7. Enter the value, in mA, from the current meter that corresponds to the zero scale, using the number keys.
8. Press ENTER
9. Enter the value, in mA, from the current meter that corresponds to the full scale, using the number keys.

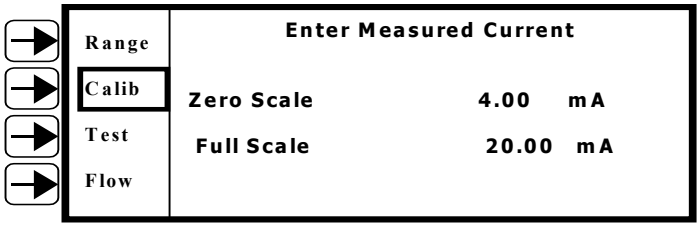


Figure 2.20b – Calibration Screen

3. Maintenance

3.1 Flowmeter Maintenance

The Hydra SX30 Portable Flowmeter is easy to maintain. The DFD transducers and flowmeter are factory service only components and maintenance free. The following Flowmeter Maintenance table describes:

· system components

· appropriate maintenance actions

Table 3.1 –Component Maintenance and Schedule

Component	Recommended Maintenance	How Often
Transducers	– none, this is a	–––––
Coupling compound	– add more compound	Whenever: – compound diminishes – transducers repositioned – meter is
Flowmeter	– none, this is a service item	–––––
Pipe strap	– re-tighten	– once yearly
Cable connections	– make sure connections are secure – remove any residue build-up within the	– as part of your facility's maintenance schedule

3.2 Upgrade Meter Software

The most current software is installed in the meter prior to shipment. You can upgrade the software as newer versions become available, using the RS232 port and a remote terminal. Contact your local Polysonics Service Representative to inquire about software upgrades.

Polysonics, Inc.
Attn: Service Center
10335 Landsbury Dr., Suite 300
Houston, TX 77099-3407 USA

4. Troubleshooting

4.1 Different Modes of Operation

1. Start Up Mode – initialize meter
2. Learn Mode – meter "learns" the system's parameters – – There MUST BE FLOW in the pipe during learn mode.

4.2 Learn Mode Warnings

Table 4.2 below describes the Learn Mode warnings and the appropriate corrective actions. Perform the corrective actions in the sequence

Table 4.2 – Learn Mode Warnings and Recommended

Warning	Corrective Action
Invalid Signal, Can't Learn	1. A 2. B 3. C (see Table 4.3c
No Flow, Can't Learn	1. Check for flowing fluid 2. Make sure pipe is full 3. Check BNC connections 4. Restart meter go into learn mode, check to see if warning is gone
Warning Low S Strength	1. Shut meter down 2. A 3. B 4. C (see Table 4.3c
Warning Poor S Quality	1. Let meter enter operating mode 2. See procedure 5.1 (Check the

4.3 Operating Mode Warnings

In operating mode, the warnings indicate a level of severity and a reason for fault. Table 4.3a (Operating Mode Warnings and Indicated Level of Severity), below, describes:

· operating mode warning messages
· the level of severity indicated.

Table 4.3b (Operating Mode Faults & Corrective Actions), on page 28, describes:

Table 4. 3a – Operating Mode Warnings and Indicated

Warning	Level of Severity
Warning	– flow reading is marginal
Alarm	– flow reading is unreliable
Failed/No Flow	– the meter will not read flow – the meter will continue to read zero flow until the fault is cleared **NOTE!** A "Failed" message is normal under no-flow conditions. The meter

Table 4. 3b – Operating Mode Faults & Corrective Actions

Faults	Corrective Action **Note!** If more than one of the faults appear then perform the actions for each in order.
PQ – Poor Signal Quality	1. See procedure 5.1 (Check the FFT), page 31 2. Perform sequence B,C,D,E (see Table 4.3c Action Codes,
FS – Failed Signal Status	1. Perform sequence A,B,C,D (see Table 4.3c Action Codes, below) 2. See procedure 5.1 (Check the FFT), page 31
IS – Invalid Signal	1. See procedure 5.1 (Check the FFT), page 31
Action	**Action Description**
A	1. Turn off meter 2. Apply more coupling compound 3. Tighten pipe strap 4. Remove and reconnect BNC
B	1. Reposition transducers to another position 2. See if signal strength increases 3. See if fault clears
C	1. Try a new pipe location 2. See if signal strength increases 3. See if fault clears
D	1. Turn off meter 2. If pipe surface is rough or coated, then grind the pipe surface 3. Remount the transducers
E	1. See section 4.4 (Service), page 29

4.4 Service

4.4.1 Contacting the Polysonics Service Center

To expedite service by helping the service technician to better diagnose the problem, please have the following information ready before contacting the factory.

