genuine
BINDICATOR®

SonoTracker Ultrasonic
Liquid Level
Installation & Operation Manual

SonoTracker Ultrasonic Liquid Level Installation & Operation Manual

CONTENTS

SAFETY SYMBOLS

WARNING:

IDENTIFIES CONDITIONS OR PROCEDURES, WHICH IF NOT FOLLOWED, COULD RESULT IN SERIOUS INJURY. RISK OF ELECTRICAL SHOCK.

CAUTION:

IDENTIFIES CONDITIONS OR PROCEDURES, WHICH IF NOT FOLLOWED, COULD RESULT IN SERIOUS DAMAGE OR FAILURE OF THE EQUIPMENT.

SonoTracker Ultrasonic Liquid Level & Open-Channel Flow Controller Installation & Operation Manual

I.   HANDLING AND STORAGE

SAVE THESE INSTRUCTIONS

INSPECTIONS AND HANDLING

Do not dispose of the carton or packing materials.

Each package should be inspected upon receipt for damage that may have occurred due to mishandling during shipping. If the unit is received damaged, notify the carrier or the factory for instructions. Failure to do so may void your warranty. If you have any problems or questions, consult Customer Support at 800-778-9242.

DISPOSAL AND RECYCLING

This product can be recycled by specialized companies and must not be disposed of in a municipal collection site. If you do not have the means to dispose of properly, please contact for return and disposal instructions or options.

STORAGE

If the device is not scheduled for immediate installation following delivery, the following steps should be observed:

1. Following inspection, repackage the unit into its original packaging.
2. Select a clean dry site, free of vibration, shock and impact hazards.
3. If storage will be extended longer than 30 days, the unit must be stored at temperatures between 32º and 104º F (0º to 40° C) in non-condensing atmosphere with humidity less than 85%.

⚠ CAUTION: DO NOT STORE A NON-POWERED UNIT OUTDOORS FOR A PROLONGED PERIOD.

II. GENERAL SAFETY

AUTHORIZED PERSONNEL

All instructions described in the document must be performed by authorized and qualified service personnel only. Before installing the unit, please read these instructions and familiarize yourself with the requirements and functions of the device. The required personal protective equipment must always be worn when servicing this device.

USE

The device is solely intended for use as described in this manual. Reliable operation is ensured only if the instrument is used according to the specifications described in this document. For safety and warranty reasons, use of accessory equipment not recommended by the manufacturer or modification of this device is explicitly forbidden. All servicing of this equipment must be performed by qualified service personnel only. This device should be mounted in locations where it will not be subject to tampering by unauthorized personnel.

MISUSE

Improper use or installation of this device may cause the following:

- Personal injury or harm
- Application specific hazards such as vessel overfill
- Damage to the device or system

If any questions or problems arise during installation of this equipment, please contact Customer Support at 800-778-9242.

III.   PRODUCT DESCRIPTION

The SonoTracker Series Ultrasonic System can monitor up to a total of 8 transducers of various frequencies, accommodating multiple vessels of different heights and shapes.

The high scan rates of the SonoTracker Series provide fast information updates on material level. The SonoTracker Series has an integral keyboard and a display that provide easy access for programming and allows the user to input their own vessel identifications. The enclosure is designed for rugged, outdoor applications and is wall-mounted. The SonoTracker Series is available in AC and DC powered versions.

OPERATING PRINCIPLE OF ULTRASONIC MEASUREMENT

The operating principle of ultrasonics is based on the reflection of sound, which is used in many applications to determine distance. The transducer sends out a sound pulse through the air and then receives an echo a short time later. The time is carefully measured, allowing the distance to the reflecting object to be determined.

SYSTEM APPLICATIONS

The SonoTracker Series can be used in three ways:

1. Level

    •   Monitors level from up to 8 transducers.

    •   Can display volume or weight converted from level.

2. Flow

    •   Monitors up to 4 sensors.

    •   Measures flow using flumes, weirs and nozzles

    Note: The SonoTracker Series can monitor level, with a maximum of 8 transducers.

CONTROLLER SPECIFICATIONS

| FUNCTIONAL	
Operating Power	110/230 VAC (+/- 10%) 50/60 Hz or 24 VDC
Power Requirement	20 VA
Operating Temperature	-5º to 122º F (-20º to 50º C)
Measuring Distance	1 to 125 ft (0.3 to 38 m) depending on sensor
PERFORMANCE	
Transducer Compatibility	Frequencies from 10 KHz to 45 KHz
Memory	Non-volatile RAM, common isolation parameter storage
Relay Output	Form "C" SPDT, programmable, 10 A 110 VAC, 8 A 230 VAC non-inductive, 10 A 30 VDC; available as plug in modules of 2, 4, 5 and 8 relays each
	4-20 mA option: Isolated 600 ohms maximum or externally powered to 1000 ohms, 12 bit resolution; available as plug in modules of 2, 4, and 8 outputs with common isolation; must be installed in third option slot
	Combi-Card option: One combi-card per unit; combinations are 2 relays, 1 current; or 4 relays, 2 currents
PLC Interface Option	32 channel block transfer, 6 channel discreet transfers, Profibus-DP Slave
PHYSICAL	
Enclosures	NEMA 4X fiberglass reinforced polyester (FRP) or NEMA 4X Stainless Steel
Display	Large, back lit alphanumeric liquid crystal, two lines of 16 characters, user programmable IDs, selectable bar graph display or engineering units formats

TRANSDUCER SPECIFICATIONS

	NOMINAL RANGE LIQUIDS	NOMINAL RANGE SOLIDS	MINIMUM RANGE	TEMPERATURE RANGE	FREQUENCY	BEAM ANGLE
BT-26T	25′ (7.6m)	15′ (4.6m)	12″ (305 mm)	-40° to 160°F (-40° to 71°C)	43KHz	12° included
BT-26ST*	25′ (7.6m)	15′ (4.6m)	12″ (305 mm)	-40° to 230°F (-40° to 110°C)	43KHz	12° included
BT-61PT	50′ (15.2m)	30′ (9.2m)	24″ (610 mm)	-40° to 160°F (-40° to 71°C)	22KHz	12° included
BT-55	100′ (30.5 m)	50′ grains 100′ plastics	24″ (610 mm)	-40° to 230°F (-40° to 110°C)	24KHz	12° included
BT-101PT	125′ (38.1 m)	100′ (30.5 m)	36″ (914 mm)	-40° to 230°F (-40° to 110°C)	14KHz	12° included

* 3A Approved (Transducer Specific)

Figure 1. SonoTracker Series Ultrasonic System Configuration Diagram
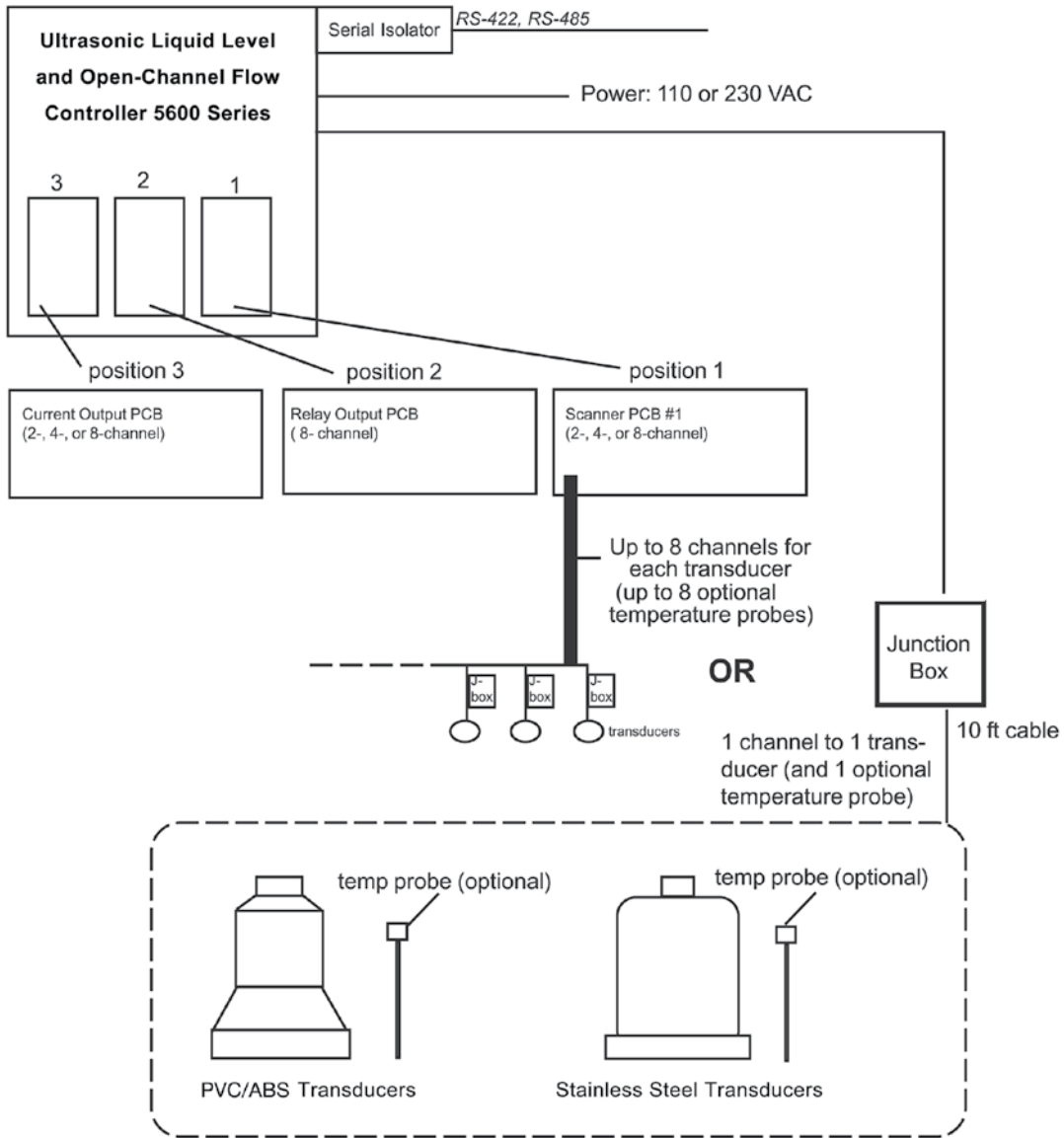
IV. MECHANICAL INSTALLATION

GENERAL INSTALLATION GUIDELINES

- Aim the transducer perpendicular to the surface of liquids.

- Provide sufficient flexible conduit at the transducer location to facilitate transducer aiming movement and removal.

- Run transducer cable from the transducer to the junction box, and from the junction box to the controller in dedicated grounded metal conduit or in cable tray. All cables connected to the same controller may be routed in the same conduit.

⚠ WARNING: DO NOT RUN TRANSDUCER CABLE WITH ANY OTHER AC POWER WIRING.

MOUNTING INSTRUCTIONS

To configure the full system, the following will need to be mounted and/or installed

1. Transducer into the tank or vessel

2. Temperature Probe (optional)

3. Junction Box
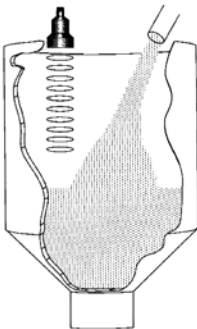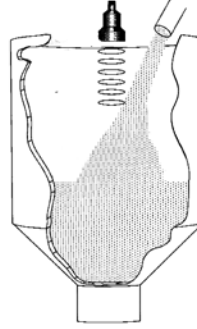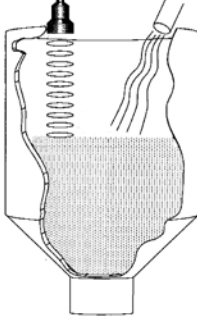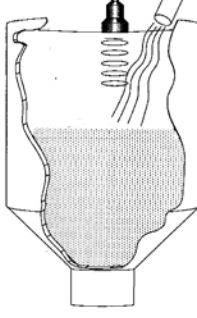
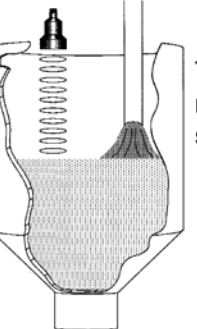4. SonoTracker Controller

MOUNTING TRANSDUCERS
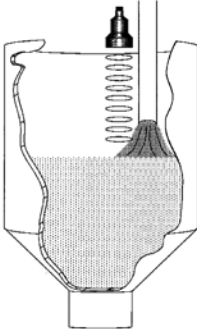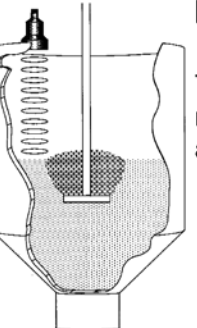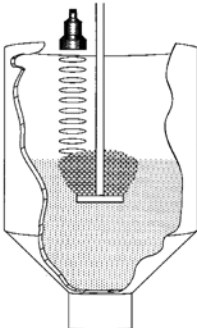
For optimum results, a clear sound beam path between the transducer and the lowest level of material is required. See Figure 2: Positioning Transducers for Optimum Results with Level Applications. When selecting a mounting location for the transducer, follow these guidelines:

- Minimum distance from the transducer to any sidewall is the greater of the following:

  — 1′ (0.30m) horizontal distance for each 10′ (3.0m) in vertical distance from the face of the transducer to the zero level (no material in the vessel)

  — 2′ (0.60m) horizontal distance

Note: For a very deep vessel with a small cross-section, it may be impossible to meet the above requirements.

- Transducer beam path is outside the path of the fill stream.

- Transducer beam path is away from splashing or agitating liquid or bouncing materials.

- Ladders, seams, rebar, etc. in the transducer beam path are avoided or eliminated.

- Transducer location is away from equipment which create vibration and noise that can interfere with the operation of the system: dryers, motors, compressors, fans, blowers, air conditioning units, etc.

- Face of the transducer is above the maximum expected material level by a minimum of:

  — 12″ (305 mm) for 56T-25 transducers

  — 24″ (610 mm) for 56T-50 transducers

This is required to avoid having material within the transducer's blind space (amount of time required for transducer vibration to decay to a level where ultrasonic measurement is possible).

Do	Don't
Transducer properly mounted away from fill stream	Transducer mounted too close to fill stream
Transducer properly mounted away from air currents	Transducer mounted too close to air currents
Transducer properly mounted away from splashing liquid	Transducer mounted too close to splashing liquid
Transducer properly mounted away from agitated liquid	Transducer mounted too close to agitated liquid

MOUNTING TEMPERATURE PROBE

Location Guidelines:

- Ensure that the temperature probe does not come in contact with the liquid during normal fill and during overfill conditions. The probe may be damaged if it comes in contact with the liquid during these conditions.

- Temperature probe may be mounted pointing in any direction.

- Mount the temperature probe so that an average or representative air temperature in the vessel is read.

- Temperature probe has a 1/4" NPT mount. It can be mounted on the same flange with the transducer or through use of a small bracket that will allow for a hanger type mounting within the vessel.

- Many users find it convenient to mount the temperature probe near the transducer. If mounted in this way, the temperature probe cable can be run through the same conduit as the transducer cable.

DRILLING HOLES IN THE ENCLOSURE

If the standard fiberglass NEMA 4X rated enclosure has no openings or pre-drilled punch-outs through which to route cables or install the conduit, holes will need to be drilled. Hole location is critical for proper conduit installation. Check clearances to ensure that the fittings and wire routing will not interfere with the PCB or enclosure door.

PREPARE THE ENCLOSURE FOR CONDUIT

1. Open door of the enclosure.

2. Remove all four (4) mounting screws that attach the plate to the enclosure.

3. Remove entire frame, and place in a safe location.

4. Drill holes for wiring and cables. Holes should be made in the front 2 inches of the the bottom of the enclosure (see Drawing SK90010); this allows for appropriate spacing for the unit and cables.

    4.1. Make a hole for AC cable and relay wiring.

    4.2. Make a hole for sensor cable.

    4.3 Make a hole for 4-20mA wiring.

5. Clean enclosure of any debris; replace the plate back into the enclosure, using all four (4) mounting screws.

6. Determine desired location for mounting the unit.

MOUNTING JUNCTION BOX

Mount the junction box close enough to the transducer to use the supplied 10' (3.0 m) transducer cable without splicing. Mount the junction box so that water cannot reach the terminal block.

1. See Figure 3: Junction Box Mounting and Wiring. Hold the junction box at the desired location and mark the positions of the mounting holes. Place the junction box in a safe place.

2. Drill the mounting holes.

3. Attach the junction box using hardware that will secure it firmly in place.

Note: Mounting hardware for the junction box is not supplied by Bindicator.

MOUNTING CONTROLLER

When mounting the controller, be sure there is enough clearance to open the front door completely. Removal and insertion of the modular PCBs and wiring of the transducers and the PCBs are done through the front of the unit. Do not mount the controller near high power equipment, contractors, SCR drives, 440 V lines, etc. The controller enclosure dimensions are shown in Appendix E, Technical Drawings. Refer to Appendix A for environmental specifications before mounting the unit.

Follow this procedure to mount the controller:

1. Hold the controller enclosure against the wall in the desired location and mark the positions of the mounting holes. Place the controller in a safe place.

2. Drill the mounting holes in the wall.

3. Attach the controller to the wall using hardware that will secure it firmly in place.

Note: Mounting hardware for the controller is not supplied by Bindicator.

NEMA-4X FIBERGLASS ENCLOSURE MOUNTING DIMENSIONS
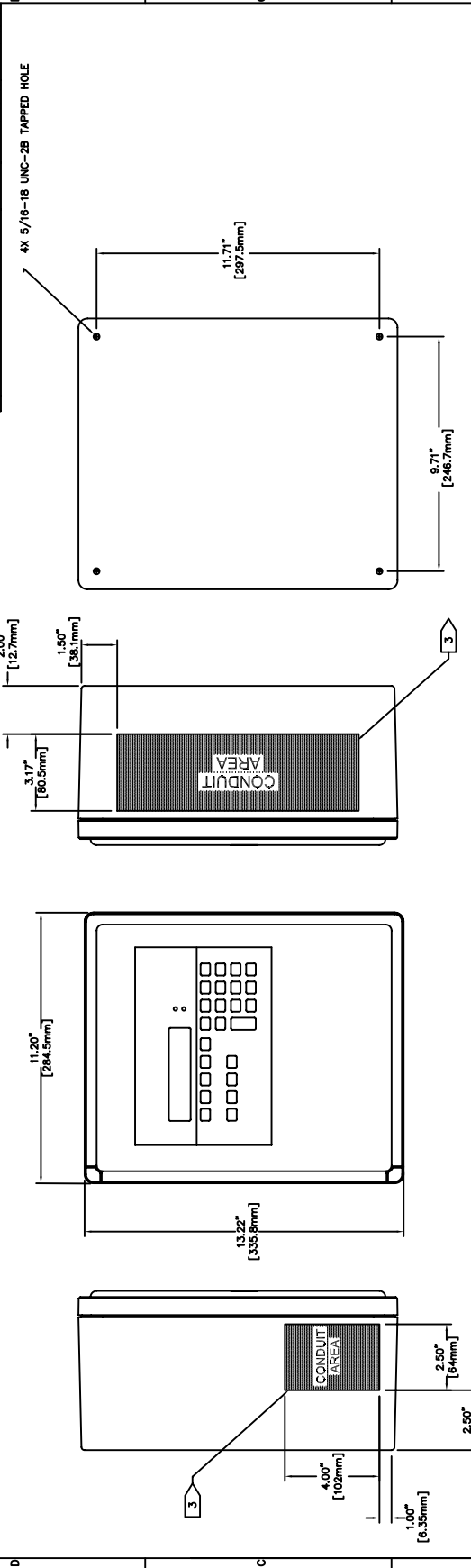
REVISIONS

		ECN/ECO	DRWN/CK'D BY	DATE	APP'D BY	DATE
A	INITIAL RELEASE		J.M.B.	7-5-01	R.MARTIN	7-5-01
B	INCORP B.W.C.	4784	M.R.F.	9-18-01	R.M.	9-18-01
C	GENERALIZED MANUFACTURER	07-331	S.E.	7-16-07	G.A.	7-16-07

4X 5/16-18 UNC-2B TAPPED HOLE

11.71" [297.5mm]
9.71" [246.7mm]

2.00" [12.7mm]
1.50" [38.1mm]
3.17" [80.5mm]
CONDUIT AREA

11.20" [284.5mm]
13.22" [335.8mm]

CONDUIT AREA
2.50" [64mm]
2.50" [63.5mm]
4.00" [102mm]
1.00" [6.35mm]

3.00" [76.2mm]
2.20 [56mm]
1.49 [37.8mm]
8.00" [203mm]
CONDUIT AREA
6.60" [167.5mm]

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ENCLOSURE DOOR MUST BE CLOSED AT ALL TIMES, AND UNUSED OPENINGS MUST BE SEALED TO MAINTAIN THE ENCLOSURE RATING.

2. FOR MAXIMUM NOISE IMMUNITY, GROUNDED METAL CONDUIT AND FITTINGS (OR EQUIVALENT) ARE REQUIRED. SEAL ENCLOSURE AND CONDUIT ENTRIES WITH CONDUIT SEALS, OR PLUG CONDUIT ENTRY WITH APPROPRIATE SEALING COMPOUND. CAUTION! ALL SEALING COMPOUNDS MUST BE ELECTRICAL GRADE. SEALANTS CONTAINING ACETIC ACID WILL DAMAGE THE ELECTRONICS. INSTALL ENCLOSURE ABOVE LOW POINT IN CONDUIT RUN.

3. CONDUIT/CABLE PENETRATIONS AREAS ON BOTTOM/SIDE OF ENCLOSURES AS SHOWN. VERIFY FITTING CLEARANCES BEFORE DRILLING OPENINGS

4. DELETED.

5. THE CONDUIT CABLE ENTRY AREAS ARE PROVIDED AS A GUIDE TO ASSIST IN LOCATING ELECTRICAL FITTINGS ON THE ENCLOSURE VERIFY THAT FITTING LOCKNUTS, WRENCH, FLATS, BOSSES, etc... WILL NOT INTERFERE WITH THE ENCLOSURE LID, LATCHES, CLAMPS OR OPTION CARDS PRIOR TO DRILLING OPENINGS.

6. MOUNT ENCLOSURE TO A STRUCTURE WHICH IS FREE FROM VIBRATION.

venture MEASUREMENT
150 VENTURE BLVD.
SPARTANBURG, SC 29306

FILE TI-UC-UW-01

TITLE SONOCELL CONTROLLER ENCLOSURE DIMENSION AND INSTALLATION SPECIFICATIONS

REF

MATERIAL

FINISH

PART TI-UC-UW-01

SCALE NONE
SIZE B
SHEET 1 of 3
RevC

10

SON280020 Rev. C

NEMA-4 STEEL ENCLOSURE MOUNTING DIMENSIONS
(NOT TO SCALE)

NEMA-4X STAINLESS STEEL ENCLOSURE INSTALLATION MOUNTING DIMENSIONS

(NOT TO SCALE)

PART TI-UC-UW-01

SHEET 3 of 3
RevC

SON280020 Rev. C

SONOCELL TRANSDUCER SPECIFICATIONS:

SONOCELL MODEL	NOMINAL MEASURING RANGE		BLIND SPACE	CONSTRUCTION	INSTALLED CABLE	OPERATING TEMPERATURE	OPERATING PRESSURE	WEIGHT	FREQUENCY	BEAM ANGLE	MAXIMUM SEPARATION TRANSDUCER TO CNTRL. [1]
	LIQUIDS	SOLIDS									
SON200064 SON200058	25FT (7.6m)	15FT (4.6m)	12in (305mm)	CPVC W/TFE FACE VITON SEAL	10FT (3.0m)	−40° F TO 160° F (−40° C TO 71° C)	10 PSIG (.69 BAR) MAX.	1.2 LBS (0.5 Kg)	43 KHz	12° INCLUDED	750FT (228m)
SON200074 SON200077	50FT (15.2m)	30FT (9.2m)	24in (610mm)	CPVC W/TFE FACE VITON SEAL	10FT (3.0m)	−40° F TO 160° F (−40° C TO 71° C)	10 PSIG (.69 BAR) MAX.	3.1 LBS (1.4 Kg)	22 KHz	12° INCLUDED	1,000FT (305m)
SON200084 SON200057	125FT (38.1m)	100FT (30.5m)	36in (915mm)	CPVC W/PVC BACKCOVER	10FT (3.0m)	−40° F TO 160° F (−40° C TO 71° C)	10 PSIG (.69 BAR) MAX.	5.75 LBS (2.6 Kg)	14 KHz	12° INCLUDED	1,200FT (365m)
SON200085	100FT (30.5m)	50FT (15.25m)	24in (610mm)	PVC W/PVC BACKCOVER	10FT (3.0m)	−40° F TO 160° F (−40° C TO 71° C)	10 PSIG (.69 BAR) MAX.	13 LBS (6.0 Kg)	24 KHz	<5° INCLUDED	1,000FT (305m)

NOTES: (UNLESS OTHERWISE SPECIFIED)

[1] USING 18-GA TWISTED SHIELDED PAIR CABLE, BELDEN #8760 OR EQUIVALENT INTERCONNECT CABLE.