1. Signal Strength
   %SS – from the bottom of Flow screen
2. Process Temperature
3. Transducer Mounting Configuration
4. Power Consumption
5. Pipe Orientation
6. Fluid Type
7. Pipe OD and ID
8. Pipe Material
9. Liner Material
10. Liner Thickness
11. Model Number
12. Serial Number

Polysonics, Inc.
Attn: Service Center
10335 Landsbury Dr., Suite 300
Houston, TX 77099-3407 USA

Telephone: (281) 879-3700
Fax: (281) 498-7721
Web: www.peekmeas.com

(section 4.4 Service continued.....)

4.4.2 Factory Service

If Polysonics determines that the problem cannot be resolved over the phone, return the entire unit to Polysonics.

Contact the Polysonics Service Center before returning an instrument for repair. **Mark the RMA number issued by the service representative on the outside of the shipping box.** The receiving dock will not accept shipments without an RMA number.

You must include a letter fully explaining the symptoms of the failure as well as details describing the application where the unit was being operated (type of fluid, pipe size, pipe material, fluid velocity, temperature, etc.). Service cannot be adequately performed until the Service Center receives this written information.

To ship an instrument to Polysonics:

1. Ensure that the instrument is well packed (in its original shipping box, if available).
2. Include the letter of explanation.
3. Write the RMA number of the outside of the shipping box.
4. Send the unit freight-paid to the Service Center:

Polysonics, Inc.
Attn: Service Center
10335 Landsbury Dr., Suite 300

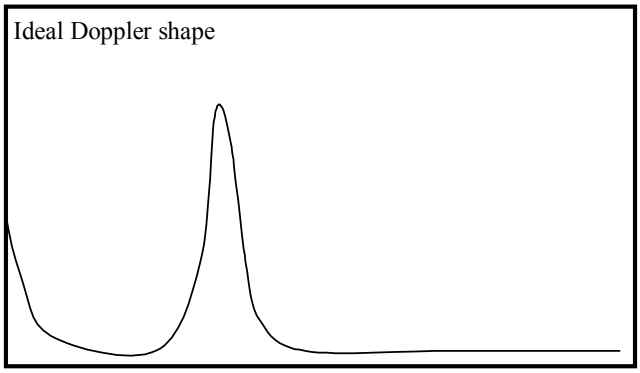
5. Troubleshooting Procedures

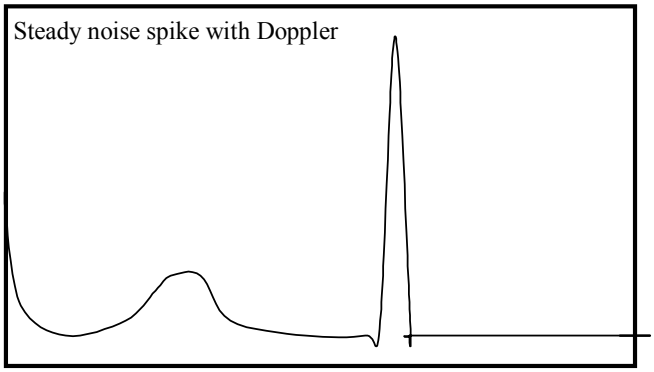
5.1 Check the FFT

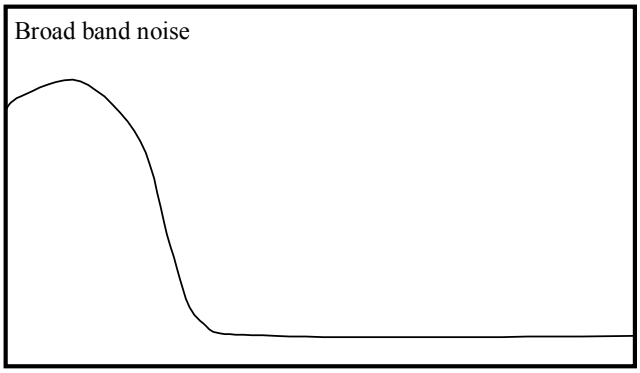
1. Press the Menu à key to the left of Diags in the Flow screen.
2. Wait for the Limits screen to appear.
3. Press the Menu à key to the left of FFT in the Limits screen.
4. See Figures 5.1 a-f (FFT Diagrams), on pages 32,33 to determine the FFT condition.
5. See Table 5.1 (FFT Analysis and Corrective Actions), below, to determine the corrective

Table 5.1 – FFT Analysis and Corrective Actions

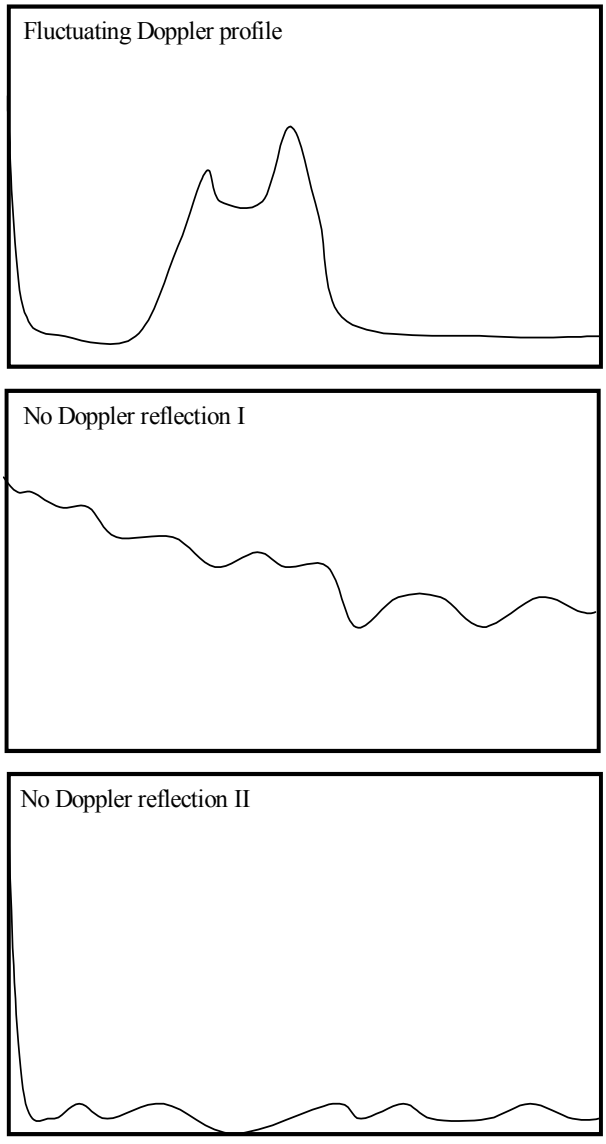
FFT shape	Possible Causes	Corrective Actions
Ideal Doppler	-----	– restart the meter
Broad Band Noise	– poor pipe coupling – multiple noise generators	– A,B,C,D (see Table 4.3c Action Codes, page 28) – relocate transducer – shut off noise
Steady Noise Spike	– electromagnetic noise	– shut off noise source – relocate transducer
Fluctuating Doppler	– constantly changing flow – noise	– increase damping, see procedure 5.5 (Set the damping parameter), page 35
No Doppler Reflection I & II	– ultrasound signal is not transmitting	– A,B,C,D,E (see Table 4.3c Action Codes,







Figures 5. 1 a. b. c – FFT Diagrams

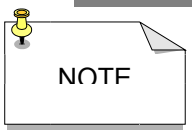


Figures 5.1 d, e, f – FFT Diagrams

5.2 Set the low flow cutoff.

1. Press the Menu à key to the left of Diags in the Flow screen.
2. Wait for the Limits screen to appear. (See Figure 5.5 – Limits Screen, on page 35)
3. Press **ENTER** until the blinking cursor appears in the Low Flow Cutoff box.
4. Enter the rate for low flow using the number keys.