Drawing labels (dimensioned views):

TRANSDUCER CABLE
1" NPT
8.90in (226mm)
7.12in (180.8mm)
18.3in (463.6mm)
SON200085

INTERNAL TEMP PROBE CABLE
TRANSDUCER CABLE
1" NPT
1.9in (48.3mm)
5.2in (132.1mm)
2.3in (58.4mm)
SON200064
SON200058

INTERNAL TEMP PROBE CABLE
TRANSDUCER CABLE
1" NPT
2.0in (50.8mm)
9.2in (233.7mm)
5.5in (139.7mm)
SON200084
SON200057

INTERNAL TEMP PROBE CABLE
TRANSDUCER CABLE
1" NPT
1.9in (48.3mm)
6.9in (175.0mm)
4.2in (107mm)
SON200074
SON200077

Title block:

REVISIONS

ZONE	REV	DESCRIPTION	ECN/ECO #	DRWN/CK'D BY	DATE	APP'D BY	DATE
	A	PRODUCTION RELEASE	07-331	S.E. 7-16-07		G.A.	7-16-07

venture
MEASUREMENT
150 VENTURE BLVD.
SPARTANBURG, SC 29306

FILE TI-BINDICATOR TRPT-01
REF ----------
MATERIAL ----------
FINISH ----------

TITLE
SONOCELL
TRANSDUCER SPECIFICATIONS
(PT) PVC/CPVC BODY

PART TI-BINDICATOR TRPT-01

SCALE NONE
SIZE B
SHEET 1 of 1 RevA

NOTES (UNLESS OTHER WISE SPECIFIED):

1. USE 18ga TWISTED SHIELDED PAIR CABLE, BELDEN 8760 OR EQUIVALENT.

SONOCELL TRANSDUCER SPECIFICATIONS:

SONOCELL MODEL	NOMINAL MEASURING RANGE LIQUIDS	NOMINAL MEASURING RANGE SOLIDS	BLIND SPACE	CONSTRUCTION	INSTALLED CABLE	OPERATING TEMPERATURE	OPERATING PRESSURE	WEIGHT	FREQUENCY	BEAM ANGLE	MAXIMUM SEPARATION – TRANSDUCER TO CONTROLLER 1
SON200069 SON200058	25 FT (7.6m)	15 FT (4.6m)	12in (305mm)	STAINLESS STEEL W/TFE FACE VITON SEAL	10 FT (3.0m)	230° F (110° C) CONTINUOUS OPERATION 250° F (121° C) MAX. WASH DOWN	10 PSIG (.69 BAR) MAX.	1.8 LBS (0.9 Kg)	43 KHz	12° INCLUDED	750 FT (228m)

TRANSDUCER CABLE

INTERNAL TEMP PROBE CABLE

2.0 in (50.8mm)

5.43 in (137.9mm)

2.5 in (63.5mm)

1" NPT

SON200069
SON200058

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL PARTS SHOWN SUPPLIED BY CUSTOMER UNLESS OTHERWISE NOTED.

2. THIS INSTALLATION IS PROVIDED ONLY AS A GUIDE. LOCAL INSTALLATION CODES MUST BE FOLLOWED.

3. THE AIMING MOUNT CAN BE POSITIONED USING THE NIPPLES AS A GUIDE BEFORE THE SONOCELL IS INSTALLED. MARK THE FLOOR AND BASE PLATE ORIENTATION AND TIGHTEN THE TOP CUP BOLTS FIRMLY BEFORE REMOVING AIMING MOUNT TO INSTALL THE TRANSDUCER.

4. 1 X 10" NIPPLE SUPPLIED WITH AIMING KIT PART NUMBER 29-1029-07

5. MAXIMUM DIAMETER REQUIRED TO INSTALL/REMOVE ANY SONOCELL TRANSDUCER FROM TOP OF BIN. OPENING CAN BE SIZED AS REQUIRED TO FIT THE TRANSDUCER USED OR IF ACCESS TO INSTALL SONOCELL IS FROM THE BOTTOM. ALLOW SUFFICIENT SIDEWALL CLEARANCE FOR THE TRANSDUCER TO BE AIMED.
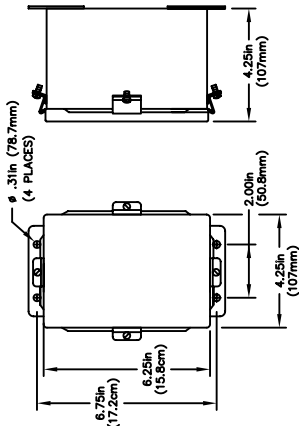
6. TRIM GASKET AS REQUIRED

7. PROVIDE SUFFICIENT FLEXIBLE CONDUIT LENGTH (OR A SERVICE LOOP) TO ALLOW FOR SWIVELING AND REMOVAL OF THE SONOCELL TRANSDUCER ASSEMBLY WITHOUT DISASSEMBLING THE CONDUIT.

8. SMALLER CONDUIT DIAMETER IS ACCEPTABLE. USE APPROPRIATE REDUCERS AS REQUIRED.

9. TIGHTEN BOLTS ON TOP CUP UNTIL BALL SWIVEL IS SNUG. MOVE SONOCELL TRANSDUCER TO DESIRED POSITION. TIGHTEN BOLTS TO PREVENT SONOCELL FROM MOVING.

10. SEAL GAP ON BALL AS REQUIRED WITH RTV 738 (NON-ACETIC ACID BASED) OR EQUIVALENT.

11. BOLT CIRCLE DIAMETER MATCHES AN 8" PVC BLIND FLANGE

12. FLANGE USED WHEN SONOCELL IS INSTALLED THRU AN ACCESS OPENING >6" (REF PN 39-1174-01).

13. FOR "SWING" IN INSTALLATIONS, USE HOLE TO FASTEN ROPE TO SONOCELL AND PIPE.

REVISIONS

		ECN/ECO #	DRWN/CK'D BY DATE	APP'D BY DATE
A	PRODUCTION RELEASE		HLK 8-22-02	HLK 8-22-02
B	INCORP BY BvC	4918	HLK 8-22-02	HLK 8-22-02
C	GENERALIZED MANUFACTURER	07-331	S.E. 7-16-07	G.A. 7-16-07

8X ø875 THRU
ON A 11.75 B.C.

7.25 -INCH DIAMETER
ACCESS OPENING [5]

45° TYP

FLANGE, [12] [11]

AIMING MOUNT ASSEMBLY.
(Supplied by Manufacturer) [3]

TOP VIEW
AND ACCESS OPENING W/ FLANGE

GASKET
(Supplied by Manufacturer) [6]

15° TILT

[13] [10] [9] (3PLS)

1-INCH FLEXIBLE WATER TIGHT
CONDUIT TO J-BOX (AS REQUIRED) [8] [7]

1-INCH
CONDUIT FITTING

1-INCH COUPLING

1x6-INCH NIPPLE
(Supplied by Manufacturer)

FLANGE,
(TYP.) [11] [12]

6-INCH CONCRETE

1x10-INCH NIPPLE
(Supplied by Manufacturer) [4]

SONOCELL TRANSDUCER (TYP.)
(Supplied by Manufacturer)

SIDE VIEW

venture MEASUREMENT
150 VENTURE BLVD.
SPARTANBURG, SC 29306

FILE TI-UC-UW AIM-01

TITLE
SONOCELL TRANSDUCER
AIMING MOUNT
INSTALLATION

PART TI-UC-UW AIM-01

REF

MATERIAL
FINISH

SCALE NONE
SIZE B
SHEET 1of1 RevC

REVISIONS

		EON/ECO	DRWN/CK'D BY	DATE	APP'D BY	DATE
A	INITIAL RELEASE	07-054	S.E.	2-6-07	D.M.	2-6-07
B	CHANGED VIEW	07-331	S.E.	7-16-07	G.A.	7-16-07
C	GENERALIZED MANUFACTURER	07-333	S.E.	7-23-07	N.B.C.	7-23-07
D	CHG'D CIDULET FROM 3 TO 4 POSITION	07-368	S.E.	8-2-07	G.A.	8-2-07
E	CHG'D ILLUSTRATION FOR 61-4013-04					

NOTE (UNLESS OTHERWISE SPECIFIED):

1. THE -XXX DESIGNATION REFERS TO CABLE LENGTH OPTION IN FEET. STANDARD OPTION IS -010, OR 10 FEET (3.04m) IN LENGTH.

SHIELD (GRN)
NO POLARITY
NO POLARITY

1/2" NPT

1/4" NPT

1.38 [34.9mm]

.25in (6.4mm) DIA.

THERMISTOR TEMPERATURE PROBE, STAINLESS STEEL FOR SONOCELL
(P/N 61-6018-02-XXX) 1

1" NPT

PIVOT POINT

1" NPT (FEMALE)

4.9in (124mm)

6.00in (152mm)

DIRECTIONAL AIMING MOUNT
(P/N 39-1024-01)

4.25in (107mm)

ø .31in (78.7mm) (4 PLACES)
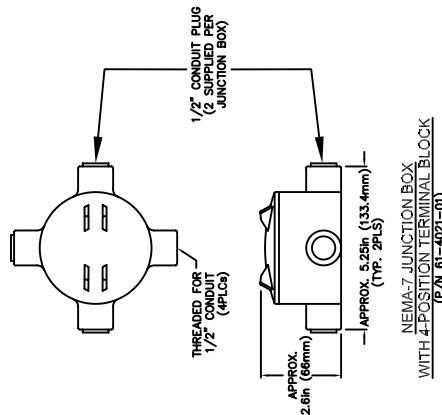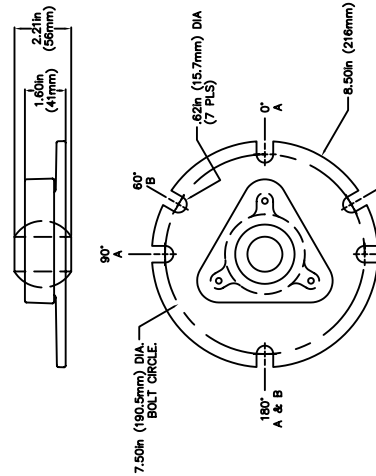
2.00in (50.8mm)

4.25in (107mm)

6.25in (15.8cm)

6.75in (17.2cm)

NEMA-4X STAINLESS STEEL JUNCTION BOX WITH 9-POSITION TERMINAL BLOCK
(P/N 61-4018-01)

2.21in (56mm)

1.60in (41mm)

.62in (15.7mm) DIA (7 PLS)

0° A

60° B

300° B

90° A

270° A

180° A & B

8.50in (216mm)

7.50in (190.5mm) DIA. BOLT CIRCLE.

4-BOLT MOUNTING PATTERN, SEE A
3-BOLT MOUNTING PATTERN, SEE B

AIMING MOUNT
(P/N 39-2049-01)

4.10" (104.1mm)

4.90" (124.5mm)

3.00" (76.2mm)

2.20" (55.9mm)
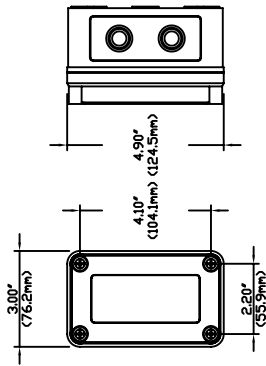
NEMA-4X PLASTIC JUNCTION BOX WITH 6-POSITION TERMINAL BLOCK
(P/N 61-4013-04)

1/2" CONDUIT PLUG (2 SUPPLIED PER JUNCTION BOX)

THREADED FOR 1/2" CONDUIT (4PLCs)

APPROX. 2.6in (66mm)

APPROX. 5.25in (133.4mm) (TYP. 2PLS)

NEMA-7 JUNCTION BOX WITH 4-POSITION TERMINAL BLOCK
(P/N 61-4021-01)

Ventura
MEASUREMENT
150 VENTURE BLVD.
SPARTANBURG, SC 29306

FILE: TI-UC-UW TRACC-01

UNIFORMED TOLERANCES
DECIMALS .XX ±.03 .XXX ±.005
ANGLES ±1/2°
SECTION A-A WHERE UNLESS JOB
D - CRITICAL DIM, OR NOTE

TITLE: **SONOCELL TRANSDUCER OPTIONAL ACCESSORIES**

REF: -------- --------

MATERIAL: --------

FINISH: --------

PART: **TI-UC-UW TRACC-01**

SCALE: NONE

SIZE: B

SHEET: 1 of 1

REVISIONS

| A | INITIAL RELEASE | | | |

ECN/ECO	DRWN/CK'D BY	DATE	APP'D BY	DATE
07-331	S.E.	7-16-07	G.A.	7-16-07

FM CONTROLLED DOCUMENT
NO CHANGES TO THIS DRAWING
WITHOUT PRIOR FM APPROVAL

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. NO CHANGES TO THIS DOCUMENT ALLOWED WITHOUT PRIOR FACTORY MUTUAL APPROVAL.

2. CONDUIT SEAL MUST BE INSTALLED OUTSIDE HAZARDOUS WALL AT 18" MAXIMUM.

3. SONOCELL MUST BE INSTALLED BY QUALIFIED PERSONNEL.

4. INSTALLATION MUST BE IN ACCORDANCE WITH ANSI/ISA RP12.6 AND THE NEC ANSI/NFPA 70 FOR FACTORY MUTUAL APPROVAL

5. CABLES FROM SONOCELL MUST BE ROUTED THROUGH CONDUIT FROM SONOCELL TO CONDUIT SEAL.

6. ALL WIRING SHOWN SHEET 2 OF 2 CUSTOMER INSTALLED.

7. ROUTE ALL A.C. WIRING SEPARATE FROM ALL OTHER WIRING.

8. CONTROL ROOM EQUIPMENT CONNECTED TO THE NON-HAZARDOUS LOCATION EQUIPMENT MUST NOT USE OR GENERATE MORE THAN 250V.

9. HAZARDOUS LOCATION CONDUIT SEALS MUST BE INSTALLED IMMEDIATELY ADJACENT TO SONOCELLS AND REMOTE TEMPERATURE SENSOR. USE APPROVED SEALS SUCH AS O-Z/GEDNEY TYPE EY OR EZS, OR EQUIVALENT. FITTING ON TEMPERATURE SENSOR IS THREADED TO FIT 1/2" NPT SEAL. SONOCELL THREADS ARE 1" NPT.

venture
MEASUREMENT
150 VENTURE BLVD.
SPARTANBURG, SC 29306

TITLE
BINDICATOR
SONOCELL INSTALLATION
FM APPROVED

PART
TI-2121

SCALE	NONE
SIZE	B
SHEET	1 of 2 Rev A

REMOTE TEMPERATURE SENSOR

TO ELECTRONIC CONTROLLER

APPROVED CONDUIT SEAL

TO ELECTRONIC CONTROLLER

18"

NON-HAZARDOUS LOCATION

HAZARDOUS LOCATION

Class I, II, III, Division 1, Group C, D, E, F AND G.

TYPICAL INSTALLATION

THIS DRAWING APPLIES TO THE REMOTE TEMPERATURE SENSOR AND TO THE FOLLOWING FM-APPROVED SONOCELLS:

Model SON200069	Model SON200062
Model SON200058	Model SON200063
Model SON200064	Model SON200068
Model SON200059	Model SON200087
Model SON200074	Model SON200072
Model SON200077	Model SON200073
Model SON200084	Model SON200082
Model SON200057	Model SON200083

V.   ELECTRICAL INSTALLATION

⚠ WARNING: VERY HIGH VOLTAGE IS PRESENT. REMOVE POWER FROM THE UNIT BEFORE INSTALLING, REMOVING, OR MAKING ADJUSTMENTS

GENERAL SAFETY

When using electrical equipment, you should always follow basic safety precautions, including the following:

- The installation and wiring of this product must comply with all national, federal, state, municipal, and local codes that apply.

- Properly ground the enclosure to an adequate earth ground.

- Do not modify any factory wiring. Connections should only be made to the terminals described in this section.

- All connections to the unit must use conductors with an insulation rating of 300 V minimum, rated for 212º F (105º C), a minimum flammability rating of VW-1, and be of appropriate gauge for the voltage and current required (see specifications).

- Do not allow moisture to enter the electronics enclosure. Conduit should slope downward from the unit housing. Install drip loops and seal conduit with silicone rubber product.

DISCONNECT REQUIREMENTS FOR PERMANENTLY INSTALLED EQUIPMENT

A dedicated disconnecting device (circuit breaker) must be provided for the proper installation of the unit. If independent circuits are used for power input and main relay outputs, individual disconnects are required.

Disconnects must meet the following requirements:

- Located in close proximity to the device

- Easily accessible to the operator

- Appropriately marked as the disconnect for the device and associated circuit

- Sized appropriately to the requirements of the protected circuit (See specifications)

WIRING TRANSDUCER AND TEMPERATURE PROBE TO JUNCTION BOX

Avoid cutting the transducer cable if possible. See Figure 4: Wiring Transducers to Controller.

1. Transducer cable — connect the cable to the junction box terminals.
2. Optional temperature probe — connect the cable to the junction box terminals.

⚠ CAUTION: DO NOT RUN OTHER CABLES OR WIRES THROUGH THE SAME CONDUIT WITH THE TRANSDUCER AND TEMPERATURE PROBE CABLES. DO NOT ROUTE THE TRANSDUCER/JUNCTION BOX CABLES IN THE SAME CONDUIT WITH THE SERIAL DATA BUS CABLES.
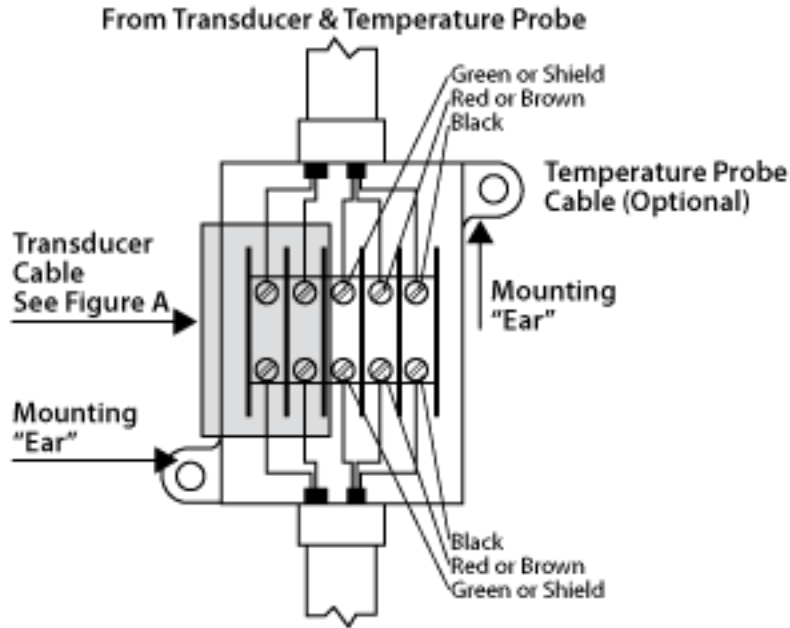
Notes:

1. Seal all conduit fittings against water entry. Install drain holes at conduit's lowest elevation(s) to allow condensation to drain.

2. Wiring for transducer, from junction box to controller: Use Belden 8760 two-conductor twisted shielded pair cable. Maximum lengths are:

    •   56T-25 — 750′ (228 m)

    •   56T-50 — 1000′ (304 m)

3. For runs up to 1200 ft (365 m) for all transducers, RG62U coaxial cable can be substituted.

4. Wiring for temperature probe (optional) from junction box to controller: Use Belden 8790 two conductor twisted shielded pair cable.

5. All wiring routed between junction boxes and controller must be continuous (no splices).

WIRING JUNCTION BOX TO CONTROLLER

1. The Scanner PCB can be temporarily removed from the controller to make wiring easier.

See Figure 4: Wiring Transducers to Controller for wiring at the junction box.

    •   Transducer Interconnect — cut the shield wire at the J-Box end of the cable only. Connect this end of the cable to the junction box terminals.

    •   Temperature probe Interconnect — connect one end of the cable to the junction box terminals.

2. If wiring a single transducer to the controller (see Appendix E)

    •   Connect the transducer wiring to TB7 on the motherboard (on right side).

    •   Connect the temperature probe wiring (optional) to TB6 on the motherboard (to left of TB7).

3. If wiring multiple transducers to the controller (see Appendix E)

    •   Connect the transducer wiring to the designated terminals on the Scanner PCB.

    •   Connect the temperature probe wiring (optional) to the designated terminals on the Scanner PCB.

From Transducer & Temperature Probe

Green or Shield
Red or Brown
Black

Temperature Probe
Cable (Optional)

Transducer
Cable
See Figure A

Mounting
"Ear"

Mounting
"Ear"

Black
Red or Brown
Green or Shield

5600 Series
Wiring for Temperature Probe to Contoller

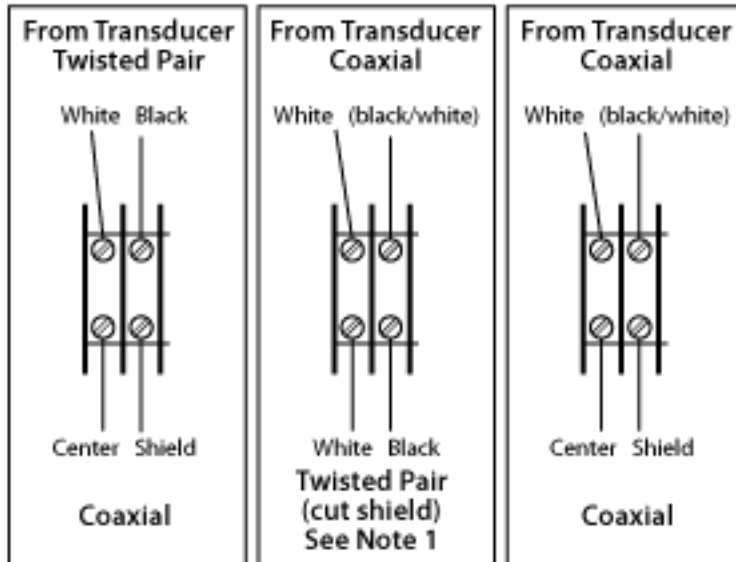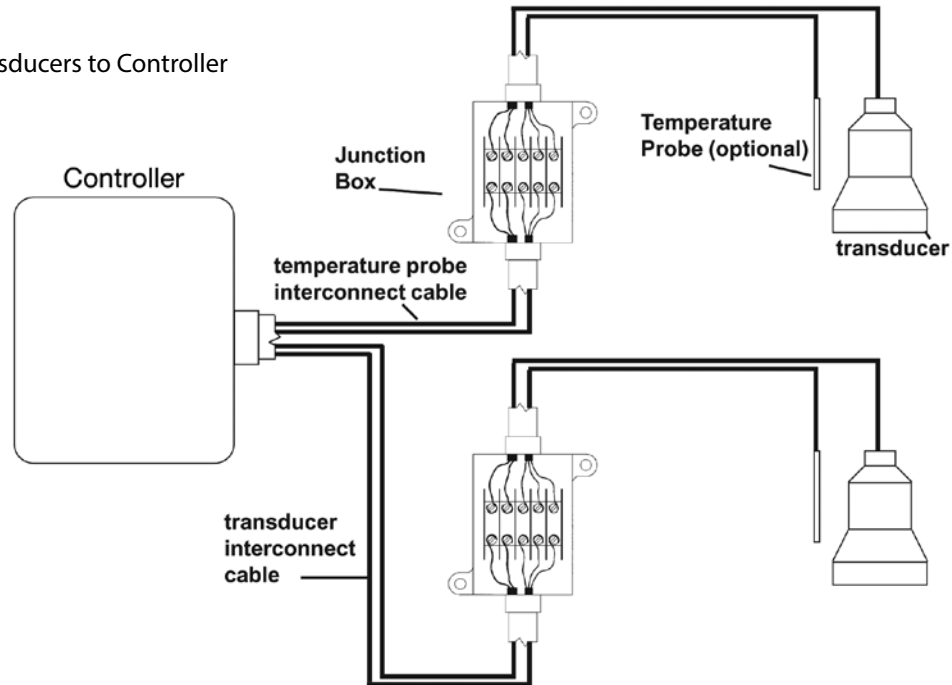| From Transducer Twisted Pair	From Transducer Coaxial	From Transducer Coaxial
White Black	White (black/white)	White (black/white)
Center Shield	White Black	Center Shield
Coaxial	Twisted Pair (cut shield) See Note 1	Coaxial

Figure 4: Wiring Transducers to Controller

The current output transmitter drives a maximum load of 600 ohms. If an external current loop power supply is provided, the transmitter drives a maximum load of 1,000 ohms. Multiple current outputs share a common lowside.
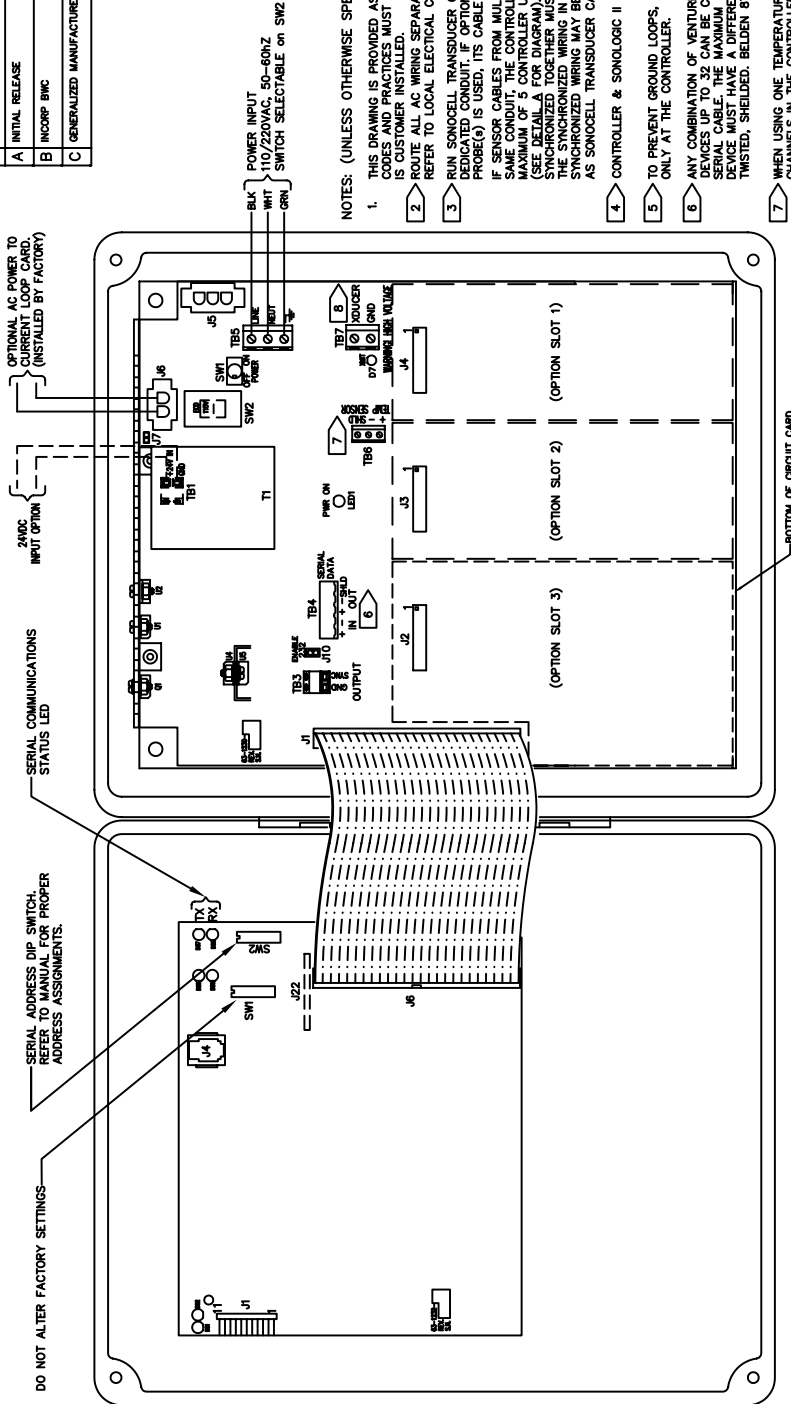
SEALING OPENINGS IN ENCLOSURE

After you have completed installation of the conduit and cables, seal around the openings in the controller enclosure to prevent moisture entry.

Caution: Only use Sikaflex™ 1A polyurethane sealant or Dow Corning RTV 739 or RTV 738. Other sealants may contain acetic acid, which is harmful to electronics.

SYNCHRONIZATION OF TRANSDUCERS

If you use the same conduit to run transducer cables from more than one SonoTracker Series controller, the units must be synchronized. To do this, wire the synchronize terminal blocks (TB3) on the main boards of the controller to each other. TB3 is on the left side of the motherboard, to the right of the ribbon cable. Refer to Appendix E. The synchronize cable can be run in the same conduit as the transducer cable.

DC POWERED CONTROLLER CURRENT OUTPUT CARD
(SLOT 3 ONLY)

2 CHANNEL ANALOG OUTPUT
(63-1260-13)
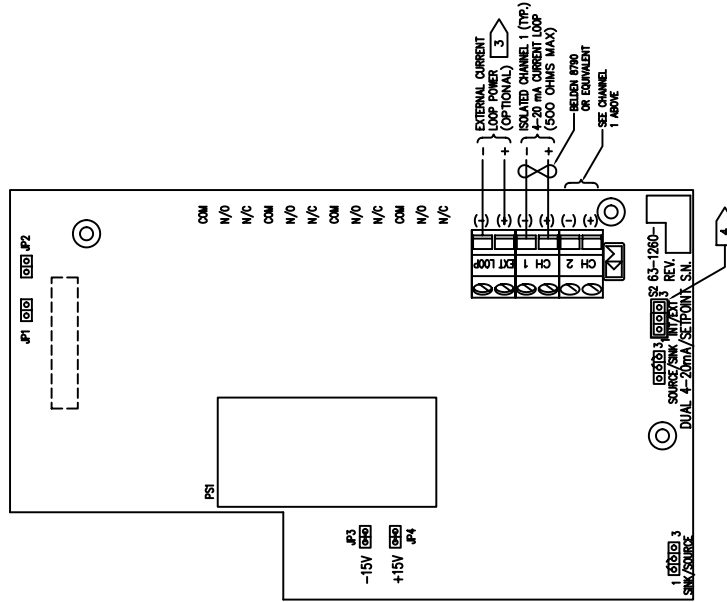
NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DC POWERED VERSION OF CONTROLLER ANALOG OUTPUT CARD FOR SLOT 3 ONLY.

2. MAXIMUM OF 2 ANALOG OUTPUTS PER SONOCELL TRANSDUCER.

3. MAXIMUM EXTERNAL LOOP VOLTAGE IS 24VDC. THE MAXIMUM LOOP RESISTANCE WHICH CAN BE DRIVEN PER FORMULA BELOW:

$$Rmax(\text{MAXIMUM RESISTANCE}) = \frac{Vext\ (\text{EXT. VOLTAGE}) - 4V}{20mA}$$

4. INSTALL JUMPER IN POSITION S2-2 & S2-3 (EXT) WHEN EXTERNAL CURRENT LOOP IS USED.

EXTERNAL CURRENT LOOP POWER (OPTIONAL)

ISOLATED CHANNEL 1 (TYP.) 4-20 mA CURRENT LOOP (500 OHMS MAX)

BELDEN 8790 OR EQUIVALENT SEE CHANNEL 1 ABOVE

REVISIONS

		#	DATE		DATE
A	INITIAL RELEASE		J.BAUER 5-25-01	R.MARTIN 7-5-01	
B	GENERALIZED MANUFACTURER	07-331	S.E. 7-16-07	G.A. 7-16-07	

REVISIONS

		DATE		DATE
A	INITIAL RELEASE	J.BAUER 5-24-01	R.MARTIN	7-5-01
B	GENERALIZED MANUFACTURER	07-331	S.E. 7-16-02	G.A. 7-16-02

AC POWERED CONTROLLER CURRENT OUTPUT CARDS
(SLOT 3 ONLY)

TO CONTROLLER MOTHERBOARD J6

2-CHANNEL CURRENT CARD (63-1241-03)

EXTERNAL CURRENT LOOP POWER (OPTIONAL)
ISOLATED CHANNEL 1 (TYP.)
4-20 mA CURRENT LOOP (600 OHMS MAX)
BELDEN 8760 OR EQUIVALENT
SEE CHANNEL 1 WIRING ABOVE

EXT LOOP S2 EXT INT
63-1241- REV. S.N.

4-CHANNEL CURRENT CARD (63-1241-02)

8-CHANNEL CURRENT CARD (63-1241-01)

Rmax(MAXIMUM RESISTANCE) = Vext (EXT. VOLTAGE) − 4V / 20mA

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. AC POWERED VERSION OF CONTROLLER ANALOG OUTPUT CARD FOR SLOT 3 ONLY.
2. MAXIMUM OF 2 ANALOG OUTPUTS PER SONOCELL TRANSDUCER.
3. MAXIMUM EXTERNAL LOOP VOLTAGE IS 24VDC. THE MAXIMUM LOOP RESISTANCE WHICH CAN BE DRIVEN PER FORMULA BELOW:
4. INSTALL JUMPER IN POSITION S2-2 & S2-3 (EXT) WHEN EXTERNAL CURRENT LOOP IS USED.

venture MEASUREMENT
150 VENTURE BLVD.
SPARTANBURG, SC 29306

TITLE: CURRENT OUTPUT CARD AC POWERED
PART: TI-UC-UW XMT-01
FILE: TI-UC-UW XMT-01
SCALE NONE SIZE B SHEET 1of1 RevB

POINT LEVEL INPUT CARD
(SLOT 2 & 3 ONLY)

J1 (on far side)

Pin 1

CH 1

CH9
POINT LEVEL INPUT.
5mA CURRENT SENSE

BELDEN 8760 OR EQUIVELENT

AC POWERED CONTROLLER COMBINATION (SETPOINT/ANALOG) OUTPUT CARDS
(SLOT 3 ONLY)

REVISIONS

		ECN/ECO #	DATE	DRWN/CKD BY	APP'D BY
A	INITIAL RELEASE		DATE J.BAUER 5-24-01 S.E. 7-16-07	R.MARTIN 7-5-01	G.A. 7-16-07
B	GENERALIZED MANUFACTURER	07-331			
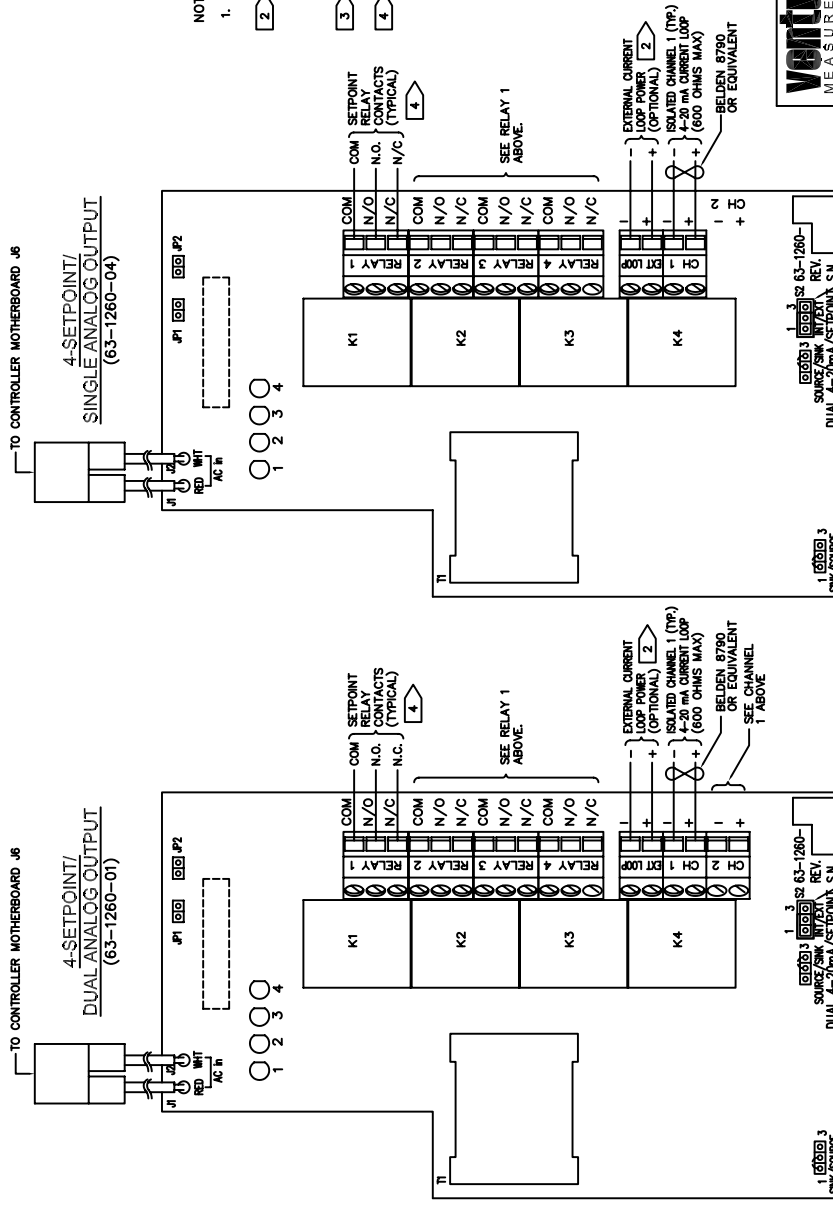
NOTES: (UNLESS OTHERWISE SPECIFIED)

1. AC POWERED VERSION OF ULTRAWAVE COMBINATION RELAY AND ANALOG OUTPUT CARD FOR MOTHERBOARD OPTION SLOT 3 ONLY.

2. MAXIMUM EXTERNAL LOOP VOLTAGE IS 24VDC. THE MAXIMUM LOOP RESISTANCE WHICH CAN BE DRIVEN PER FORMULA BELOW:

$$R_{max}(\text{MAXIMUM RESISTANCE}) = \frac{V_{ext}(\text{EXT. VOLTAGE}) - 4V}{20mA}$$

3. INSTALL JUMPER IN POSITION S2-2 & S2-3 (EXT) WHEN EXTERNAL CURRENT LOOP IS USED.

4. MAXIMUM RELAY RATING:
   = 30VDC, 10AMP
   = 120VAC, 10AMP (RESISTIVE LOAD)
   = 240VAC, 8AMP (RESISTIVE LOAD)

4-SETPOINT/ SINGLE ANALOG OUTPUT (63-1260-04)

TO CONTROLLER MOTHERBOARD J6

COM COM N.O. N/C — SETPOINT RELAY CONTACTS (TYPICAL)

SEE RELAY 1 ABOVE.

RELAY 1 / RELAY 2 / RELAY 3 / RELAY 4

K1 / K2 / K3 / K4

EXTERNAL CURRENT LOOP POWER (OPTIONAL)
ISOLATED CHANNEL 1 (TYP.)
4-20 mA CURRENT LOOP (600 OHMS MAX)
BELDEN 8790 OR EQUIVALENT

EXT LOOP / CH 1 / CH 2

SOURCE/SINK INT/EXT
DUAL 4-20mA/SETPOINT S.N.
SINK/SOURCE

4-SETPOINT/ DUAL ANALOG OUTPUT (63-1260-01)

TO CONTROLLER MOTHERBOARD J6

COM COM N.O. N.C. — SETPOINT RELAY CONTACTS (TYPICAL)

SEE RELAY 1 ABOVE.

RELAY 1 / RELAY 2 / RELAY 3 / RELAY 4

K1 / K2 / K3 / K4

EXTERNAL CURRENT LOOP POWER (OPTIONAL)
ISOLATED CHANNEL 1 (TYP.)
4-20 mA CURRENT LOOP (600 OHMS MAX)
BELDEN 8790 OR EQUIVALENT
SEE CHANNEL 1 ABOVE.

EXT LOOP / CH 1 / CH 2

SOURCE/SINK INT/EXT
DUAL 4-20mA/SETPOINT S.N.
SINK/SOURCE

RED WHT AC In

TITLE: AC POWERED CONTROLLER COMBINATION OUTPUT CARD, RELAY/CURRENT OUTPUT

venture MEASUREMENT
150 VENTURE BLVD.
SPARTANBURG, SC 29306

FILE: TI-UC-UW CMB-01
PART: TI-UC-UW CMB-01

SCALE: NONE
SIZE: B
SHEET: 1 of 2
RevB

AC POWERED CONTROLLER COMBINATION (SETPOINT/ANALOG) OUTPUT CARDS
(SLOT 3 ONLY)

DC POWERED CONTROLLER COMBINATION (SETPOINT/ANALOG) OUTPUT CARDS
(SLOT 3 ONLY)

4-SETPOINT/ SINGLE ANALOG OUTPUT
(63-1260-14)

4-SETPOINT/ DUAL ANALOG OUTPUT
(63-1260-11)

SETPOINT RELAY CONTACTS (TYPICAL) 4

COM
N.O.
N.C.

SEE RELAY 1 ABOVE.

COM / N/O / N/C — RELAY 1
COM / N/O / N/C — RELAY 2
COM / N/O / N/C — RELAY 3
COM / N/O / N/C — RELAY 4

EXTERNAL CURRENT LOOP POWER (OPTIONAL)
ISOLATED CHANNEL 1 (TYP.) 2
4-20 mA CURRENT LOOP (600 OHMS MAX)
BELDEN 8790 OR EQUIVALENT
SEE CHANNEL 1 ABOVE.

EXT LOOP — CH1 — CH2

SOURCE/SINK INT/EXT SETPOINT S.N.
DUAL 4-20mA/SETPOINT
SINK/SOURCE
S2 63-1260- REV.

JP1   JP2
JP3 -15V
JP4 +15V

K1 K2 K3 K4
PS1
1 2 3 4

3

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DC VERSION OF ULTRA-WAVE COMBINATION RELAY AND ANALOG OUTPUT CARD FOR SLOT 3 ONLY.

2 MAXIMUM EXTERNAL LOOP VOLTAGE IS 24VDC. THE MAXIMUM LOOP RESISTANCE WHICH CAN BE DRIVEN PER FORMULA BELOW:

$$R_{max}(MAXIMUM\ RESISTANCE) = \frac{V_{ext}\ (EXT.\ VOLTAGE) - 4V}{20mA}$$

3 INSTALL JUMPER IN POSITION S2-2 & S2-3 (EXT) WHEN EXTERNAL CURRENT LOOP IS USED.

4 MAXIMUM RELAY RATING:
30VDC, 10AMP (RESISTIVE LOAD)
120VAC, 10AMP (RESISTIVE LOAD)
240VAC, 8AMP (RESISTIVE LOAD)

DC POWERED CONTROLLER COMBINATION (SETPOINT/ANALOG) OUTPUT CARDS
(SLOT 3 ONLY)

2-SETPOINT/
SINGLE ANALOG OUTPUT
(63-1260-15)

2-SETPOINT/
DUAL ANALOG OUTPUT
(63-1260-12)

JP1 JP2

SETPOINT
RELAY
CONTACTS
(TYPICAL)

COM
N.O.
N.C.

SEE RELAY 1
ABOVE.

COM
N/O
N/C
COM
N/O
N/C
COM
N/O
N/C
COM
N/O
N/C

RELAY 1
RELAY 2

K1
K2

PS1

JP3 −15V
JP4 +15V

EXTERNAL CURRENT
LOOP POWER
(OPTIONAL)

ISOLATED CHANNEL 1 (TYP.)
4-20 mA CURRENT LOOP
(600 OHMS MAX)

BELDEN 8790
OR EQUIVALENT

SEE CHANNEL
1 ABOVE

−
+

EXT LOOP
CH1
CH2

63-1260
REV.
IN7EXT S.N.
SOURCE/SINK
SOURCE/SINK
DUAL 4-20mA SETPOINT

1 3
SINK/SOURCE

63-1260
REV.
IN7EXT S.N.
SOURCE/SINK
DUAL 4-20mA SETPOINT

1 3
SINK/SOURCE

REVISIONS

ECN/ECO #	REV.	DESCRIPTION	ECN/ECO DRWN/CK'D BY	DATE	APP'D BY	DATE
	A	INITIAL RELEASE	J.BAUER	5-24-01	R.MARTIN	7-5-01
07-331	B	GENERALIZED MANUFACTURER	S.E.	7-16-07	G.A.	7-16-07

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. CONTROLLER RELAY OUTPUT CARD FOR SLOTS 2 AND 3 ONLY.

2. MAXIMUM OF 8-RELAYS PER SONOCELL TRANSDUCER.

3. INSTALL THE HIGHER CAPACITY CARD IN THE FIRST AVAILABLE SLOT WHEN USING MORE THAN ONE RELAY OUTPUT CARD.

4. MAXIMUM RELAY RATING:

   30 VDC, 10A
   120VAC, 10AMP (RESISTIVE LOAD)
   240VAC, 8AMP (RESISTIVE LOAD)

RELAY OUTPUT CARDS
(SLOT 2 AND 3 ONLY)

5-CHANNEL RELAY CARD

63-1240-
REV.
S.N.

COM
N/O SETPOINT
N/C RELAY CONTACTS (TYPICAL)

SEE CHANNEL 1 (TYPICAL)

K1 K3 K5
K2 K4

CH1 CH2 CH3 CH4 CH5

8-CHANNEL RELAY CARD

63-1240-
REV.
S.N.

COM SETPOINT
N/O RELAY CONTACTS (TYPICAL)
N/C

SEE CHANNEL 1 (TYPICAL)

K1 K3 K5 K7
K2 K4 K6 K8

CH1 CH2 CH3 CH4 CH5 CH6 CH7 CH8

venture
MEASUREMENT
150 VENTURE BLVD.
SPARTANBURG, SC 29306

TITLE: RELAY OUTPUT CARD

PART: TI-UC-UW RLY-01

FILE: TI-UC-UW RLY-01

SCALE: NONE
SIZE: B
SHEET 1 of 1
RevB

VI. SET-UP

SETTING SERIAL ADDRESSES

The controller will monitor up to 16 channels, with each channel having its own address. The SW2 switch, located on the Display PCB inside the door of the controller, sets the base address for channel 1. See Figure 2-4: SW2 on the Display PCB. The addresses for the remaining channels (if there is more than one) will automatically be set in sequential order. For example, if the controller is monitoring 8 transducers and SW2 is set for address 8, channel 1 will be address 8, channel 2 will be address 9, channel 3 will be address 10, etc. The SonoTracker Series controller supports a total of 256 addresses (range of 0-255). Setting the starting address is done by positioning the rocker-arm switches (S1 - S8) on SW2 to the binary equivalent of the address number. Figure 3-5: Address Selections shows how the switches are set in binary sequence for the first 16 (0 - 15) and last two (254 and 255) addresses. The SonoTracker Series controller counts a block of eight serial addresses for each Scanner PCB in the controller, even if you do not enable all channels on the Scanner PCB. If any math channels are enabled, the math channel serial addresses begin after the block of monitoring channel addresses.

EXAMPLE:

The SonoTracker Series controller has one Scanner PCB, with a total capacity of 8 monitoring channels, but you enable only 7 monitoring channels. You enable channel 9, the first available math channel. You set the base serial address to 0. The serial addresses are:

- Addresses 0 through 6 for the monitoring channels
- Address 8 for the math channel

Note: Address 7 is not being used for the SonoTracker Series controller.

Note: Setting the addressing dipswitch is not required unless you are using the serial port.