5.3 Perform an on-site calibration.

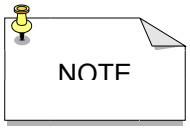


Determine the flow using another source

1. Calculate the site calibration adjustment. (actual flow,Hydra flow)
2. Press the Menu à key to the left of Diags in the Flow screen.
3. Wait for the Limits screen to appear. (See Figure 5.5 – Limits Screen, on page 35)
4. Press **ENTER** until a cursor appears in the Site Cal box.
5. Enter the site calibration adjustment.

5.4 Reset the factory settings.

1. Shut off the meter.



All of the settings will reset except:

- 4-20 mA calibration
- pipe ID

5.5 Set the damping parameter.

1. Press the Menu à key to the left of Diags in the Flow screen.
2. Wait for the Limits screen to appear. (See Figure 5.5-Limits Screen, below)
3. Enter the amount of damping (0-99 units,

NOTE

The Smart Filter used by this meter, allows the damping function to smooth small fluctuations without diminishing the meter's response to large flow changes,

4. Press the Menu à key to the left of FLOW

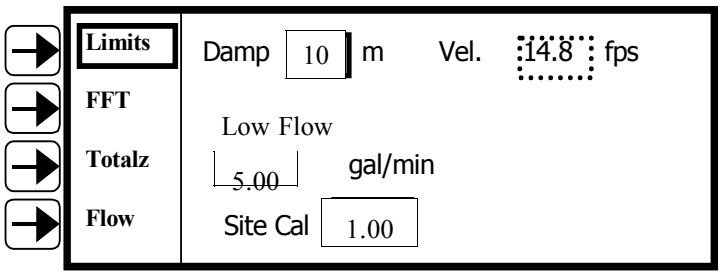


Figure 5.5 – Limits Screen

6. Appendix

6.1 Pipe ID

6.1.1 Obtain the Pipe ID.

If you do not know the pipe ID, then try to get the Outside Diameter (OD) by one of the following methods:

1. Read the pipe Outside Diameter (OD) and schedule on the pipe
2. Read the OD and schedule from system drawings
3. Measure the pipe circumference using a tape measure, and divide the measured circumference by 3.14
4. For an approximate pipe ID use the OD with the charts in section 6.1.2 (Pipe ID Charts), on pages 37-39.
5. For a more accurate pipe ID use an ultrasonic pipe thickness gauge (part #0704/0187, available from Polysonics), AND perform the following calculation:

pipe ID = pipe OD − (2 x pipe thickness)

Table B-1
Steel, Stainless Steel and PVC Pipe Standard Schedules
Inside Diameter (ID) and Outside Diameter (OD) in Inches

Nominal Pipe Size (")	Outside Diameter (OD)	Sched. 5	Sched. 10 (Light Wall)	Sched. 20	Sched. 30	Sched. 40	Sched. 60	Sched. 80	Sched. 100	Sched. 120	Sched. 140	Sched. 160	Std. Wall	X STG
1	1.315	1.185	1.097			1.049		0.957				0.815	1.049	0.957
1.25	1.660	1.530	1.442			1.380		1.278				1.160	1.380	1.278
1.5	1.900	1.770	1.682			1.610		1.500				1.338	1.610	1.500
2	2.375	2.245	2.157			2.067		1.939				1.687	2.067	1.939
2.5	2.875	2.709	2.635			2.469		2.323				2.125	2.469	2.323
3	3.500	3.334	3.260			3.068		2.900				2.624	3.068	2.900
3.5	4.000	3.834	3.760			3.548		3.364					3.548	3.364
4	4.500	4.334	4.260			4.026		3.826		3.624		3.438	4.026	3.826
5	5.563	5.345	5.295			5.047		4.813		4.563		4.313	5.047	4.813
6	6.625	6.407	6.357			6.065		5.761		5.501		5.187	6.065	5.761
8	8.625	8.407	8.329	8.125	8.071	7.981	7.813	7.625	7.437	7.187	7.001	6.813	7.981	7.625
10	10.750	10.482	10.420	10.250	10.136	10.020	9.750	9.562	9.312	9.062	8.750	8.500	10.020	9.750
12	12.750	12.438	12.390	12.250	12.090	11.938	11.626	11.374	11.062	10.750	10.500	10.126	12.000	11.750
14	14.000		13.500	13.376	13.250	13.124	12.812	12.500	12.124	11.876	11.500	11.188	13.250	13.000
16	16.000	15.670	15.500	15.376	15.250	15.000	14.688	14.312	13.938	13.562	13.124	12.812	15.250	15.000
18	18.000	17.670	17.500	17.376	17.124	16.876	16.500	16.124	15.688	15.255	14.876	14.438	17.250	17.000
20	20.000	19.634	19.500	19.250	19.000	18.812	18.376	17.938	17.438	17.000	16.500	16.062	19.250	19.000
24	24.000	23.564	23.500	23.250	22.876	22.624	22.062	21.562	20.938	20.376	19.876	19.312	23.250	23.000
30	30.000	29.500	29.376	29.000	28.750	28.500							29.250	29.000
36	36.000		35.376	35.000	34.750	34.500					31.876	31.312	35.250	35.000
42	42.000			41.000	40.750	40.500							41.250	41.000
48	48.000					47.250							47.250	47.000

Table B-2
Cast Iron Pipe Standard Classes
Inside Diameter (ID) and Outside Diameter (OD) in Inches

Nominal Pipe Size (")	Class A		Class B		Class C		Class D		Class E		Class F		Class G		Class H	
	OD	ID	OD	ID	OD	ID	OD	ID	OD	ID	OD	ID	OD	ID	OD	ID
3	3.80	3.02	3.96	3.12	3.96	3.06	3.96	3.00								
4	4.80	3.96	5.00	4.10	5.00	4.04	5.00	3.96								
6	6.90	6.02	7.10	6.14	7.10	6.08	7.10	6.00	7.22	6.06	7.22	6.00	7.38	6.08	7.38	6.00
8	9.05	8.13	9.05	8.03	9.30	8.18	9.30	8.10	9.42	8.10	9.42	8.10	9.60	8.10	9.60	8.00
10	11.10	10.10	11.10	9.96	11.40	10.16	11.40	10.04	11.60	10.12	11.60	10.00	11.84	10.12	11.84	10.00
12	13.20	12.12	13.20	11.96	13.50	12.14	13.50	12.00	13.78	12.14	13.78	12.00	14.08	12.14	14.08	12.00
14	15.30	14.16	15.30	13.98	15.65	14.17	15.65	14.01	15.98	14.18	15.98	14.00	16.32	14.18	16.32	14.00
16	17.40	16.20	17.40	16.00	17.80	16.20	17.80	16.02	18.16	16.20	18.16	16.00	18.54	16.18	18.54	16.00
18	19.50	18.22	19.50	18.00	19.92	18.18	19.92	18.00	20.34	18.20	20.34	18.00	20.78	18.22	20.78	18.00
20	21.60	20.26	21.60	20.00	22.06	20.22	22.06	20.00	22.54	20.24	22.54	20.00	23.02	20.24	23.02	20.00
24	25.80	24.28	25.80	24.02	26.32	24.22	26.32	24.00	26.90	24.28	26.90	24.00	27.76	24.26	27.76	24.00
30	31.74	28.98	32.00	29.94	32.40	30.00	32.74	30.00	33.10	30.00	33.46	30.00				
36	37.96	35.98	38.30	36.00	38.70	35.98	39.16	36.00	39.60	36.00	40.04	36.00				
42	44.20	42.00	44.50	41.94	45.10	42.02	45.58	42.02								
48	50.50	47.98	50.80	47.96	51.40	47.98	51.98	48.00								
54	56.66	53.96	57.10	54.00	57.80	54.00	58.40	53.94								
60	62.80	60.02	63.40	60.06	64.20	60.20	64.82	60.06								
72	75.34	72.10	76.00	72.10	76.88	72.10										
84	87.54	84.10	88.54	84.10												

NOTE: For pipes with cement linings, reduce the pipe inside diameter by two times the lining thickness. Standard and double cement lining thicknesses are listed in Table B-3.