Figure 5: SW2 on the Display PCB
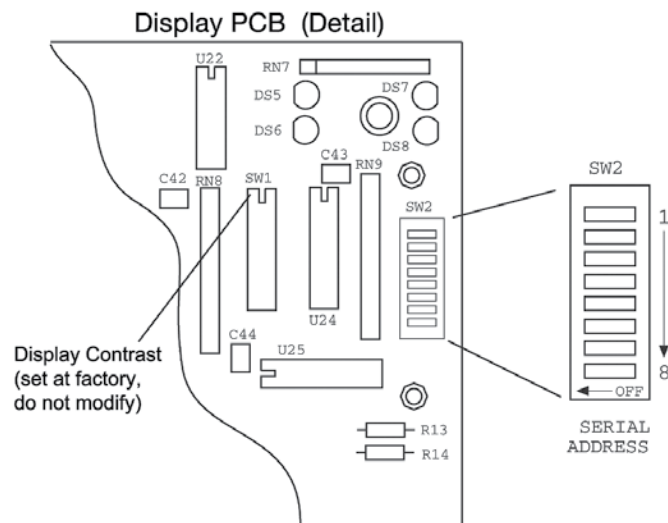
Figure 6: Address Selections - 0 = Off, 1 = On

Binary					Decimal			
S8	S7	S6	S5	S4	S3	S2	S1	ADDR
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	1	0	2
0	0	0	0	0	0	1	1	3
0	0	0	0	0	1	0	0	4
0	0	0	0	0	1	0	1	5
0	0	0	0	0	1	1	0	6
0	0	0	0	0	1	1	1	7
0	0	0	0	1	0	0	0	8
0	0	0	0	1	0	0	1	9
0	0	0	0	1	0	1	0	10
0	0	0	0	1	0	1	1	11
0	0	0	0	1	1	0	0	12
0	0	0	0	1	1	0	1	13
0	0	0	0	1	1	1	0	14
0	0	0	0	1	1	1	1	15
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
1	1	1	1	1	1	1	0	254
1	1	1	1	1	1	1	1	255

INSTALLING PCBS

The SonoTracker Series controller arrives from Bindicator with the specified PCBs installed. However, you can expand your system. There are three positions on the motherboard of the controller that accept PCBs. Note the following restrictions on PCB positions in the controller:

Position 1:

2-, 4-, or 8-channel Scanner PCB only

Refer to Appendix E and follow this procedure to install an optional PCB into the controller:

1. Open the door of the controller.

2. Turn off the SonoTracker Series controller — the AC switch is in the upper right corner of the PCB.

3. Place the PCB in the designated position on the motherboard. Be sure the PCB connector inserts completely into the motherboard connector.

4. Secure the PCB in place with the three screws supplied with the PCB.

5. Connect the field wiring to the PCB.

6. Restore power to the controller. Close the door. Installation is complete.

If you change a 2-, 4-, or 8-channel Scanner PCB on the controller, you must use the Enable functions in the Service Menu to bring the new channels on-line. Refer to Menu Descriptions for the use of those functions.

METHODS OF OPERATION

INTRODUCTION

The SonoTracker Series controller has two modes of operation:

- Channel Monitoring — level (or other indication of vessel contents) is displayed. Channel monitoring has two submodes:

  — Auto/Scan displays information on each channel sequentially.

  — Manual/Hold displays information on one channel.

The Up and Down Arrow Keys are used to manually scroll to other channels. Pressing the Scan/Hold Key switches between Auto and Manual Modes.

- Menu Operation — system parameters for display, input/output, calibration, and troubleshooting can be viewed and modified. Pressing the Menu Key while in Manual Mode accesses Menu Operation. Pressing the Scan/Hold Key switches between Auto and Manual Modes.

DISPLAY AND KEYBOARD

The SonoTracker Series controller display/keyboard panel has a liquid crystal display (LCD) made up of two 16-character lines and an integral, weather-sealed membrane keyboard. The LCD displays the vessel ID, material level (or other indication of vessel contents), menu selections, and error messages. See Figure 7: Display and Keyboard.

The controller keyboard is used to access the different menus, scroll through the vessel monitoring display screens, and enter setup and calibration parameters. The function of each key on the keyboard is described in the sections to follow.

See Figure 7: Display and Keyboard
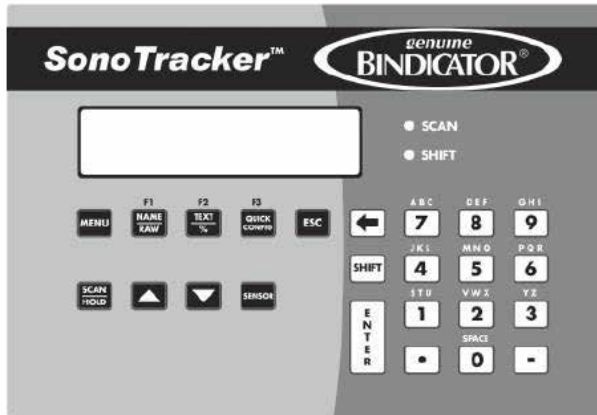
SCAN/HOLD KEY

When in RUN Mode, the controller displays the factory-set ID number (or the customer-defined ID, if input) and Material Level, Range, or Flow. The controller display can be set up to scroll automatically through the display screens for each channel (Auto Mode) or remain fixed on a selected channel (Manual Mode). The Scan/Hold Key toggles between Auto and Manual Modes:

- When the controller is in the Auto Mode, the display remains on a channel for a preset period of time before scrolling to the next channel. The preset display time can be changed to suit the operator needs, using the Display Scan Time function (see Chapter 6, Display Menu). The Auto LED to the right of the LCD is illuminated when the controller is in the Auto Mode.

- When the SonoTracker Series is in the Manual Mode, the display remains fixed on a selected channel and must be scrolled manually with the Up Arrow and Down Arrow Keys to display information on another channel. The Auto LED is off when the controller is in the Manual mode.

The Scan/Hold Key is also used to exit any function in the menu tree and return the display to the RUN Mode.

UP ARROW AND DOWN ARROW KEYS

The Up Arrow and Down Arrow Keys are used to manually scroll the display through the channels when the controller is in the Manual Mode. These keys are also used to scroll to desired values when in the menu tree, entering setup and calibration parameters.

MENU KEY

Pressing the Menu Key accesses the Main Menu. Pressing the ESC key backs through the submenus one level at a time. To scroll through the menus, use the Up and Down Arrow Keys.

Note: The controller must be in the Manual Mode (Auto LED off) to access the menus.

For example, the first screen shows:

> SonoTracker Series
> 10 Display

Press the Up Arrow Key for further options, e.g.:

> SonoTracker Series
> 20 Calibration

F1, F2, AND F3 KEYS

The Function Keys — F1, F2, and F3 — are used for lower case characters and special symbols when editing the display. From Scan mode, press HOLD then F1 to display the raw target (in inches or centimeters) from transducer face to processed echo. In flow mode, the backspace key displays the raw target. Pressing F2 changes to bar graph mode. Pressing F3 will initiate a quick configuration or re-calibration of a channel (level only). See Appendix G.

NAME	TEXT	QUICK
RAW	%	CONFIG
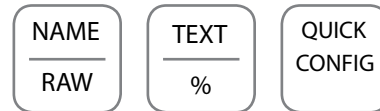
ESC KEY

The Esc Key has several functions:

- The Esc Key is used to back through the submenus one menu level at a time. Pressing this key while in the Main Menu returns the display to the RUN Mode.

- The Esc Key also has another function. The SonoTracker Series controller arrives from Bindicator with a factory-set ID number assigned to each channel. If you replaced the number with a customer-defined ID during the Startup Procedure or in the Display Menu, pressing the Esc Key while the display is in the Manual Mode (Auto LED off) briefly displays the factory-set ID.

(BACKSPACE ARROW) KEY

The Backspace key is used to back up the cursor on the LCD display when using the alphanumeric keypad.

"." (PERIOD) KEY

When the controller is in the Manual Mode, pressing the "." key briefly displays the current controller software revision letter and the date of the release.

The "." key also functions as a decimal point when entering numbers in the math channel.

ALPHANUMERIC KEYS AND SHIFT KEY

The Alphanumeric Keys (also referred to as the keypad) are used to input numeric parameters during setup and calibration and customer-defined IDs.

The Shift LED is located below the Auto LED on the faceplate. Pressing the Shift Key toggles the Shift LED on and off. The effect is described below:

- Shift LED not illuminated — pressing an Alphanumeric Key types the number shown on the key.

- Shift LED illuminated — pressing an Alphanumeric Key types a letter labeled above the key. Pressing the key repeatedly toggles the display through the three letters labeled above the key. When the desired letter is displayed, pressing the Enter Key or a different Alphanumeric Key advances the cursor one space to the right. See Figure 8: Characters Available for Customer-Defined ID.Enter Key

Figure 8: Characters Available for Customer-Defined ID

Key	Character Shift LED On	Character Shift LED Off
1	S T U	1
2	V W X	2
3	Y Z	3
4	J K L	4
5	M N O	5
6	P Q R	6
7	A B C	7
8	D E F	8
9	G H I	9
0	Space	0
.	.	:
-	-	-
Menu	+ * / @ % # &		a b c d e f g h
F1	( ) { } [] <>	i j k l m n o p
F2	! ^ $ x ` , ?;	q r s t u v w x
F3	→ ← ° & ! α σ	y z , " ' ! : ;
Auto/ Manual	- o • ° Ö Ü è ∞	

The Enter Key has several functions:

- The Enter Key is used to save in memory any parameter set up in the menus. For example, if you enter an operating span value in the Main/Calibration/Span Menu, pressing the Enter Key saves it to memory. The value remains in memory until a new value is entered.

- When entering a vessel ID, the Enter Key advances the cursor one space to the right.

- When the SonoTracker Series controller is vessel monitoring in Manual Mode, pressing the Enter Key toggles the display from numerical format to bar graph format. The display remains in the bar graph format (even when the controller is turned off and back on again) until the Enter Key is pressed to toggle back to the numerical format.

SENSOR KEY

The Sensor Key allows you to copy parameters to a different channel while remaining in a particular menu function.

For example, assume the display is showing this screen for channel 2 under the Main/Calibration/Span Menu:

> Operating Span
> > 25.0 ft
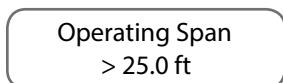
Note: The Sensor Key only works if you are at the "end" of a menu; i.e., where the screen allows you to enter a value or select from a list of choices on the display. If you press the Sensor Key, the display changes to:

```
'Enter' to Copy
    > 25.0 ft
```

Press the Up/Down Arrow Keys to switch to the previous channel (ID#01). When the display shows the desired channel, press the Enter Key. For Next and Back, the controller display actually switches to the menu tree for the selected channel.

If you do not want to switch channels but simply want to copy the Span you entered for channel 2 for use in another channel(s), press enter for Copy. The controller then asks whether you want to copy the value to all other channels or to a selected channel.

Figure 9: Level Parameters
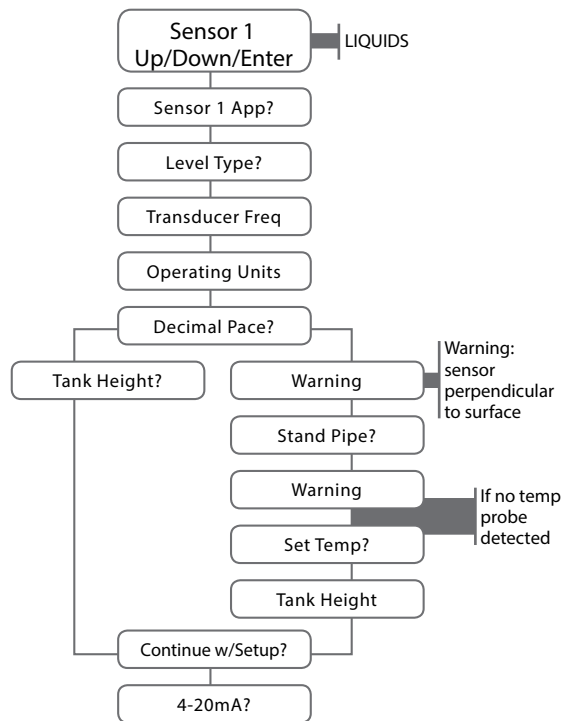
QUICK CONFIGURATION PARAMETERS

At power-up in Level applications the parameters shown in Figure 9 will appear. Selecting Yes allows the entering of the second transducer parameters or continues to auto assign channels. Selecting No completes the configuration of transducers and begins measuring. Once the Auto Assign mode is initiated, select Yes or No to Auto Set Pts, Auto Point Level, Auto PLC or Auto 4-20? In Auto Assign Mode, you are assigning the following per enabled channel for each transducer, if the PCB's are installed:

```
Set Point: 1
4-20mA: 1
```

All are assigned sequentially. Press Enter to save. Quick Config is now completed.

MENU TREE

The menu tree of the SonoTracker Series controller is used to enter and view settings, set up, calibrate, and troubleshoot for the system. There are nine submenus listed in the Main Menu:

- 10 Display: enter and view display settings
- 20 Calibration or Math Menu: calibrate the system
- 30 Relay Set Point: enter and view set point parameters
- 40 I-Output: enter and view current output parameters
- 50 Serial /PLC: enter and view serial port configurations
- 60 Transducer: configure transducer specific parameters (power, gain, etc.)
- 70 Range/Filters: configure min/max range and filters i.e. noise, Sentry™ DSP
- 90 Service Menu: turn channels on and off
  - reset parameters to default values
  - test the keyboard and non-volatile RAM
  - set up a user access code

Figures 10a - 10e show menu levels 1-3 for all parameters. These figures are used as a quick reference guide to quickly find the function to be performed. For example, to change setpoint parameters, the figure shows how this is done in the level 30 parameters.

Note: Some of the submenus are not shown in the menu tree in Figure 10a due to space constraints and will vary depending on application.

Figure 10a: 10 Display
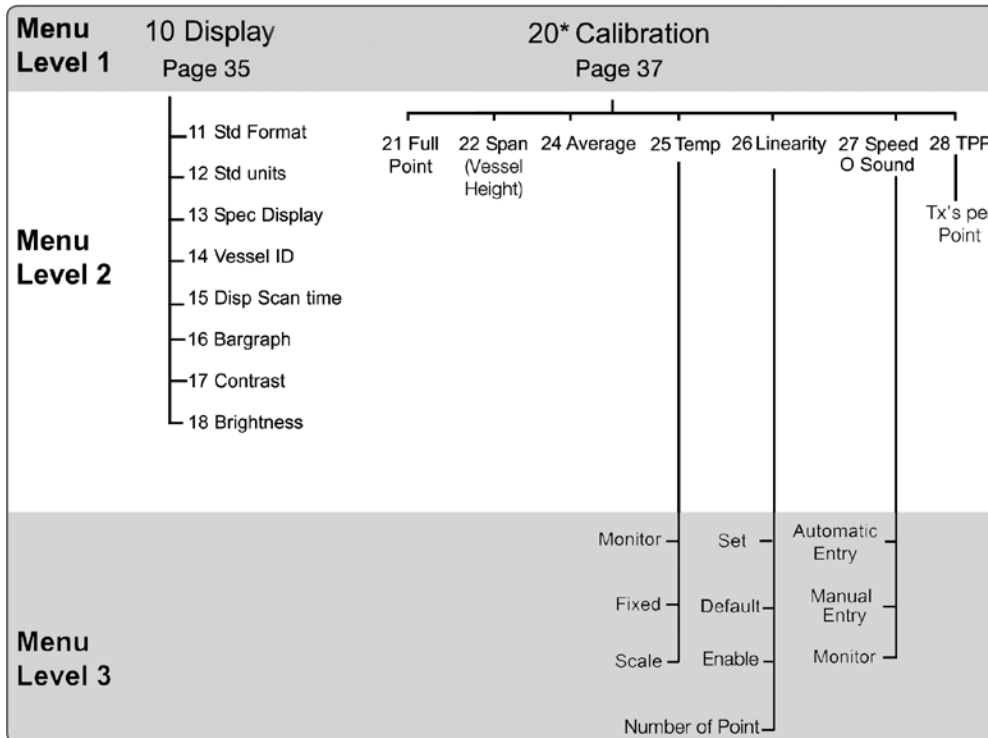
* Parameters may change for flow. See page 32.

Figure 10b: 30 Relay Set Point
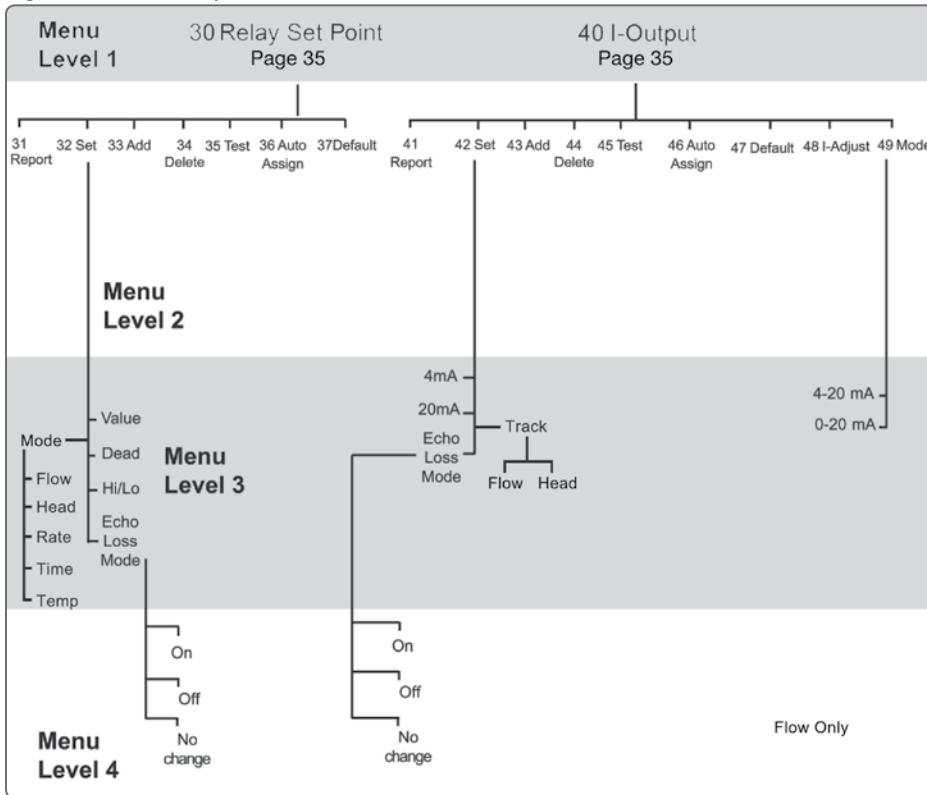
Figure 10c: 50 Serial / PLC
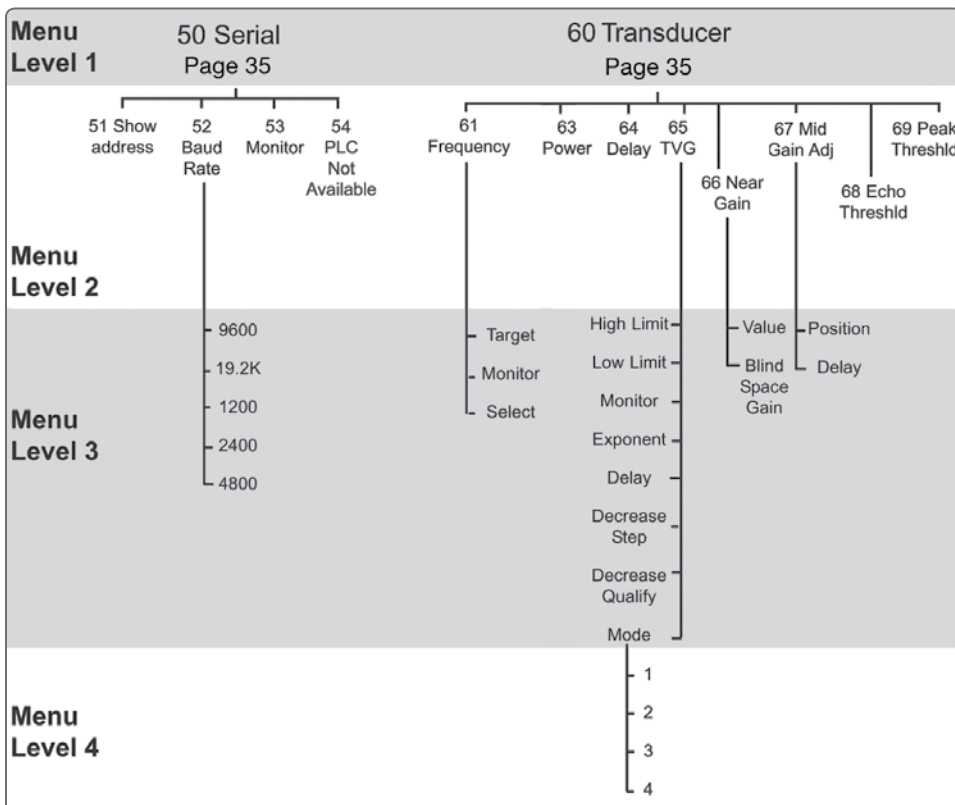
Figure 10d: 70 Range Filters
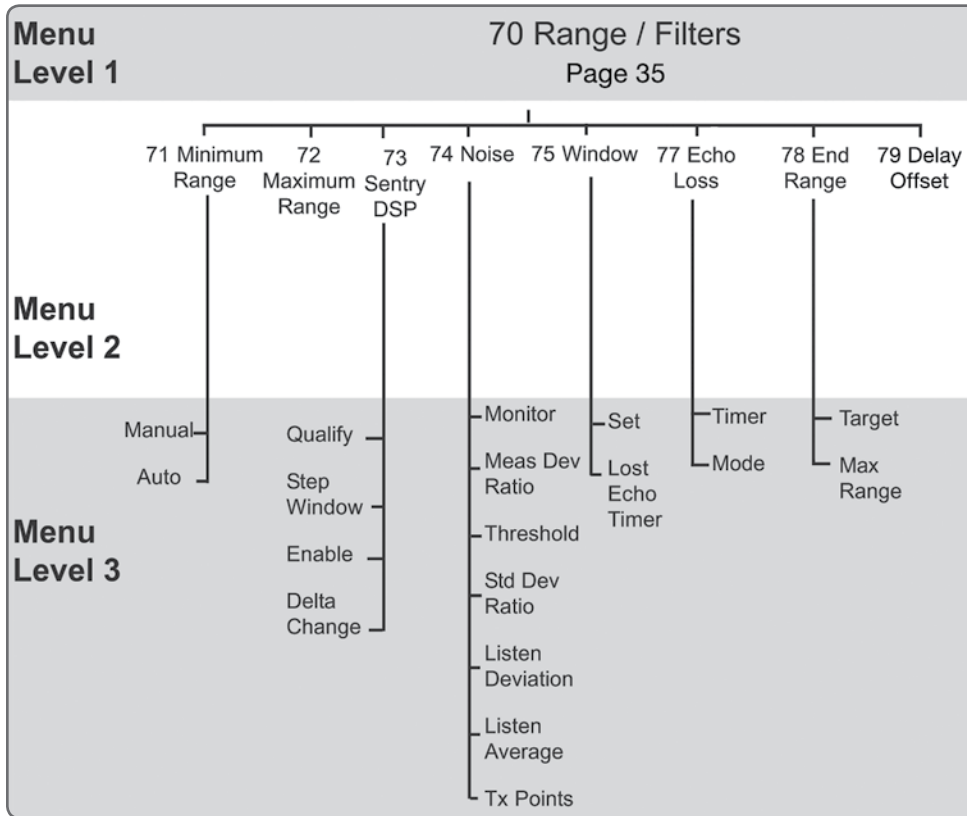
Figure 10e: 90 Service Menu
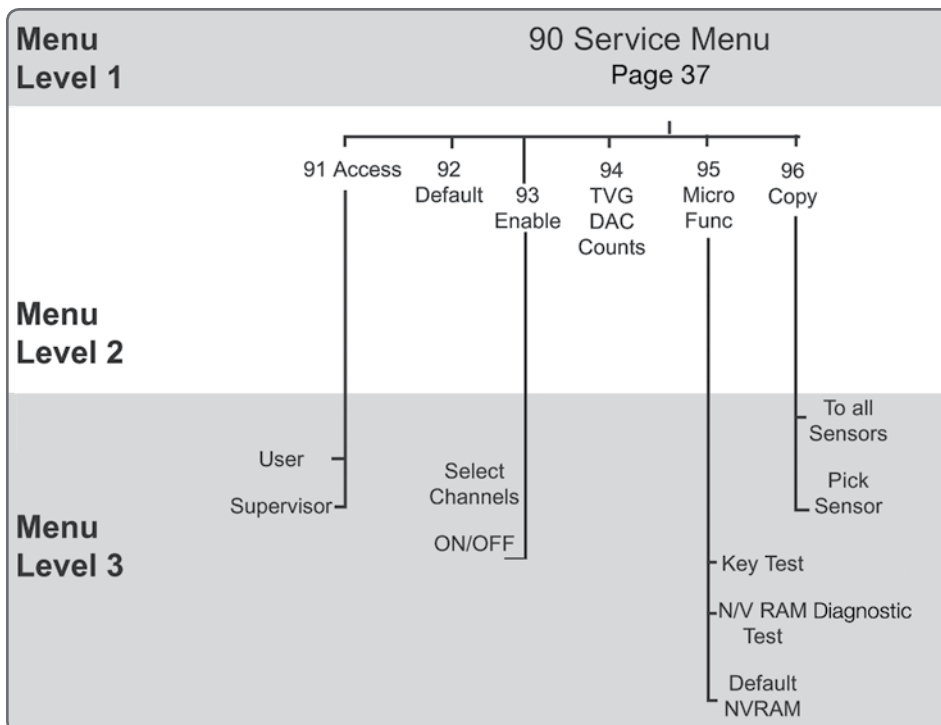
OPERATING THE SONOTRACKER SERIES IN LEVEL APPLICATIONS

INTRODUCTION

The SonoTracker Series is designed to get you up and running quickly once the system is installed. The controller guides you through the Startup Procedure. See Figure 11: Startup Procedure Diagram. During the Startup Procedure, you will be asked to input a number of parameters, including:

- Tank Height: The distance from the full point to the point where the vessel is considered empty. Material level changes within this range are displayed by the SonoTracker Series controller. See Figures 12 and 13.