Table B-3
Ductile Iron Pipe Standard Classes
Inside Diameter (ID) and Outside Diameter (OD) in Inches

Nominal Pipe Size	Outside Diameter (OD)	Inside Diameter							Cement Lining (See Note)	
		Class 50	Class 51	Class 52	Class 53	Class 54	Class 55	Class 56	Standard Thickness	Double Thickness
3	3.96		3.46	3.40	3.34	3.28	3.22	3.16		
4	4.80		4.28	4.22	4.16	4.10	4.04	3.98		
6	6.90	6.40	6.34	6.28	6.22	6.16	6.10	6.04	0.125	0.250
8	9.05	8.51	8.45	8.39	8.33	8.27	8.21	8.15		
10	11.10	10.52	10.46	10.40	10.34	10.28	10.22	10.16		
12	13.20	12.58	12.52	12.46	12.40	12.34	12.28	12.22		
14	15.30	14.64	14.58	14.52	14.46	14.40	14.34	14.28		
16	17.40	16.72	16.66	16.60	16.54	16.48	16.42	16.36		
18	19.50	18.80	18.74	18.68	18.62	18.56	18.50	18.44	0.1875	0.375
20	21.60	20.88	20.82	20.76	20.70	20.64	20.58	20.52		
24	25.80	25.04	24.98	24.92	24.86	24.80	24.74	24.68		
30	32.00	31.22	31.14	31.06	30.98	30.90	30.82	30.74		
36	38.30	37.44	37.34	37.06	37.14	37.04	36.94	36.84		
42	44.50	43.56	43.44	43.32	43.20	43.08	42.96	42.84	0.250	0.500
48	50.80	49.78	49.64	49.50	49.36	49.22	49.08	48.94		
54	57.10	55.96	55.80	55.64	55.48	55.32	55.16	55.00		

Note: For pipes with cement linings, reduce the pipe inside diameter by two times the lining thickness listed above.

6.2 Application Signal Quality and Signal Strength

Signal quality and signal strength are indicators of how well suited an application is to a Doppler flowmeter. To determine the quality of your application:

1. Look at the bottom right corner of the Flow screen.（See Figure 6.2a – Flow Screen, below.）
2. Note the SQ number and the %SS number.
3. Refer to Figure 6.2b – Signal Quality/Signal

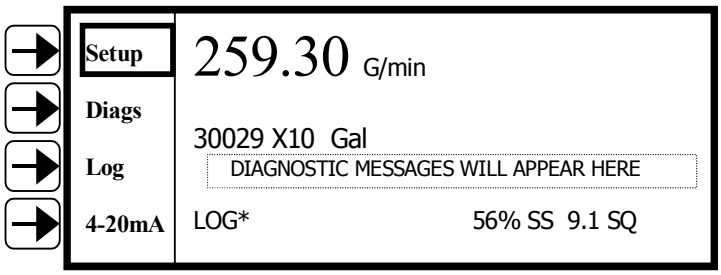


Figure 6.2a – Flow Screen

(section 6.2 Application Signal Quality and Signal Strength

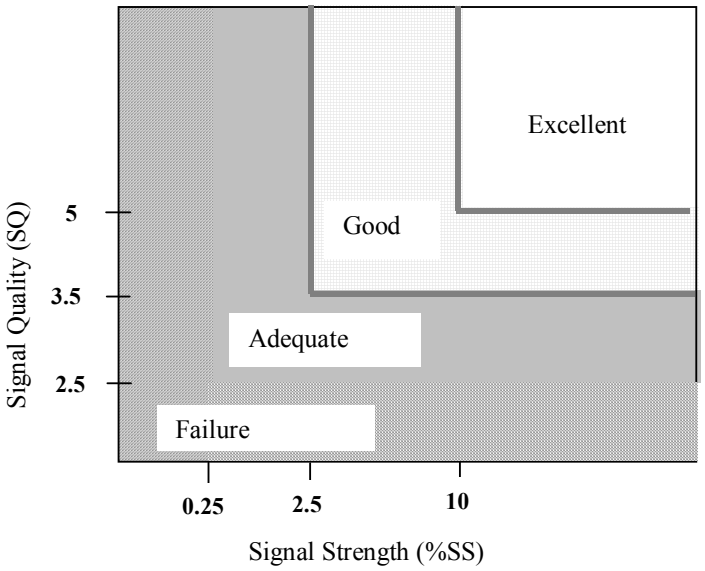


Figure 6. 2b – Signal Quality/Signal Strength Chart

Failure – the meter is not reading flow

Adequate – minimum quality, flow readings may be inconsistent or inaccurate

Good – flow readings are fairly accurate and consistent

6.3 Hydra SX 30 menu tree