Note: The maximum distance a transducer can measure depends on its frequency and the type of liquid in the vessel. Entering a value for Operating Span greater than the transducer's capability may cause erratic reading.

Note: See Calibration Menu for a description of the full point.

Figure 11: Startup Procedure Diagram
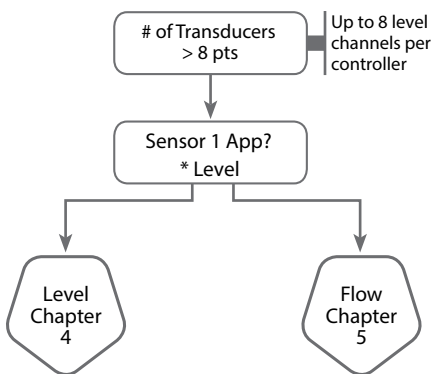
START-UP

When performing the Startup Procedure, use backspace if you make an error. The parameters can also be corrected in the Calibration Menu after you complete the Startup, or the entire Startup Procedure can be repeated by defaulting the channel in the Service Menu. Perform the Startup Procedure, as follows:

1. Apply power to the unit. If there are Scanner PCB(s) installed, the display is shown below. If not, go to step 2.

2. Use the keypad to input the number of transducers you want to set up. Press ENTER to save the value in memory.

3. Press ENTER to select Level.
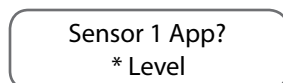
4. Press ENTER and the display shows:

> Transducer Freq
> * 43 KHz

The model number of the transducer indicates the nominal frequency of operation: SC43PT = 43KHz, SC22PT = 22KHz. Refer to the model number of the transducer for the proper frequency selection.

Use the up/down arrow keys to select the desired frequency and press ENTER.

5. Press the up/down arrows to select the desired units. Press ENTER to save.

> Operating Units?
> * Feet

6. Press the up/down arrows to select the decimal place format. Press ENTER to save.

> Decimal Place?
> * XXXX.X

Note: Make sure transducer is perpendicular to liquid level.

7. Press the up/down arrows to select standpipe. Press ENTER to save.

> Standpipe?
> * No

Note: Only if no temperature probe is detected.

8. Use the numeric keys to enter the temperature. Press ENTER to save.

> Set Temperature
> > 67.8

9. Select YES to continue through the menus as above for the second sensor, selecting vessel parameters and identification. Select NO to discontinue the setup of the remaining channels. See the Service Menu to copy all parameters to the remaining channels or cycle power to start again. Once complete, you will be given a chance to auto assign inputs and outputs. See page 18.

> Vessel Height

> Call More Chans?
> * Yes

Note: Goes on to 10 when Call More Chans is answered NO.

10. Auto assigns 4-20mA output.

> Auto 4-20mA
> * No

Notes:

1. Full Point + Span must be less than the Maximum Range for the transducer, or the SonoTracker Series will not be able to detect material levels near the bottom of the vessel.

2. If Full Point is less than the Minimum Range for the transducer, be aware that the SonoTracker Series will not detect or report material levels near the top of the Span. Full Point is normally 0.0.

Figure 12: Span Diagram
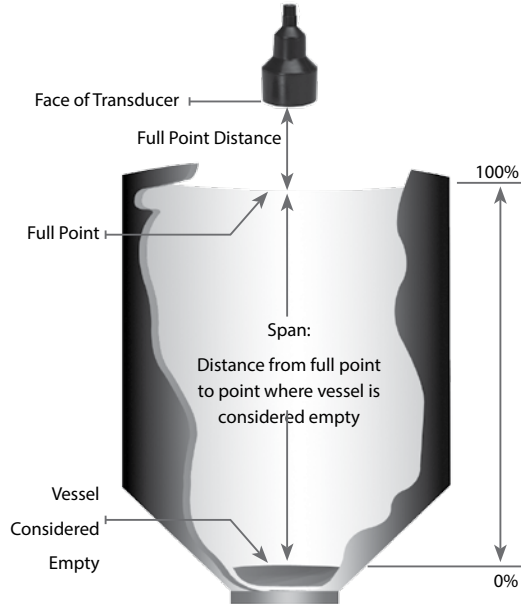
Figure 13: Examples of Effect of Full Point, Span and Mode of Display
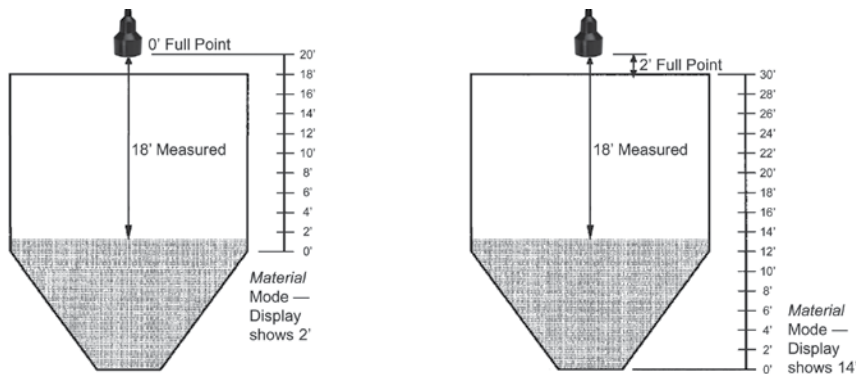
Example 1:

Span = 20' (NOT interested in material level in cone)
Full Point = 0' (Note that SonoTracker Series will not be able to detect material levels close to the transducer)

Example 2:

Span = 30' (Interested in material level in cone)
Full Point = 2'

INTRODUCTION

Refer below to the block diagram of the initial part of the Startup Procedure, and Figure 15 for the remainder of the Startup Procedure. The SonoTracker Series is designed to get you up and running quickly once the system is installed. The SonoTracker Series controller guides you through the initial Startup Procedure. During the Startup Procedure, you will be asked to input a number of parameters, including the following (See Figure 16):

- Maximum Head — The maximum head for your primary element is available from the flow chart supplied by the primary element manufacturer.

- Zero Distance — If doing a Manual Calibration during Startup, measure the zero flow distance, the distance from the face of the transducer to the bottom of the channel.

- Current Head — If doing an Auto Calibration during Startup, measure the current head height just before you input the value to perform an accurate calibration.
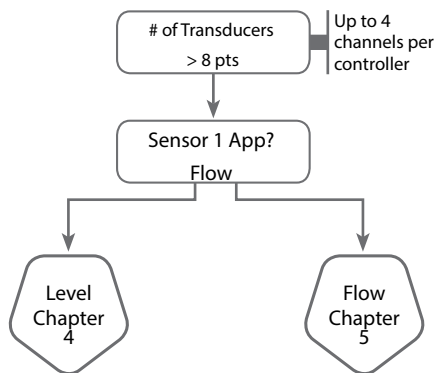
Note: The maximum distance a transducer can measure depends on the type of material being measured. Do not enter a value for Zero Distance greater than the transducer's capability. Zero Distance minus Max head must be greater than 12".

Figure 15: Flow Start-Up Procedure

Flow

| Operating Units | Inches | Centimeters | | | | | | | | | |

Primary Element	Flume					Weir				Nozzle
	Parshall	P-B	L-L	Trap	Othr	Rect	V notch	Cip	Other	Ken*
	1"	4"	4"	L60°V	Const	Cont W/O Cont	22.5°	1'	Const	6"
	2"	6"	6"	XL60°V			30°	1.5'		8"
	3"	8"	8"	2"45°V	Expo	1' 1'	45°	2'	Expo	10"
	6"	10"	10"	12"45°V		1.5' 1.5'	60°	2.5'		12"
	9"	12"	12"			2' 2'	90°	3'		16"
	1'	15"	15"			2.5' 2.5'	120°	4'		20"
	1.5'	18"	18"			3' 3'		5'		24"
	2'	21"	21"			4' 4'		6'		30"
	3'	24"	24"			5' 5'		8'		36"
	4'	27"	30"			6' 6'		10'		
	5'	30"				8' 8'				
	6'	36"				10' 10'				
	8'	42"				Othr				
	10'	48"								
	12'	60"								
		72"								

Flow Type	CFS GPS GPM GPD MGD (CMS CMH LPS LPM LPD MLD)
Flow Format	X.XXXX XXXXX XXXX.X XXX.XX XX.XXX
Total Type	CF GL MG (CM LT ML)
Totalizer Format	XXXXX0 XXXXXX XXXX.X XXX.XX XX.XXX X.XXXX XXX000 XXXX00

Zero Calibration	Auto			Manual	
	Max Head	Current Head	Zero Distance	Max Head	Zero Distance

Low Head Cutoff	
ID	

* Kennison:

The 20" Kennison Nozzle is the only nozzle size currently available. If you select another Kennison nozzle size, the display shows function not available.

Figure 16: SonoTracker Series Definitions for Flow Applications

(0.3m) Maximum

FLOW →

Zero Distance
2.0 feet

Max Head

Current Head
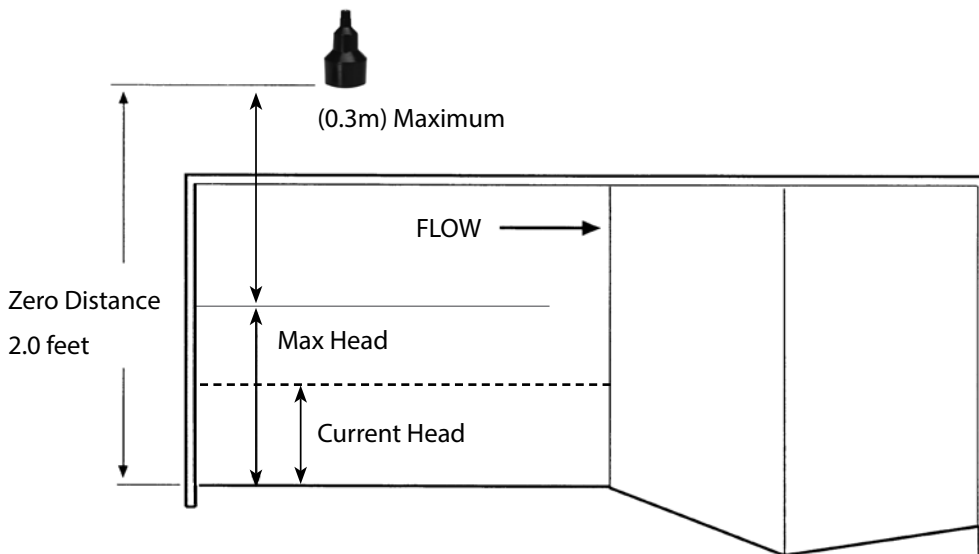
START-UP

When performing the Startup Procedure, do not worry if you make an error. The parameters can be corrected after you complete the startup, in the Calibration Menu, Figure 17, or the entire Startup can be repeated by defaulting the channel in the Service Menu. Perform the Startup Procedure, as follows:

1. Apply power to the unit. If there are Scanner PCB(s) installed, the display shows (If not, go to Step 2): Use the keypad to input the number of transducers you want to set up. Press ENTER to save the value in memory.

```
# of Transducers
  Up/Down/Enter
```

2. Press the arrow keys to select Flow and press ENTER. If a temperature compensation sensor is not connected, a warning displays stating that one was not detected. Press any key to continue.

```
Sensor 1 App
   * Flow
```

3. Press the Enter Key to select Inches or scroll with the arrow keys to select Centimeters.

```
Operating Units?
    * Inches
```

4. Press the Enter Key to select Flume, or the arrow keys to select Weir or Nozzle as the primary element.

```
Primary Element
    Flume
```
Note: If you select Flume, continue with Step 5. If you select Weir, go to Step 7. If you select Nozzle, go to Step 8.

5. Flume — The five flume selections are: Parshall, Palmer-Bowlus, Leopold-Lagco, Trapezoid, and Other. If you selected Flume in Step 5, the display shows:

```
Flume Select
  Parshall
```

Press the arrow keys to access the remaining options of the Flume Menu. Press the Enter Key for your desired option.

6. For each option, there are sub-menus. Scroll through the options and make your selection. Once selected, press ENTER and go to step 9: Select Flow Type.

```
Parshall Flume
      1"
```

7. Weir — The four Weir selections are: Rectangular, V-Notch, Cipolletti, and Other.

```
Weir Select
 Rectangular
```

Press the arrow keys to access the options of the Weir Menu. Press Enter for your desired options. Once completed, you will go to Step 9, Select Flow Type.

8. Nozzle—The only option here is Ken. Press ENTER.

> Primary Element
> Ken

Scroll through the Kennison Nozzle options with the arrow keys and press

ENTER.9.　　　Flow Type determines the units to use for measuring the flow rate. Select the Flow Type by scrolling through the options with the arrow keys. Press ENTER.

> Select Flow Type
> * CFS

10. The Flow Format allows you to choose how many digits you want to the left and right of the decimal point for displaying the flow rate. Scroll through the format options and press ENTER.

> Pick Flow Format
> * XXX.XX

Note: Weir: If you selected Other in the Menu, the controller asks you to enter a custom value for Crest Length. Use the keypad to enter the Crest Length. Press the Enter Key. The display flashes a message acknowledging your selection. Go to Step 9.

Note: CFS is cubic feet per second, GPS is gallons per second, GPM is gallons per minute, GPD is gallons per day, and MGD is million gallons per day.

11. After selecting Flow Format, the display prompts you to select the Total Type, the units to use for measuring total   flow. The display shows:

> Total Type
> * CF

An asterisk indicates the default units. CF is cubic feet, GL is gallons, and MG is million gallons.

12. After selecting the Total Type, the display prompts you to select the Total Format or Totalizer Format. This allows you to select how many digits you want to the left and right of the decimal point or how many fixed zeros you want for displaying the total flow. The display shows:

> Total Format
> XXX000

13. Use the arrow keys to scroll through the options available. Press ENTER. The display shows:

> Zero Calibration
> Auto

The SonoTracker Series controller has two methods of calibration, Auto and Manual, for a flow application. For Auto calibration, you enter the maximum head and the current head. For Manual calibration, you enter the maximum head and the zero distance. Press ENTER to select Auto or the arrow key to select Manual, then ENTER. If you select Manual, skip Step 15 and go directly to Step 16 to calculate Zero Distance.

14. For Auto and Manual calibration, the display shows:

```
Maximum Head Hgt
      > .0 in
```

Use the keypad or the up/down arrow keys to enter the Maximum Head Height, obtained from the flow chart supplied by the primary element manufacturer. Press ENTER.

15. Physically measure the Current Head. Use the keypad or the up/down arrow keys to enter the Current Head. Press ENTER.

```
Current Head?
     > .0 in
```

16. The Zero Distance shown on the display is a calculated value, for information only, and cannot be modified while in the Auto calibration. In Manual Calibration the zero distance number must be entered. Zero Distance = Current Head + Distance measured by transducer from face of transducer to liquid surface. Press Enter.

```
Zero Distance:
     > .X in
```
Warning: Zero Distance error. Possible overflow reading change distance.

17. Using the keypad, enter Low Head Cutoff and press ENTER.

```
Low Head Cutoff
     > .X in
```

18. Press ESC to enter the values to memory.

```
01  FLOW
esc to exit
```
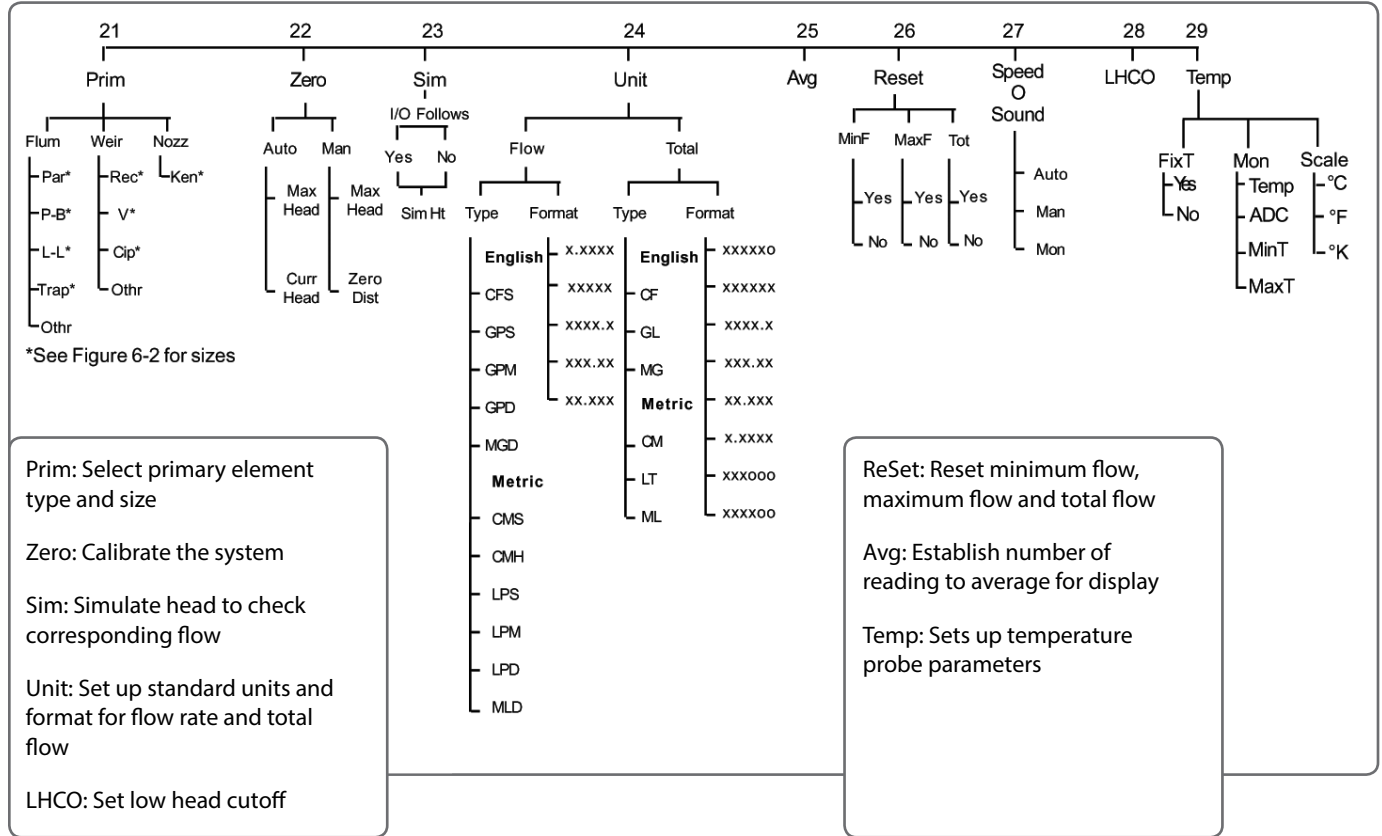
19. The display then shows:

```
Call more chans?
     * No
```

20. Select NO to exit out of the quick configuration, skipping the setup of any remaining channels; select YES to continue the configuration process on the remaining sensors. Once complete, the display will show:

```
01  FLOW
Flow: .00 CFS
```

Figure 17: Flow Calibration Menu

```
         21              22            23              24            25        26          27       28    29
        Prim            Zero          Sim            Unit           Avg      Reset      Speed     LHCO  Temp
                                   I/O Follows                                            O
                                                                                        Sound
  Flum  Weir  Nozz    Auto  Man    Yes  No      Flow        Total          MinF MaxF Tot               FixT  Mon   Scale
  Par*  Rec*  Ken*                                                                            Auto       Yes  Temp   °C
                      Max   Max    Sim Ht   Type  Format   Type  Format    Yes  Yes  Yes      Man        No   ADC    °F
  P-B*  V*             Head  Head                                          No   No   No       Mon             MinT   °K
  L-L*  Cip*                      English  x.xxxx  English  xxxxxo                                          MaxT
                      Curr  Zero   CFS     xxxxx    CF      xxxxxx
  Trap* Othr          Head  Dist   GPS     xxxx.x   GL      xxxx.x
  Othr                              GPM     xxx.xx   MG      xxx.xx
                                    GPD     xx.xxx   Metric  xx.xxx
  *See Figure 6-2 for sizes         MGD              CM      x.xxxx
                                    Metric           LT      xxxooo
                                    CMS              ML      xxxxoo
                                    CMH
                                    LPS
                                    LPM
                                    LPD
                                    MLD
```

Prim: Select primary element type and size

Zero: Calibrate the system

Sim: Simulate head to check corresponding flow

Unit: Set up standard units and format for flow rate and total flow

LHCO: Set low head cutoff

ReSet: Reset minimum flow, maximum flow and total flow

Avg: Establish number of reading to average for display

Temp: Sets up temperature probe parameters

CALIBRATION MENU

This section provides a general overview of the Calibration Menu. The Startup Procedure got your system up and running. The Calibration Menu is used to enter setup and calibration parameters if your application requires a more detailed set up, and/or to modify parameters you originally entered during startup.

21 PRIM (PRIMARY ELEMENT)

The primary element type and size were selected during the Startup Procedure. The Prim Menu allows you to display and modify the primary element type and size. The primary element type choices are:

- Flum (flume) — Parshall, Palmer-Bowlus, Leopold-Lagco, Trapezoidal, and Other

- Weir — Rectangular (with and without end contractions), V-Notch, Cipolletti, and Other

- Nozz (nozzle) — Kennison

22 ZERO

The Zero Menu allows you to display and modify the Auto or Manual calibration parameters.

The Auto parameters are:

- Max Head — The maximum head for your primary element, available from the flow chart supplied by the primary element manufacturer.

- Curr Head — The current head; to perform an accurate calibration, measure this just before you input the value.

- Zero Dist — The distance from the face of the transducer to the bottom of the channel. Zero Dist shown on the display is a calculated value, the sum of Curr Head and the distance measured by the transducer from the face of the transducer to the liquid surface. Zero Dist is shown for information only and cannot be modified while in Auto calibration.

The Manual parameters are:

- Max Head — The maximum head for your primary element, available from the flow chart supplied by the primary element manufacturer.

- Zero Dist — The measured distance from the face of the transducer to the bottom of the channel.

The numbers shown upon entry into these menus show the current values for the displayed channel. Modification of any of the calibration values is performed by direct entry using the keypad or by using the Arrow Keys to scroll to a number. When the desired number is shown, pressing the Enter Key registers the new value in memory.

23 SIM (SIMULATE)

This menu allows you to input a simulated head and display the corresponding flow, so that you can check the flow calculation against the flow values provided by the primary element manufacturer.

When in the Sim Menu, a prompt, asks I/O Follows Sim?. If you select Yes, the setpoints, current output, etc. respond to the simulated value as if it was the actual value. If you select No, the setpoints, current output, etc. are not affected by the simulation.

The display then shows the last Simulated Head input. Modification of the Simulated Head is performed by direct entry using the keypad or by using the Arrow Keys to scroll to a number. When the desired number is shown, pressing the Enter Key registers the Simulated Head in memory and initiates the simulation. The display then shows the corresponding Simulated Flow. Pressing the Esc Key exits the Sim Menu.24 Unit

The flow rate and total flow units and format were selected during the Startup Procedure. This menu allows the flow rate (Flow) and total flow (Total) units and format to be displayed and modified.

When in each submenu, an asterisk on the display indicates the current selection. Pressing the Function Key (F1, F2, or F3 Key) directly below the desired selection on the display registers it in memory.

25 AVG (AVERAGE)

This menu is used to set the number of individual readings (from 1 to 255) that the controller averages for each display reading while vessel monitoring. The controller calculates a running average. The larger the number of individual readings in the running average, the smaller effect a variation in signal will have on the average. This results in fewer variations on the display reading and an easier to read display. Avg affects the value seen on the display as well as setpoints, current outputs, and serial outputs. The default value for Avg is 10 for flow applications.

The number shown upon entry into this menu is the channel's current averaging factor. This number can be modified by using the Up and Down Arrow Keys or by direct entry with the Alphanumeric Keys. When the desired number is shown, pressing the Enter Key saves the new value.

26 RESET

The ReSet Menu allows you to reset calculated flow values:

- Minimum flow (MinF) — reset to the current flow rate
- Maximum flow (MaxF) — reset to the current flow rate
- Total flow (Tot) — reset to 0

The ReSet function is useful if you want to monitor total flow and minimum and maximum flows on a regular basis (for example, you want to track daily total flow and daily minimum and maximum flows).

29 TEMP (TEMPERATURE)

This menu sets up the temperature compensation parameters. Temp has three submenus: FixT, Mon, and Scale.

FIXT (FIXED TEMPERATURE)

FixT allows you to enter a fixed temperature, usually to match the temperature inside the vessel where the transducer is operating. The controller then adjusts the speed of sound in the calculations to correspond to that temperature. FixT has two submenus:

- If you select Yes, enter the fixed temperature.
- If you select No, the controller disables the fixed temperature function. If you have a temperature compensation probe, the controller uses the probe's temperature data to adjust the speed of sound in the calculations. If there is no probe, the controller uses the speed of sound at the default temperature.

MON (MONITOR)

Mon lets you monitor the temperature (Temp), the A to D counts (ADC), and the minimum and maximum temperature (MinT and MaxT) since the last reset. The value for Temp is based on the following:

- If you selected Yes for FixT, the temperature that you entered in that menu displays for Temp.
- If you selected No for FixT and there is no temperature compensation probe, the default temperature displays for Temp. If there is a temperature compensation probe, the measured temperature displays for Temp.

To reset MinT to the current temperature, press the Enter Key while in the MinT function. To reset MaxT to the current temperature, press the Enter Key while in the MaxT function.

SCALE

Scale lets you select Celsius (°C), Fahrenheit (°F), or Kelvin (°K) as the temperature scale for entering a temperature (in FixT) and monitoring the temperature in Mon.

SONOTRACKER SERIES MENU DESCRIPTIONS

MENU OPTIONS

The following options are available from the MENU key in manual mode:

- • 10 Display: Select desired display formats, input vessel and adjust brightness and contrast.

- • 20 Calibration: System configurations including full point, or Math Menu span and mode of operation; Math Menu for Math Channel configuration.

- • 30 Relay Set Point: Configure relay set point.

- • 40 I-Output: Configure Current (mA) output.

- • 50 Serial/PLC: Set up serial out and PLC.

- • 60 Transducer: Configure the transducer including frequency, delay and threshold values.

- • 70 Range/Filters: Set up range and filter windows.

- • 90 Service Menu: Includes access configuration as well as system default and copy function.

Figure 18: Controller Menu Access Diagram
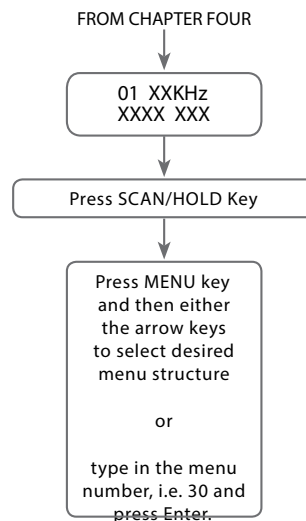
Figure 19: Menu Tree Diagram
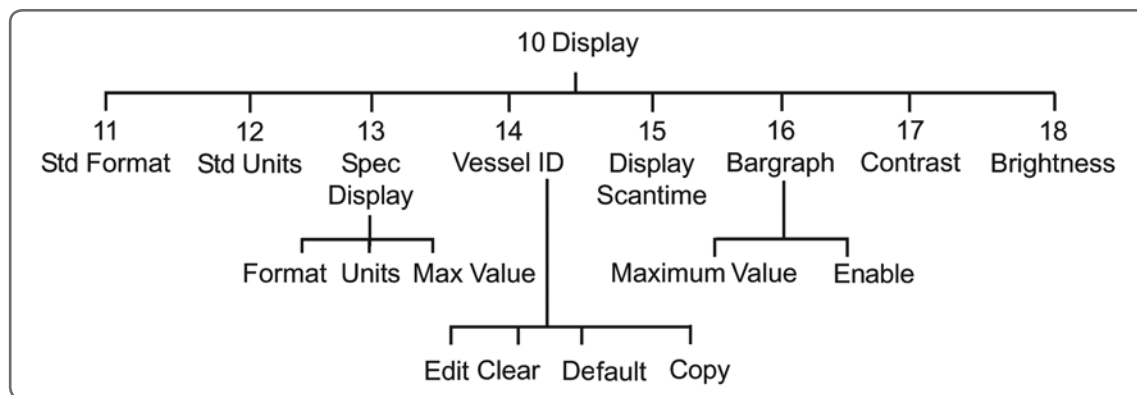
10 DISPLAY

The Display Menu is used to set up the parameters that govern the display functions when channel monitoring. This section covers the functions in the Display Menu. Explanations of each of the functions are provided.

Unless otherwise noted, the display function for each channel (such as ID) can be set differently. The descriptions below for each function note those that are global in nature and that affect the display for all channels.

As shown in Figure 19, the Display Menu has eight submenus.

11 STD FORMAT

Select a format from the menu options:

    XXXX.X
    XXX.XX
    XXXXX

12 STD UNITS

Select the desired units: Feet, Inches, Meters, or Centimeters

13 SPEC DISPLAY

Enter Format, Units, and Max Value. (Must be zero for format and units to be active)

14 VESSEL ID

During the Startup Procedure for the SonoTracker Series, you input a customer-defined ID for each channel. This menu allows you to later change the customer-defined ID.

The SonoTracker Series controller arrives from Bindicator with a factory-set ID number assigned for each channel in the system. Note that after you have input a customer-defined ID, you can still view the original factory-set ID when vessel monitoring in the Manual Mode by pressing the Esc Key.

15 DISPLAY SCAN TIME

When the controller is in the Auto Mode this menu allows you to choose the amount of time the controller displays vessel monitoring information before scrolling to the next channel (It is not the internal scantime.) Scantime can be set to 1 second, 2 seconds, or 5 seconds. The current selection is indicated by an asterisk.

The value for Scan Time is selected while in the menu tree for any channel, and applies to all of the channels in the system.

16 BAR GRAPH

You can choose to view a numerical display or a bar graph of a vessel's contents while vessel monitoring. The maximum span for the bar graph (Span) is set and the bar graph option for the display is turned on and off (Enable) in this menu.

The bar graph displays the level as a numerical percentage to the left of the graph, as shown below:

```
    01  43
   50% |||||||
```
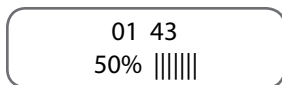
The 0% point of the bar graph is always 0. The 100% point of the bar graph is set by direct entry in the Span menu using the Alphanumeric Keys or by scrolling to the desired value with the Up and Down Arrow Keys. For example, entering the vessel's maximum level of 100' as the BarS value results in a bar graph with 0% corresponding to 0 feet and 100% corresponding to 100'.

If the level reading goes above the Span value, the graph remains at 100% and the numerical percentage reflects the actual level. For example, if the Span value is 100' and the actual level is 120', the numerical percentage

displayed is 120% while the graph remains at 100%. The default for the display is bar graph Off (bar graph not displayed when vessel monitoring). The current selection for Enable is indicated by an asterisk.

If enabled, the bar graph displays for the channel while channel monitoring in both Manual and Auto Modes. While in Manual Mode, pressing the Enter Key toggles the display between bar graph and numerical display.

17 CONTRAST

The contrast of the display is adjusted in this menu. The Up and Down Arrow Keys are used to make adjustments. The display contrast changes immediately as you make the adjustments. When the desired results are attained, pressing the Enter Key saves the new value.

The value for Contrast is selected while in the menu tree for any channel, and applies to all of the channels in the system.

18 BRIGHTNESS

The brightness of the display is adjusted in this menu. This menu is functional only with the purchase of the Backlight option.

The displayed number ranges from 0 (darkest) to 255 (lightest). The default value is 127. The Up and Down Arrow Keys are used to make adjustments. The display brightness changes immediately as you make the adjustments. When the desired results are attained, pressing the Enter Key saves the new value.

The value for Brightness is selected while in the menu tree for any channel, and applies to all of the channels in the system.

20 CALIBRATION

Most users leave Full Point at zero.

Note: The transducer has a blind space near its face where there are mechanical limitations that prevent detecting a target. The SonoTracker Series controller comes defaulted with a minimum range equal to the blind space for the transducer. If you leave Full Point at its default of 0 or enter a Full point less than Minimum Range, be aware that the SonoTracker Series will not detect or report levels at the top of the Span.

Figure 20: Calibration Menu Diagram
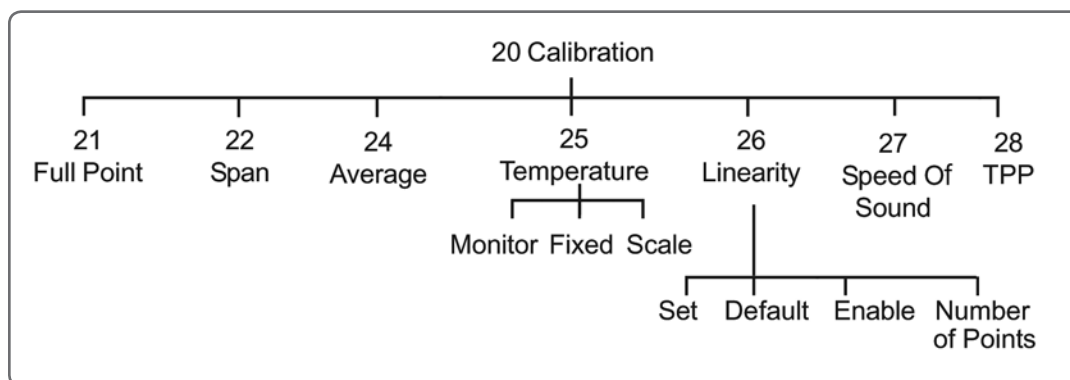
21 FULL POINT

Refer to Figure 12. Full Point is the distance from the face of the transducer to the top of the Span. Modifying Full Point allows you to change the point of reference for measurement. If you add 1' to Full Point you are essentially moving the Span down 1'. If you take 1' away from Full Point, you are essentially pulling the span up 1'. The default value for Full Point is 0 (i.e., the Span begins at the face of the transducer).

The number shown upon entry into this menu shows the current Full Point for the displayed channel. Modification of Full Point is performed by direct entry using the Alphanumeric Keys or by using the Arrow Keys to scroll to a number. When the desired number is shown, pressing the Enter Key registers the new Full Point in memory.

22 SPAN

Refer to Figure 12. The Span was entered during the Startup Procedure. The Span is displayed and modified in this menu. Span is the distance from the Full Point to the point where the vessel is considered empty. Material level changes within this range are displayed by the transducer.

The number shown upon entry into this menu shows the current Span for the displayed channel. Modification of Span is performed by direct entry using the Alphanumeric Keys or by using the Arrow Keys to scroll to a number. When the desired number is shown, pressing the Enter Key registers the new Span in memory.

The system also performs a test to insure that the span and Full Point do not exceed the maximum range.

Note: The SonoTracker Series controller calculated the default value for maximum range as 120% of the Span input in the Startup Procedure. If you enter a Full Point or change the Span, the controller checks the (Span + Full Point) to see if it's less than the Maximum Range. If this requirement is not met, the controller rejects the new Full Point or Span and displays an error message. To enter the desired Full Point or Span, first increase Maximum Range and then enter Full Point or Span. See Figure 10d: Range/Filters Menu.

24 AVERAGE

This menu is used to set the number of individual readings (from 1 to 255) that the controller averages for each display reading while vessel monitoring. The controller calculates a running average. The larger the number of individual readings in the running average, the smaller affect a variation in signal will have on the average. This results in fewer variations on the display reading and an easier to read display. Average affects the value seen on the display as well as set points, current outputs, and serial outputs. The default value for Average is 5.

The number shown upon entry into this menu is the channel's current averaging factor. This number can be modified by using the Up and Down Arrow Keys or by direct entry with the Alphanumeric Keys. When the desired number is shown, pressing the Enter Key saves the new value.

25 TEMPERATURE

This menu sets up the temperature compensation parameters. Temperature has three submenus: Fixed, Monitor, and Scale.

FIXED (FIXED TEMPERATURE)

- Fixed allows you to enter a fixed temperature, usually to match the temperature inside the vessel where the transducer is operating. The controller then adjusts the speed of sound in the calculations to correspond to that temperature. Fixed has two submenus:

  – If you select Yes, the controller asks for the fixed temperature.

  – If you select No, the controller disables the fixed temperature function. If you have a temperature compensation probe, controller uses the probe's temperature data to adjust the speed of sound in the calculations. If there is no probe, the controller uses the speed of sound at the default temperature.

MON (MONITOR)

Mon lets you monitor the temperature (Temp), the A to D counts (ADC), and the minimum and maximum temperature (MinT and MaxT) since the last reset. The value for Temp is based on the following:

- If you selected Yes for FixT, the temperature that you entered in that menu displays for Temp.

- If you selected No for FixT and there is no temperature compensation probe, the default temperature displays for Temp. if there is a temperature compensation probe, the measured temperature displays for Temp.

To reset MinT to the current temperature, press the Enter Key while in the MinT function. To reset MaxT to the current temperature, press the Enter Key while in the MaxT function.

SCALE

Scale lets you select Celsius (°C), Fahrenheit (°F), or Kelvin (°K) as the temperature scale for entering a temperature (in FixT) and monitoring the temperature in Mon.

26 LINEARITY

Linearization tables allow us to compensate for vessels that do not have a linear relationship between level and weight (or level and volume). For example, the vessel has a cone bottom, and we are interested in weight or volume information instead of level information. An increase in the level does not produce a proportionate increase in weight or volume, because of the shape of the vessel.

The SonoTracker Series has the capability to linearize up to 32 points. The more points of linearization you provide, the more accurate the system will be. Linearity has four submenus:

- Set — allows you to set the values for the linearization. For each point, you enter a input and an output value.

- Default — changes the values in the linearization table back to the default values. Note that for the default condition the input and output values are identical. Therefore, for the default condition the linearization table has no effect on the SonoTracker Series, even if linearization is enabled.

- Enable — turns linearization on and off.
- Number of points — allows you to select the number of points to input for the linearization (32 maximum points).

Contact Bindicator for technical assistance in calculating linearization parameters. 27 Speed O Sound

The Speed O Sound Menu allows you to monitor and adjust the value for the speed of sound, which is used by the SonoTracker Series controller in the calculation of range. The default value for speed of sound is based on the sound pulse traveling through air. At 68° F [20° C], the speed of sound is approximately 1127 ft/sec [344 m/sec]. Note that the controller automatically adjusts the speed of sound for temperature based on the information from the temperature probe (if installed) or the fixed temperature input (see Chapter 5, Calibration Menu). In the Speed O Sound Menu, an adjustment is made based on the medium of sound travel — the material that the pulse is traveling through above the material actually being measured. Speed O Sound has three submenus:

- Automatic Entry — this menu allows you to input a correction distance for the speed of sound. For example, if you know there is 3 feet of material in the vessel but the controller is displaying 4.2 feet because the medium is not standard air, input 3.0 ft for Auto. The controller takes that distance and uses it to automatically calculate a correction factor, in percent, for the speed of sound.
- Manual Entry — this menu allows you to input a correction factor, in percent, for the speed of sound. For example, if the speed of sound through the medium is only 95% of the speed of sound in air, enter 95% for Manual Entry.
- Monitor — this menu allows you to view the current value for speed of sound.

Note: Bindicator recommends this only be changed by authorized personnel.

28 TPP (TRANSMISSIONS PER POINT)

In a multipoint system for liquids, TPP sets the number of transmissions on each point prior to advancing to the next channel. For a vessel with rapidly changing conditions, it can be helpful to send out several transmissions in a row to get an accurate reading before the controller moves on to the next channel. TPP can range from 1 to 255. The default is 1.

30 RELAY SET PT

The setpoint value is the measured value where you wish a device (for example, a pump) to activate or deactivate. The setpoint setup functions for each channel are accessed in this menu. They include adding and deleting set points and selecting activation values, high or low activation, deadband values, and fail-safe parameters. In addition, for flow applications, set point setup includes selecting what parameter triggers activation (flow, head, total, time, or temperature) and the amount of time for pulse activation.

Figure 21: Relay Set Point Menu Tree

30 Relay Set Pt						
31 Report	32 Set	33 Add	34 Delete	35 Test	36 Auto Assign	37 Default
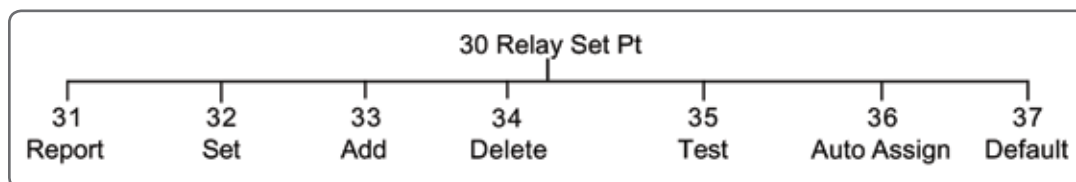
The Relay Set Pt section defines each of the parameters.

31 REPORT

When this menu is accessed, the display shows all setpoints assigned to the current channel. A typical display looks like this:

```
SP2 Output Chan
Slot 03 Chan # 02
```

- • SP2 is the setpoint label.
- • Slot 03 is the slot number where the Relay Output PCB resides.
- • Chan # 02 is the relay channel of the setpoint on the Relay Output PCB.

Pressing any key other than the Esc or Scan/Hold Key cycles through the reports for all other assigned setpoints for this channel.

32 SET

This menu is used to select the setpoint to be set up for the displayed channel. Setpoints can be established for monitoring channels and also for math channels. Up to eight setpoints can be assigned per channel, labeled SP1 for setpoint 1 through SP8 for setpoint 8.

Set has four submenus for level and five submenus for flow:

- • Value — once you have selected a setpoint to set up, the activation value, the point where the setpoint relay changes state, can be entered. This value is entered directly with the Alphanumeric Keys or scrolled to with the Arrow Keys. The "-" Key is used to toggle between the positive and negative value of the number entered.

- • Dead — the deadband value determines the point at which a setpoint relay returns to its normal on/off state after the relay has been activated. The deadband value equals the change in the measured parameter before the setpoint relay returns to its normal state. Bindicator recommends the use of a non-zero deadband to prevent relays from oscillating. The value is entered directly or scrolled to with the Arrow Keys.

- • Hi/Lo — setpoint relays can be configured to change state either above (Hi) or below (Lo) the setpoint value (Value).

- • Echo Loss Mode — if the SonoTracker Series detects an echo loss that lasts longer than a threshold time, one of three fail-safe conditions can be applied to a setpoint: On, Off, No Change. The On setting energizes the setpoint. The Off setting de-energizes the setpoint and the No Change setting means no change is made to the setpoint condition. No Change is the default.

- • Mode — (Flow Only) This menu sets up how the setpoint relays are going to be activated and used. There are five choices for Mode:

  1. Flow relay activation is based on the flow rate - for example, CFS, GPS, etc. With this selection the relay can be programmed to control a dosing pump for a chlorine system or pace a wastewater sampler.

  2. Head relay activation allows the relay to be activated based on the head (level)- for example, ft, in, m, etc.

  3. Rate relay activation is based on total flow - for example CF, GL, etc. With this selection, the relay can

be programmed to pulse a remote totalizer or telemetry system. OnTm (flow applications only) - if you want the relay to pulse once it is activated, this menu sets up how long the relay pulses. Setting OnTm to 0 turns off the pulsing function.

4. Time relay activation is based on time. For example, every 90 minutes a relay will change status to pace a wastewater sampler based on time.

5. If a temperature compensation probe is used with the transducer, Tmp relay activation sets up the relay or setpoint to activate on temperature changes.

Note: See Figure 10c: Transducer Menu for information on setting the threshold time for echo loss.

Figure 22: Set Point Example
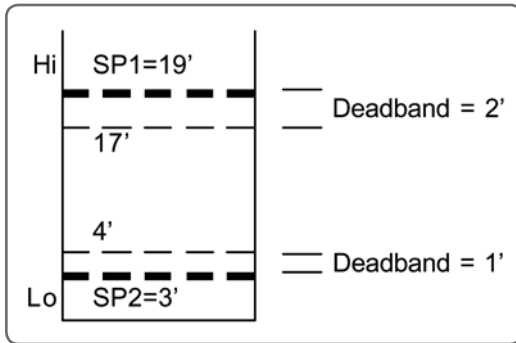
Example: Following is an example of the use of Val, Dead, and Hi/Lo for a level application.

- A vessel with a 20' Span operating in Material Level mode has Value for setpoint 1 (SP1) set at 19'. The Hi/Lo function is set to Hi and the deadband (Dead) is set at 2'. When the contents exceeds 19', the setpoint energizes, activating a pump to remove material from the vessel. The pump continues to operate until the setpoint de-energizes at a level of 17' (19' minus the 2' deadband).

- This vessel has Value for setpoint 2 (SP2) set at 3'. The Hi/Lo function is set to Lo and the deadband (Dead) is set at 1'. When the contents go below 3', the setpoint energizes, activating a pump to fill the vessel. The pump continues to operate until the setpoint de-energizes at a level of 4' (3' plus the 1' deadband).

33 ADD (THE RELAY IS ADDED TO THE CHANNEL DISPLAY PRIOR TO ENTERING THE MENU)

This menu is used to add setpoint channels (up to eight) for the current channel. Note that the setpoint must be added before the Set parameters (Val, Dead, etc.) can be input. The bottom line of the display shows the slot number of the Relay Output PCB and the channel number for the first available setpoint on the Relay Output PCB. Pressing the Up and Down Arrow Keys cycles through all other unassigned setpoint channels. Pressing the Enter Key adds the setpoint.

34 DELETE

This menu allows previously added setpoint channels to be removed from the current channel. The top line of the display shows an assigned setpoint number. The bottom line shows the slot number of the Relay Output PCB and the channel number for the setpoint on the Relay Output PCB. To delete a setpoint channel, cycle through

the setpoints by pressing the Up and Down Arrow Keys until the setpoint you want to delete is displayed. Then, press the Enter Key.

Caution: Manually activating setpoint relays may cause damage if control equipment is connected. Disconnect any control equipment before proceeding.

35 TEST

This menu allows you to turn the setpoint relays on and off for test purposes. The controller displays a warning that the automatic control of the setpoints assigned to the currently selected channel is transferred to manual control, and requests verification that this is what you want to do.

A typical setpoint test display looks like this:

```
SP 01 :Sl 02: Ch1
F3 To Toggle: On
```

- SP 01 is the current setpoint reference number (referred to as SP1 when you added it in the Set Point Relay Menu).

- SL 02 is the slot number of the setpoint PCB.

- Ch1 is the channel number of the setpoint on the Relay Output PCB. Each Relay Output PCB has eight individual channels.

- F3 to Toggle turns relay on and off

- On or Off indicates the current status of the setpoint.

Pressing the Up and Down Arrow Keys or the Enter Key toggles the display between the setpoints for the current channel.

Pressing the Esc Key or Scan/Hold Key terminates the test. Once the test is terminated, the setpoints return to automatic control.

36 AUTO ASSIGN

Automatically assigns one relay per active channel.

37 DEFAULT

Unassigns all relays.

## 40 I-OUTPUT (IF MENU 31 DOES NOT SHOW RELAYS, GO TO MENU 33 TO ADD A RELAY)

The I-Output Menu is used to enter parameters for current outputs (4-20 mA, 0-20 mA). This chapter covers the functions in the I-Output Menu. Explanations of each of the functions are provided. Additionally, detailed navigation procedures through the menu tree are provided for the setpoint and current output functions.

Current output is typically used to retransmit continuous level/flow data to a remote display or PLC/Distributed Control System (DCS). The current output setup functions are accessed in this menu. The functions include adding and deleting outputs, and selecting fail-safe and operating modes. Up to two sets of current outputs can be assigned per channel.

Figure 23: Output Menu Tree
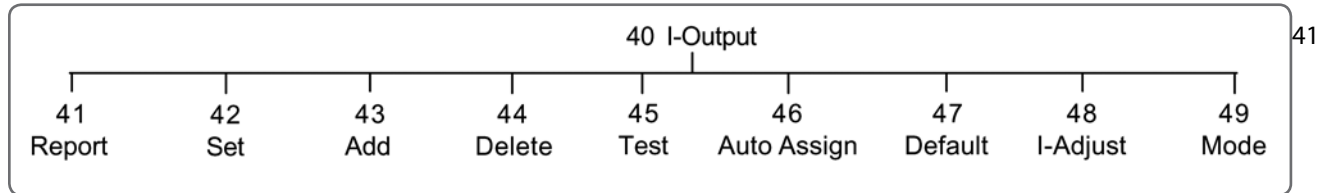
Report

When this menu is accessed, the display shows the current outputs assigned to the displayed channel. The top line of the display shows an assigned output number; the bottom line shows the slot number of the Current Output PCB and the channel number for the current output on the Current Output PCB. Pressing any key other than Esc or Scan/Hold toggles between the assigned current output channels. A typical display looks like this:

```
ONLY Output Chan
  Slot 03  Chan # 1
```
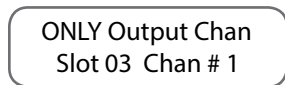
42 SET

This menu is used to select the current outputs, assign values to determine the points where the transmitter outputs the currents, and define fail-safe conditions for the current outputs. Current outputs can be established for monitoring channels and also for math channels. Set has three submenus for level and four submenus for flow applications.

- 4/0mA — the 4/0mA Menu sets the low current (4 mA or 0 mA) operation point. The value entered determines the point where the transmitter outputs the minimum current. For example, if 10' is entered as the low current operation parameter and the Mode function is set to 4-20 mA operation, when the displayed level is less than or equal to 10', the current output transmits 4 milliamps.

- 20mA — the 20mA Menu sets the high current (20 mA) operation point. The value entered determines the point where the transmitter outputs the maximum current. For example, if 50' is entered, the current output transmits 20 milliamps when level is greater than or equal to 50'.

- Echo Loss Mode — if the SonoTracker Series detects an echo loss that lasts longer than a threshold time, one of three fail-safe conditions can be applied to a current output: Lo, Hi, No Change. The Lo setting forces the current output to be 0 (in 0-20 mA operating mode) or 4 mA (in 4-20 mA operating mode) in a fail-safe condition. The Hi setting forces the output to be 20 mA. The No Change setting means no change is made to the current output in a fail-safe condition (i.e., whatever was being transmitted before the problem was detected will continue to be transmitted). No Change is the default. A fail-safe condition remains in effect until the echo loss ends. Note that when the SonoTracker Series is in echo loss, the echo loss is indicated on the display with an asterisk (*).

- Truck — (Flow Only)
  - Flow
  - Head

Note: The value entered for the 4/0 mA operation point does not have to be smaller than the value entered for the 20 mA operation point.

Note: See Figure 10c: Transducer Menu, for information on setting the threshold time for echo loss.

43 ADD

This menu is used to add current output channels (up to two) to the displayed vessel. Note that the current output must be added before the Set parameters can be input.

The top line of the display shows the first available current output. The bottom line shows the slot number of the Current Output PCB and the channel number for the current output on the Current Output PCB. Pressing the Up and Down Arrow Keys cycles through all other unassigned current output channels. Pressing the Enter Key adds the current output channel.44 Delete

This menu allows previously added current outputs to be removed from the displayed channel. The top line of the display shows an assigned current output number. The bottom line shows the slot number of the Current Output PCB and the channel number on the Current Output PCB.

To delete a current output, cycle through the current outputs by pressing the Up and Down Arrow Keys until the one you want to delete is displayed; then press the Enter Key. To prevent accidental deletion, the display requests verification that you want to delete the current output channel. If the response is Yes, then I/O CHANNEL DELETED displays to confirm the channel deletion. This current output channel is now available for use again.

45 TEST

This function allows manual activation of current output channels outside of normal control. The system issues a warning that the automatic control of current outputs assigned to the currently selected channel is transferred to manual control, and requests verification for what you want to do.

After the warning message, if more than one 0/4-20 has been assigned for this vessel, a selection of the two 0/4-20 channels is offered. After you select a 0/4-20 channel, a typical 0/4-20 Test function display looks like this:

```
Iout 1 :SL 03: Ch1
4mA:  (Up/Down)
```

- Iout02 is the current 0/4-20 channel reference number. All actions performed are with respect to this number.

- SL 03 is the slot number of the Current Output PCB.

- Ch1 is the channel number on the Current Output PCB. Each Current Output PCB has eight multiplexed current output channels.

- 0-4mA is the current that is being sent to the 0/4-20 channel being tested. If the current mode is 0-20mA, the test current output ranges from 0 mA to 20 mA in 2 mA steps. If in the 4-20mA mode, the test current output ranges from 4 mA to 20 mA in 2 mA steps.

- More or Less refers to the increase (More) or decrease (Less) of the output. Pressing the up arrow key increases the output in 2 mA steps; pressing the down arrow key decreases the output in 2 mA steps.

Pressing the ESC Key or Scan/Hold Key terminates the function. Once the test is terminated, the current outputs return to automatic control.

Caution: Manually activating current output can cause damage if control equipment is connected. Disconnect control equipment before proceeding.

46 AUTOASSIGN

Automatically assigns one 4-20mA per active channel.

47 DEFAULT

Unassigns all 4-20mA channels.

48 I-ADJUST

This menu is used to manually assign counts-to-milliamps outputs for 0 mA, 4 mA, and 20 mA outputs to calibrate to another device. Follow this procedure:

1. Put the SonoTracker Series in the Manual Mode. Proceed to the Main Menu/Service Menu/4/20 Menu/ adj Menu. The display shows:

> Chan: 1 (Up/Down)
> Enter To Select

2. Up arrow scrolls the display forward through all the current channels. Down arrow scrolls the display backward through all the current channels. Scroll to the desired current channel.

3. Press the Enter Key to access Select. The display shows:

> Select Cal Point
> 0mA

4. Press an arrow key to assign counts to the associated current output. If you select 0 mA, the display looks like this:

> 0mA Cal Point
> > x cnt

5. Use the keypad or the Up and Down Arrow Keys to change the counts if desired. Press the Enter Key to save the value in memory. The display flashes a message acknowledging your selection and returns to:

> Select Cal Point
> 0mA

6. If desired, repeat Steps 4 and 5 for the other current output, and repeat Steps 2 through 5 for other current channels.

Note: If you have set up 4-20 mA output, the SonoTracker Series controller ignores anything you enter for 0 mA. Similarly, if you set up 0-20 mA output, the controller ignores anything you enter for 4 mA.

49 MODE

The current transmitter can be set up to output 0-20 mA or 4-20 mA. This menu is used to select one of the two operating modes. The controller default current output mode is 4-20 mA.

Figure 23: PLC Menu Tree
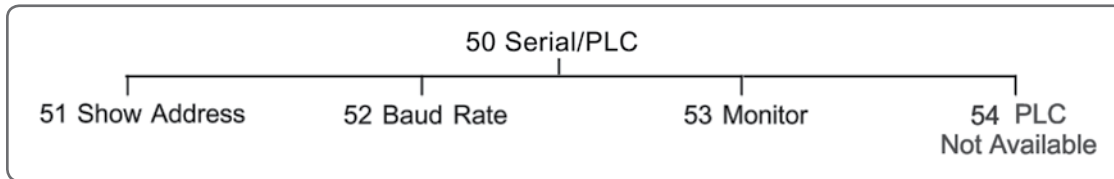
50 SERIAL/PLC

The Serial/PLC Menu is used to set up serial communications through the microprocessor COM port between the SonoTracker Series and external equipment, such as:

•   PLC with a BASIC Module or a similar communication device

The controller can only be the slave to external equipment. The controller has one COM port for serial communications. Refer to Appendix E for information on how to serially connect the controller to various external equipment.

51 SHOW ADDRESS

This parameter shows the current serial address of the displayed channel.

52 BAUD RATE

The SonoTracker Series controller's built-in serial communications settings are 8 data bits, 1 stop, no parity. These values are fixed, and cannot be modified by the user. The baud rate can be modified by the user. When connecting the controller to external equipment, all of the serial communications settings must match for the equipment to communicate. As necessary, modify the default setting for baud rate of the SonoTracker Series controller. Modify the data bits, stop, and parity settings in the external equipment to match the controller's built-in settings. There are five baud rates (bits per second) available: 1200, 2400, 4800, 9600 (default), 19.2K

53 MONITOR

A diagnostic function which indicates current serial buffer contents. Consult factory for proper interpretation.

60 TRANSDUCER

Figure 24: Transducer Menu Tree
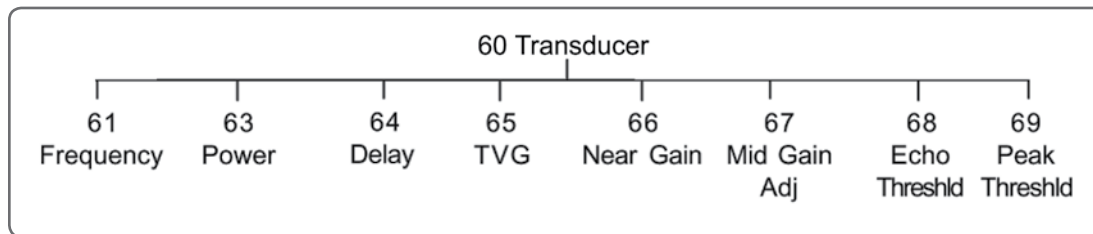
61 FREQUENCY

Frequency has three submenus:

- Target — under Target, the target frequency of the transducer set up for the current channel is displayed and can be modified. For example, a 56T-25PT Transducer has a 'nominal' frequency of 43 KHz, but the actual default frequency is 43.5 KHz. Small modifications of the target frequency can sometimes improve the performance of the system.

- Monitor — this parameter allows you to view the frequency that the transducer for the current channel is actually transmitting and receiving. It usually does not exactly equal the Target value, but is very close.

- Select — under Select, the transducer type for the current channel can be displayed and changed (you may need to change it if you made an error during the Startup Procedure or have changed the transducer). The model number of the transducer corresponds to the transducer type: Refer to the model number of the transducer for the proper selection.

63 POWER

Power defines the amount of output transmission power the controller utilizes. The range is 0 to 100%. The default value is variable depending on quick configuration settings.

64 DELAY

Delay allows you to set up a transmission delay for the transducers. Delay is the amount of time between transmit signals from the SonoTracker Series. Increasing Delay may be useful if you have a target (such as a liquid) that causes a lot of bouncing of signals. Delaying the next transmit signal allows the noise from the bouncing to dissipate before the next signal is transmitted.

Note: Delay is typically used only for a single-channel system.

65 TVG (TIME VARIED GAIN)

TVG adjusts the SonoTracker Series ability to pick up return echoes. When material is close to the transducer, the sound energy in the return echo is very high and the time for the return echo to reach the transducer is very short. As the level in the vessel decreases, the sound energy decreases and the time for the return echo to reach the transducer increases. Gain can be used to amplify the return echo, to allow a low energy echo (caused by low material level) to be picked up. However, if the gain is left continuously at a high setting to provide accurate tracking of low material levels, it will also result in amplification false echoes. This can also cause the transducer

to pick up its own transmission burst as a return echo from a full vessel, resulting in lockup of the level display at the vessel full point. TVG affects the sensitivity of the system in detecting return echoes by amplifying the return signal in relation to the time it takes the signal to reach the transducer (which is related to the distance from transducer to measured material). TVG has eight submenus:

- High Limit is the highest value the TVG will go in an effort to achieve an echo above the echo threshold (Echo) and below the peak threshold (Peak). The range for High Limit is from 0 to 200.00%. The default value is a function of the Span entered during the Startup Procedure.

- Low Limit sets the low limit for the TVG. This value is the lowest the TVG will go to get the echo below the peak threshold (Peak) and above the threshold (Echo). The range for Low Limit is from 0 to 200.00%.

- Monitor allows you to monitor the current TVG amplification.

- Exponent controls the shape of the TVG curve. Exponent can range from 0 to 2.55. Values of Exponent greater than 2.0 reduce the gain between the transducer and the middle of the vessel, often necessary for tall, narrow vessels. Values of Exponent less than 2.0 increase the gain between the transducer and the middle of the vessel.

- Delay shifts the TVG curve that is past the point where the blind space gain algorithm (BGN) is in effect. The default for Delay is 0'.

- Decrease Step controls the rate of TVG decrease. The value ranges in percentage from 0.00% to 100.00%.

- Decrease Qualify controls the number of steps decreased at one time. The value ranges from 0 to 255.

- Mode allows you to switch from the standard TVG algorithm (Mode = 1) to an algorithm designed for a specific application for a vessel filled with a very fine talcum powder (Mode = 2). The default for Mode is 1.

  For Mode=1, the TVG algorithm is applied to the closest target encountered.

  For Mode=2, the TVG algorithm is applied to the largest amplitude target.

  For Mode=3, same as Mode 1 yet only adjusts if return echo is outside the echo or peak thresholds.

  For Mode=4, same as Mode 2 yet only adjusts if return echo is outside the echo or peak thresholds.

Note Setting High Limit equal to Low Limit puts the SonoTracker Series into a Fixed TVG mode, as it prevents the SonoTracker Series from raising or lowering the TVG curve in response to echoes below the Echo threshold or above the Peak threshold.

66 NEAR GAIN

Near Gain specifies the near gain of the system and ranges from 0 to 100.00%. The near gain affects the ability to pick up targets in the first 4' (1.2m) to 6' (1.8m) from the face of the transducer. The default for Near Gain is dependent on the type of transducer and application.

- Value is used to change the entry for this parameter.

- Blind Space Gain (BGN) controls the gain in the 'blind space' region of the transducer to help reduce ringing. BGN can be set from 0 to 100%. The default for BGN is dependent on the type of transducer and Quick Configuration settings.

67 MID GAIN ADJ (CONSULT BINDICATOR BEFORE MODIFYING!)

Mid Gain Adj allows the adjustment of the TVG curve in the middle distance ranges. It is generally not used. Mid Gain Adj has two submenus:

- Position is the distance (in the selected length units) from the face of the transducer to the beginning of the midrange delay. The default for Position is 0.

- Delay sets the midrange delay. The distance (in the selected length units) over which the TVG remains constant. The TVG curve is shifted out past Delay. The default for Delay is 0.

68 ECHO THRESHLD (ECHO THRESHOLD)

Echo Threshld sets the echo threshold from 0 to 100.0%. The default is 35%. The echo threshold is the minimum amplitude the echo must achieve to be accepted as a valid echo. If the echo has an amplitude less than Echo, the SonoTracker Series responds as follows:

- If in Auto TVG mode, the SonoTracker Series increases the amplification until it detects a valid echo or the amplification reaches High Limit. If the amplification reaches High Limit without detecting a valid echo, the SonoTracker Series assumes that the echo is not from a valid target, ignores the echo, and transmits the next signal.

- If in Fixed TVG mode, the SonoTracker Series assumes that the echo is not from a valid target, ignores the echo, and transmits the next signal.

Note: 100% Echo = 5 VDC, 20% Echo = 1 VDC.

69 PEAK THRESHLD

Peak Threshld sets the peak threshold for return echoes. Peak Threshld only effects the results if the SonoTracker Series is in Auto TVG mode. If the echo has an amplitude greater than Peak Threshld while in Auto TVG mode, the SonoTracker Series decreases the amplification until the echo is below Peak Threshld or the amplification reaches Low Limit. Peak threshold can be set from 0 to 100.0%. The default setting is 50.0%.

70 RANGE/FILTERS

71 MINIMUM RANGE

Figure 25: Range/Filters Menu Tree
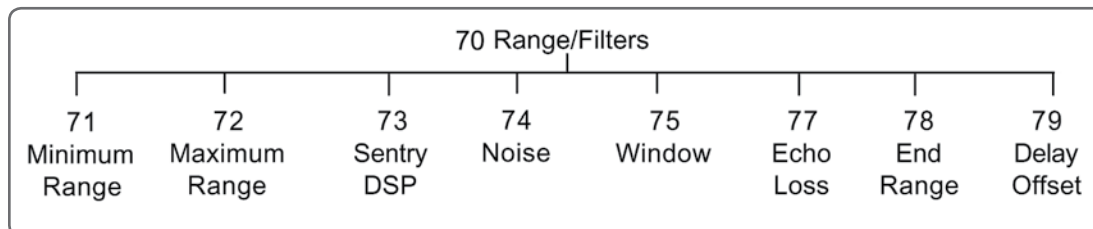
Minimum Range displays and sets up the minimum range of the transducer. The minimum range is the minimum distance from the face of the transducer where the SonoTracker Series starts recognizing the return signal (echo). The default minimum range is set past the transducer's blind space to avoid interpreting the noise from the transmission signal as a return signal. However, if there are obstructions near the face of the transducer, the

minimum range should be extended past the obstructions to eliminate the possibility of interference. Minimum Range has a submenu; Manual.

MANUAL

Min Range Set sets the distance for the minimum range.

> The defaults are:
>
> — 12" (305 mm) for 56T-25 Transducers
>
> — 24" (610 mm) for 56T-50 Transducers

72 MAXIMUM RANGE

Maximum Range displays and sets up the maximum range of operation. The maximum range is the farthest distance from the face of the transducer where the transducer stops recognizing the return signal. Typically, Maximum Range should extend past the bottom of the vessel to ensure that the SonoTracker Series displays correct values when the level (or flow) is low. For level and differential level applications, the default Maximum Range is 120% of the Span input in the Startup Procedure. For flow applications, the default Maximum Range is 120% of the Zero Distance input in the Startup Procedure.

Note: In Manual Mode, Max Range must be greater than Full Point + Span. The system will NOT allow a span value that violates this distance. Change Max Range prior to changing Span.

73 SENTRY DSP™ (CONSULT BINDICATOR BEFORE MODIFYING!)

Extraneous noise caused by acoustical or electrical interference can cause changes in the SonoTracker Series display, even though no material is moved. Sentry DSP™ helps to reduce the display changes that can result from acoustical or electrical interference. The SonoTracker Series picks the level from the first echo as a reference median; this is the value that is used in calculating the displayed level.

As shown in Figure 26, the SonoTracker Series then compares following signals to the reference median, and recalculates the reference median when either of the following happen:

- the number of successive signals above or below the median exceeds a triggering number
- a signal falls outside of a user-defined window around the reference median.

When the SonoTracker Series recalculates the reference median, the displayed level changes to correspond to the new reference median. Note that the Sentry DSP™ function affects setpoints, current output, and serial output as well as the display. DSP has four submenus:

- Qualify is the triggering number of successive signals above or below the median signal value, but within the Step window. In example 2 shown in Figure 26, Qualify is 3. When the third successive signal above the median value (but within the Step window) is detected, the SonoTracker Series moves the location of the median value to that point or a percentage of the distance from the old median as determined by DSPFact. This allows the SonoTracker Series to respond to definite trends in level changes. The default for Qualify is 4.
- Step Window is a window of equal height above and below the reference median. As shown in Figure 26,

example 1, if a large signal change is detected that falls outside of the window, the SonoTracker Series immediately moves the location of the reference median to that point. This allows the SonoTracker Series to adjust quickly to rapid material movement.

• Enable turns the filter function on and off. The default is On.

• Delta Change determines the magnitude of change from the old reference median to the new reference median, for change triggered by the Qualify parameter. In example 2 in Figure 26, the SonoTracker Series moves the reference median 80% of the distance from the old median to the last signal (which triggered the change), based on a Delta Change of 80%. A value of 100% sets the new median to the last signal value; a value of 50% sets the new median halfway between the old median and the last signal value. Note that Delta Change does not affect the change caused by a signal falling outside of the Step window, as shown in example 1 in Figure 26.

Note: The Sentry DSP algorithm dampens the response rate of the SonoTracker Series. For demonstration/test purposes set Enable to Off.

Figure 26: Sentry DSP Function Examples
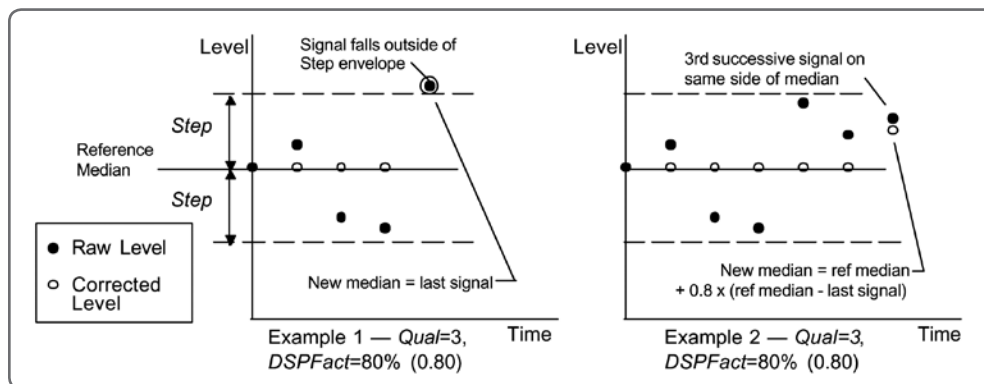
74 NOISE (CONSULT BINDICATOR BEFORE MODIFYING!)

The Noise function reduces the effect of extraneous noises that may confuse the signal processor. This menu sets up the noise routine algorithm. The algorithm is activated when the measured noise level (Monitor) exceeds the noise threshold level (Threshold). Noise has seven submenus:

• Monitor is used to monitor the current noise level. This value is calculated by capturing the voltage level at the current maximum TVG gain prior to the transmit burst. Monitor has a range between 0% (0 ADC counts) and 100% (2047 ADC counts).

• Meas Dev Ratio is used to monitor the current deviation ratio. This number is calculated by dividing the listen deviation value (Listen Deviation) by the transmit deviation value.

• Threshold is a noise threshold. Measured noise levels (Monitor) that are above this threshold cause the noise algorithm to be switched on. At this point, all level measurements are frozen and are only updated when the noise algorithm qualifies a valid target or the noise level falls below Threshold. The default for Threshold is 100.0%. When Threshold is 100.0%, the noise algorithm is turned off.

• Std Dev Ratio is a deviation ratio threshold. Any measured deviation ratios (Meas Dev Ratio) larger than Std Dev Ratio indicate a high confidence level that the mean transmit target value is the actual target. When Meas Dev Ratio exceeds Std Dev Ratio the SonoTracker Series uses the mean target value to

update the level measurement. The default for Std Dev Ratio is 3.0.

- Listen Deviation monitors the listen deviation value. The absolute value of each of 16 listen noise values are subtracted from the mean value. The results of each subtraction are added together to calculate Listen deviation.

- Listen Average monitors the mean value of the listen deviation and is displayed in the current engineering units. It is calculated by averaging 16 listen noise values.

- Tx Points provides 16 transmits and listens. This value can be modified. Consult factory.

75 WINDOW

Window sets the size of the window around the target. Only signals within the window are recognized as valid targets, in order to minimize interference from external noise. The window is maintained around the target as the target moves up and down (i.e., as the target moves, the center of the window moves with it). Window has two submenus:

- Set establishes the value for the window size. Default is 0. When window is 0 the Window function is disabled.

- Lost Echo Timer sets the limit on timing if the target cannot be detected within the window.

  - If the target reappears in the window within Lost Echo Timer, seconds the SonoTracker Series stops timing and maintains the window around the new target.

  - If the target does not reappear in the window within Lost Echo Timer seconds, the SonoTracker Series qualifies the next target (after Lost Echo Timer seconds) as the valid target, even if it is outside the window. The SonoTracker Series then sets the window up around the new target location.

The default for Lost Echo Timer is 60 seconds.

77 ECHO LOSS

Echo Loss is for the echo loss timer, which allows you to set the amount of time from when an echo loss is first detected to when the SonoTracker Series responds to the echo loss. The echo loss timer allows the SonoTracker Series to ignore momentary echo loss which may occur occasionally. Echo Loss has two submenus:

- Timer allows you to set the amount of time from when the echo loss is first detected to when it is reported on the display (with an asterisk *), reported over any communications links, and causes fail-safe conditions (Echo Loss Mode) to apply for setpoints and current outputs. The default is 60 seconds.

- Mode allows you to select the echo loss indication mode — Timed or Temporary. If Temporary is selected, the display shows an exclamation point (!) every time an echo loss is detected, even if only momentarily. If the echo loss continues for Timer, the exclamation point changes to an asterisk (*) and communications links, setpoints, and current outputs are affected. If Timed is selected, the display gives no indication of the echo loss until the echo loss continues for Timer. The default for Mode is Timed.

78 END RANGE

End Range allows you to increase the rate at which the system transmits signals for targets that are close to the transducer. Each type of transducer has a prescribed rate at which it transmits signals, based on allowing enough time for a return of signal from a target at the transducer's maximum range. There are two choices for End Range:

- MaxRange — the transducer waits the prescribed amount of time, as defined for that transducer and

based on the transducer's maximum range, before it transmits the next signal, regardless of how quickly the previous signal was returned. MaxRange is the default and recommended setting for End Range.

- Target — if the transducer detects a target closer than the maximum range (i.e., the total time to transmit and receive the signal is less than the prescribed time), the transducer sends out the next signal, rather than waiting until the prescribed time has elapsed.

79 DELAY OFFSET (CONSULT BINDICATOR BEFORE MODIFYING!)

Delay Off is a parameter related to the operating frequency of the transducers. It sets the propagational delay for the electronic circuitry. Not that a change made to Delay Offset for a particular type of transducer affects all channels that are monitoring that type of transducer. For example, if you modify Delay Offset for a 56T-25, all channels that are using 56T-25 will use the new Delay Offset value.

90 SERVICE MENU

Figure 27: Service Menu Tree
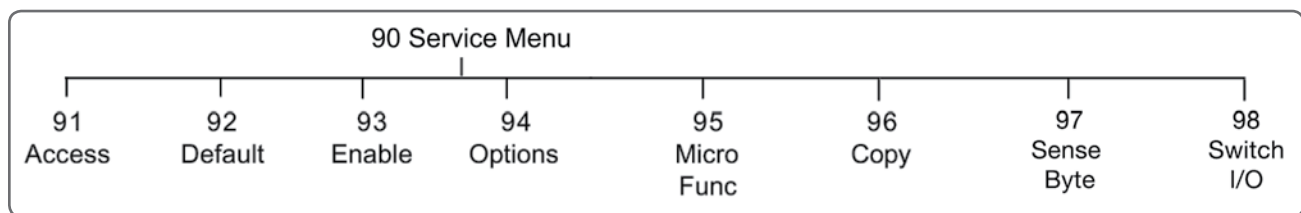
91 ACCESS

The Access menu allows you to:

- Set a user-defined access code
- Input the Bindicator Mfg Code, which is needed when performing certain troubleshooting functions.

Access has two submenus: User and Bindicator

USER

The SonoTracker Series arrives from the factory without a user-defined access code in place, allowing the user to access any function (other than those requiring the Bindicator Mfg Code or Bindicator Service Code) in the system at will. The User function allows you to set up a code to limit access to changing most system parameters (i.e., display parameters, setpoint parameters, calibration parameters, etc.). Once a User Code is in place and activated, your operator(s) will be able to go into the menu tree to view parameters, but will not be able to change parameters without entering the code. Follow this procedure to set up an access code:

1. If the controller is in Auto Mode (Auto LED illuminated), press the Scan/Hold Key to put the system in Manual Mode. The Auto LED turns off.

2. Press the Menu Key to display the Main Menu. The display shows:

> SonoTracker Series
> 10 Display

3. Scroll with the arrow keys to the 90 Service Menu option. Press Enter. The display shows:

> Service Menu
> 91 Access

4. Press Enter. Then select User, press Enter. Use the keypad to enter a one-, two-, three-, or four-digit number. Press the Enter Key when done entering the number. The display flashes a message acknowledging the entry and returns.

Note: Record the access code and store it in a safe place. If misplaced, call Bindicator for instructions   on how to bypass the code.

Once the number is entered, you have access to all functions and hidden menus that require the code, while you remain within the Manual Mode (i.e. you will only need to enter the code one time per Manual Mode session, regardless of the number of functions and channels you access). The supervisor Mfg Code (see below) has precedence over the Bindicator Service Code (same as Mfg Code). If you enter the Mfg Code in the Bindicator function under the Access Menu, the SonoTracker Series controller will not require you to enter the Bindicator Service Code when you change values in the Service Menu.

5. Press the Esc Key to scroll up the menu tree or the Scan/Hold Key to return the display to vessel monitoring. The Access Code is 'activated' when you leave the Manual Mode. Upon returning to the Manual Mode and reentering the menu tree, you will be prompted to enter the code if you attempt to change a system parameter. But, you will be prompted to enter the code only the first time you attempt to change a system parameter within one Manual Mode session (i.e., you will only need to enter the code one time per Manual Mode session, regardless of the number of parameters you change and channels you access).

BINDICATOR

The SonoTracker Series has two factory code numbers. Certain troubleshooting functions require one of these code numbers be entered before access to the function is permitted. The Service Code, described earlier in this chapter, is entered when prompted by the display and is the same as Bindicator Mfg Code. The Mfg Code is entered when in the Access Menu, as described below:

> BINDICATOR MFG CODE
> The Bindicator Mfg Code is required to access hidden menus, which are typically only used by Bindicator Meters personnel for troubleshooting and testing the equipment. The Bindicator Mfg Code number is:
>
> 9111

92 DEFAULT

This function clears all SonoTracker Series setup parameters, resets them to factory default values, and automatically leads you through the Startup Procedure again. Default has two submenus:

- Single clears all parameters only for the channel whose menu tree you are in and used when bringing new channels online or reconfigured.

- All clears all parameters for all the channels (including math channels). Be careful when using this submenu.

93 ENABLE

This function is used to enable or disable the channel. Disabling a channel actually causes the SonoTracker Series to stop monitoring the channel. The display shows:

```
Channel 1
   On *
```
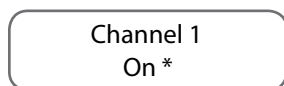
An asterisk indicates the current selection for the channel.

Pressing the up/down keys selects ON or OFF. Pressing the ENTER key saves the selection. If you have setpoint or current output set up for the channel that you are disabling, the controller will ask whether to release I/O. Releasing I/O will free up those channels currently used for setpoint and current output for this channel. If you want to retain the previously entered setpoint and current output information, do not Release I/O.

Pressing the Up and Down Arrow Keys cycles the display through all channels.

MATH CHANNELS

Math Channel functions can be used to process the vessel monitoring results in many ways. A few typical uses of the math channels follow:

- Add the level or calculate the average for the level from multiple vessels to provide information on the total inventory of a product stored in several vessels.

- Convert the data from a vessel into another set of units, such as converting a level in feet into a weight in pounds, to provide additional information on the vessel contents.

The number of channels available for math channels is dependent on the system you purchased:

- Single-point SonoTracker Series (equipped to monitor only one channel) — 23 channels available for math calculations (channels 2 through 24).

- One Scanner PCB SonoTracker Series (equipped to monitor up to eight channels) — 16 channels available for math calculations (channels 9 through 24).

Note: There are a total of 24 channels in Enable, consisting of channels that are monitoring transducers as well as math channels. RSLT comes up in the Display if you scrolled to a math channel while vessel monitoring. If the channel is a vessel monitoring channel, the menu tree shows Cal in place of Math.

ENABLING A MATH CHANNEL

1. If the controller is in Auto Mode (Auto LED illuminated), press the Scan/Hold Key to put the system in

Manual Mode. The Auto LED turns off.

2. Press the Menu Key to display the Main Menu.

3. Press the up/down arrow key until 90 Service Menu appears. Press Enter.

4. Scroll with the up arrow key to 93 Enable. Press Enter.

5. Scroll with the arrow keys to the math channel you want to enable.

6. Press the Enter Key to enable a channel. Press Enter again to enable. Scroll to No to disable.

7. Press the Scan/Hold Key to return the display to vessel monitoring.

Note: The channel number does not matter when entering the menu tree to enable channels.

CONFIGURING A MATH CHANNEL

The example below shows how to set up the math channel to calculate the average of the levels from four vessels. The equation used in the example is: $C9=(C1+C2+C3+C4)\div4.0$

1. If the controller is in Auto Mode (Auto LED illuminated), press the Scan/Hold Key to put the system in Manual Mode. The Auto LED turns off.

2. Use Up Arrow or Down Arrow key to scroll to the desired math channel (channel 9 in this example).

3. Press the Menu Key to display the Main Menu. The display shows:

> SonoTracker Series
> 10 Display

4. Select 20, the display shows:

> SonoTracker Series
> 20 Math Menu

5. Press Enter and the display shows:

> Cx=
> 'C''+''*'

x is either 2 or 9 depending on whether or not another scanner card is installed

Note: You must enable the math channel, as described above, before you set it up.

6. Press the Menu Key two times to access the third page of the Math Menu. The display shows:

> Cx=
> '('')' CLR→

7. Press the F1 Key to select (. The display shows:

> Cx=(
> '('')''*' CLR→

8. Press the Menu Key two times to access the first page of the Math Menu again. The display shows:

```
        Cx=(
   'C''+''*' →
```

9. Press the F1 Key to select C. Press 1 on the keypad. Press the F2 Key to select +. The display shows:

```
        Cx=(C1+
   'C''+''*' →
```

10. Press the F1 Key to select C. Press 2 on the keypad. Press the F2 Key to select +. The display shows:

```
      Cx = (C1+C2+
   'C''+''*' →
```

11. Press the F1 Key to select C. Press 3 on the keypad. Press the F2 Key to select +. The display shows:

```
     Cx=(C1+C2+C3+
   'C''+''*' →
```

12. Press the F1 Key to select C. Press 4 on the keypad. The display shows:

```
     Cx=(C1+C2+C3+C4
   'C''+''*' →
```

13. Press the Menu Key two times to access the third page of the Math Menu. The display shows:

```
    Cx=(C1+C2+C3+C4
   '('')''*' CLR→
```

14. Press the F2 Key to select). The display shows:

```
    x=(C1+C2+C3+C4)
   '('')''*' CLR→
```

Notice that the display has started to scroll — the C on the far left is not visible because of space limitations.

15. Press the Menu Key three times to access the second page of the Math Menu. The display shows:

```
    x=(C1+C2+C3+C4)
   '-''÷''=' →
```

16. Press the F2 Key to select ÷. Press 4.0 on the keypad. The display shows:

```
    1+C2+C3+C4)÷4.0
   '-''÷''=' →
```

17. After reviewing equation, press Enter to save equation to memory. A message should scroll across the screen acknowledging the entry. After entering the equation, the display should return to:

```
        0x
   RSLT* xx
```

Channel x will now display the average of the vessels in vessel 1 through 4.

C   Identifies a specific channel in the equation. C must be immediately followed by a channel number (for example, C9 indicates the channel with factory-set ID# 9). See Appendix F for errors. All equations must start with the current channel designation and an equal sign (for example, C9= must be the start of the equation when you are in channel 9). When a channel number appears to the right of the equal sign, it tells the controller to put the value from that channel (the level from a vessel monitoring channel or the calculated value from a math channel) in the equation.

+   Addition function. Adds the value to the right of the sign to the value to the left of the sign.

*   Multiplication function. Multiplies the value to the right of the sign by the value to the left of the sign.

-    Subtraction function. Subtracts the value to the right of the sign from the value to the left of the sign.

     Division function. Divides the value to the left of the sign by the value to the right of the sign.

=   Equals function. Places the value from the entire equation to the right of the sign in the channel designated to the left of the sign. All equations must start with the current channel designation and an equal sign (for example, C9 = must be the start of the equation when you are in channel 9).

(Left parenthesis function. Used with right parenthesis to group math functions together.

)   Right parenthesis function. Used with left parenthesis to group math functions.

CLR Clear function. Clears the entire displayed formula from memory.

√   Square root function. Takes the square root of the value to the right of the sign.

ln   Natural log function. Takes the natural log of the value to the right of the function.

e^   Inverse natural log. Takes the inverse natural log of the value to the right of the function.

KEYBOARD FUNCTIONS

Up Arrow: Scrolls to the left through the equation (the controller can only display 16 characters in the equation at a time, and the scroll function allows you to view equations that have more than 16 characters).

Down Arrow: Scrolls to the right through the equation.

[backspace]: Deletes the character to the left of the cursor.

Enter: Stores the current formula in memory.

MATH CHANNEL EQUATION LIMITATIONS

Following are the limitations on the equations put into the math channels:

- A single equation can be up to 40 characters in length. A character is a number, a decimal point, or a function from the Math Menu. The example equation below contains 10 characters: C9=C1+10.0

- A single equation can contain a maximum of 3 constants (a constant is a numerical value, such as 1000).

- A constant can have a maximum of 11 characters.

- Equations cannot contain any spaces between characters. The example below shows an incorrect and a correct equation:

  Incorrect (contains spaces):   C9 = C3 + C4 + C6

    Correct (no spaces):   C9=C3+C4+C6

- The controller interprets equations using standard math rules regarding order of operations. If you are unsure of how to apply these rules, use parentheses to ensure that the controller is calculating what you want it to calculate.

- The maximum value that a math channel can display is limited to five active digits, 65535 or a 16 bit number. If the calculated value exceeds this maximum, an error message will appear when monitoring the channel. To prevent this error, scale down the value from the equation using the divide function.

Equations containing more than 40 characters or more than three constants can be created by putting additional math channels on-line. These additional channels can be used to calculate intermediate results used by the math channel. The example below shows an incorrect equation with more than three constants and the use of multiple math channels to create a correct equation.

    Incorrect (contains more than 3 constants)   C9=10*C3+100*C2+1000*C4+10000*C1

    Correct   C10=10*C3 (hide this channel)

                                         C9=C10+100*C2+1000*C4+10000*C1

94 TVG DAC Count

TVG DAC Counts allows you to set up a transmission delay for the transducers. The amount of time between transmit signals from the SonoTracker Series will be at least TX Delay; more time will be provided if necessary because of distance to the target. Increasing TX Delay may be useful if you have a target that causes a lot of reverberation of signals. Delaying the next transmit signal allows the noise from the reverberation to dissipate before the next signal is transmitted.

95 MICRO FUNC

This menu allows you to test the keyboard, test the nonvolatile RAM, reset the nonvolatile RAM to default parameters, and monitor the serial port. It has the following submenus:

KEYTEST (KEYBOARD TEST)

This function displays the number of the last key that was pressed. Table 6-1 lists all the keys on the SonoTracker Series keypad and their corresponding reference numbers.

NVRAM TEST (RAM MEMORY TEST) (CONSULT BINDICATOR BEFORE MODIFYING!)

This function performs an internal, nondestructive test on the non-volatile RAM (NVRAM) on the Microprocessor PCB. This test does not reset any parameters. Upon completion of the test, the display should say RAM TEST PASSED! If it does not, contact Bindicator. When the test is complete, press the Esc Key to return to the Micro Func Menu.

Key	Ref #	Key	Ref #
1 (STU)	01	Menu	13
2 (VWX)	02	F1	14
3 (YZ)	03	F2	15
4 (JKL)	04	F3	16
5 (MNO)	05	*Esc	17
6 (PQR)	06	*Auto/Man	18
7 (ABC)	07	(Up Arrow)	19
8 (DEF)	08	(Down Arrow)	20
9 (GHI)	09	Sensor	21
0 (Space)	10	⇐	22
. (Period)	11	Shift	23
- (Minus)	12	Enter	24

*Note: Pressing these keys will exit the *KeyT* function.

DEFAULT NVRAM (RESET RAM MEMORY)

This function resets the non-volatile RAM (NVRAM) on the Microprocessor PCB. This resets all parameters to the factory-set default values (i.e., calibration parameters, setpoint parameters, display parameters, etc.).

The controller requires you to enter the Bindicator Service Code (9111) to access this function (unless you have already entered it during this Manual Mode session), and requests verification before it resets the NVRAM, to prevent accidental reset of the NVRAM.

96 COPY

The Copy Menu allows you to copy all parameters for the current transducer channel to one or all of the other transducer channels. This can save you a considerable amount of time if you have multiple channels with the same or similar parameters.

Follow this procedure to use the Copy Menu.

1. If the controller is in Auto Mode (Auto LED illuminated), press the Scan/Hold Key to put the system in Manual Mode. The Auto LED turns off.

2. Use the Up Arrow or Down Arrow Keys to scroll to the channel with the parameters you want to copy.

3. Press the Menu Key to display the Main Menu. The display shows:

> SonoTracker Series
> 10 Display

4. Press the up/down arrow keys until the display shows:

> SonoTracker Series
> 90 Service Menu

5. Press the enter key and press the up arrow key to access the Copy Menu. Press Enter. The display shows:

> Copy All Params
> To All Sensors

6. To copy the parameters to all channels, press the Enter Key and go to Step 7. To copy the parameters to one channel, press the up arrow Key and press enter, selecting Pick Sensor, go to Step 8.

7. If you selected To All Sensors the display flashed a message acknowledging your selection and returns. Go to Step 9.

8. YY is the factory-set ID for the channel. If you selected Pick Sensors, the display looks like this:

> Sensor:
> * YY

   Press the Up or Down Arrow Keys to scroll to the channel you want to copy the parameters into. When you have reached the desired channel, press the Enter Key. The display flashes a message acknowledging your selection and returns.

9. Press the Esc Key to scroll up the menu tree or press the Scan/Hold Key to return the display to channel monitoring.

COMMAND		FUNCTION MASTER TO SONOTRACKER SERIES	TRANSMITTED BY MASTER FROM SONOTRACKER SERIES	RECEIVED BY SONOTRACKER SERIES
HEX	ASCII			
23	#	Bindicator product identification number	>aa#ssr	Addssr (A956Er for SonoTracker Series)
61	a	Request application type: 0=level; 1=flow; 99=math	>aaassr	Addssr
32	2	Request engineering units. See notes following.	>aa2ssr	Addddddddssr
		Note 1. This digit is echo-loss character: 0=no echo-loss, 1=echo-loss condition, 2=momentary echo-loss condition. Note 2. This is the level/head data or if a flow device, this is the head.		
46,30	F0	Request flow rate (flow applications only) in selected engineering units	>aaF0ssr	Addddddddssr
74	t	Request totalizer data (flow apps only). See notes following.	>aatssr	Ahhhhhhhhhhssr
		Note 1. This digit indicates units: 0=CF, 1=GL, 2=MG, 3=CM, 4=LT, 5=ML Note 2. This digits indicates format: 0=XXXXXX, 1=XXXX00, 2=XXXXX0, 4=XXXX.X, 5=XXX.XX, 6=XX.XXX, 9=X.XXXX, B=XXX000 Note 3. 32 bit totalizer data in hexadecimal		
52,44	RD	Request raw target	>aaRDssr	Addddddddssr
Note: See Table B-2 for definitions of the characters in the command strings				

CHARACTER	DEFINITION
>	Start of message character
aa	Two-digit ASCII HEX character address of channel
d	One-digit ASCII decimal number data
dd	Two-digit ASCII decimal number data
dd..	Two-digit or more ASCII decimal number data
dd..dd	Multiple-digit decimal number data
hh	Two-digit ASCII HEX number, upper nibble, lower nibble
hh..hh	Multiple two-digit ASCII HEX numbers
ss	Two-Digit ASCII HEX checksum of characters added between '>' or 'A' and checksum characters. See Checksum Calculation in this chapter for an explanation of how checksum is calculated. Note that the '?' character in place of the checksum character is a wildcard and therefore ignores the checksum.
r	Carriage return (0x0D)
A	Acknowledge character (0x41)
N	Not acknowledge (0x4E)
+ -	Indicates polarity

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CHECKSUM CALCULATION

The one-byte checksum is calculated by adding the Hex values of all ASCII characters between the start of message character '>' or acknowledge character 'A' and the checksum character 'ss.' Overflows from the addition are ignored.

Example:

Request

To request engineering units from a SonoTracker Series controller, the command is:

>aa2ssr

If the controller address is '3', the command is:

>032ssr

Calculating the checksum 'ss' as the sum of the Hex values of all characters between '>' and 'ss':

032 ASCII =   30 Hex +   33 Hex +   32 hex = 95 Hex
                      '0'   '3'   '2'

Therefore, the ASCII string transmitted to the controller is:

>	0	3	2	9	5	CR	
3E	30	33	32	39	35	0D	Hex

Response

The response to a request for engineering units is:

Addddddddssr

If the level is 63.84 feet (transmitted without decimal points as 6384) and there is no echo loss, the response is:

A0006384ssr

Calculating the checksum 'ss' as the sum of the Hex values of all characters between 'A' and 'ss':

0006384 ASCII =   30 Hex+   30 Hex+ 30 Hex+ 36 Hex+ 33 Hex+ 38 Hex+34 Hex = 165 Hex
                          '0'   '0'   '0'   '6'   '3'   '8'   '4'

Ignoring the overflow, the checksum is 65 Hex. Therefore, the ASCII string transmitted back to the master is:

A	0	0	0	6	3	8	4	6	5	CR	
41	30	30	30	36	33	38	34	36	35	0D	Hex

Examples

For each command below, the general format of the command is shown above the example.

'#' COMMAND — BINDICATOR PRODUCT IDENTIFICATION NUMBER		
This command is sent by the master to request the controller to send its Bindicator product identification code (code is 95 for the controller). For this example, the master requests the code from a SonoTracker Series controller channel at address 01, which returns a code of 95 and a checksum of 6E.		
Request from Master	Response from Controller	
>aa#ssr	Addssr	Format
>01#84r	A956Er	Example

'A' COMMAND — REQUEST APPLICATION TYPE		
This command is sent by the master to request the controller to send the application type for the channel: 00=level, 01=flow, and 99=math. For this example, the master requests the code from a SonoTracker Series controller level channel at address 01, which returns a code of 00 and a checksum of 60.		
Request from Master	Response from Controller	
>aaassr	Addssr	Format
>01aC2r	A0060r	Example

'2' COMMAND — REQUEST ENGINEERING UNITS (LEVEL/HEAD)		
This command is sent by the master to request the controller to send the engineering units (level/head). For this example, the master requests the level from a SonoTracker Series controller channel at address 01, which is set up with a standard display format of 0.01 ft. The controller returns an indication that there is no echo-loss, a level of 2500 (25.00 feet), and a checksum of 57.		
Request from Master	Response from Controller	
>aa2ssr	Addddddddssr	Format
>01293r	A000250057r	Example
*Note 1. Echo-loss character: 0=no echo-loss, 1=echo-loss condition, 2=momentary echo-loss condition.		

'F0' COMMAND — REQUEST FLOW RATE (FLOW APPLICATIONS ONLY)		
This command is sent by the master to request the controller to send the flow rate. For this example, the master requests the flow from a controller channel at address 01, which is set up with standard flow format of XXX.XX and standard flow units of cubic feet per second (CFS). The controller returns a flow rate of 989 (9.89 cubic feet per second) and a checksum of 6A.		
Request from Master	Response from Controller	
>aaF0ssr	Addddddddssr	Format
>01F0D7r	A00009896Ar	Example

'T' COMMAND — REQUEST TOTALIZER DATA (FLOW APPLICATIONS ONLY)		
This command is sent by the master to request the controller to send the totalizer data. For this example, the master requests the totalizer data from a controller channel at address 01, which is set up with standard totalizer format of XXXX.X and standard totalizer units of cubic feet. The controller returns a total flow of 2753 (275.3 cubic feet) and a checksum of A5.		
	Request from Master	Response from Controller	
	>aatssr	Note 1 Ahhhhhhhhhhssr Note 3 Note 2	Format
	>01tD	Note 1 5r A0400000AC1A5r Note 3 Note 2	Example
Note 1. 0=CF, 1=GL, 2=MG Note 2. Format: 0=XXXXXX,1=XXXX00, 2=XXXXX0, 4=XXXX.X, 5=XXX.XX, 6=XX.XXX, 9=X.XXXX, B=XXX000 Note 3. 32 bit totalizer data in hexadecimal; 00000AC1 is the hexadecimal equivalent of 2753.		

'RD' COMMAND — REQUEST RAW TARGET		
This command is sent by the master to request the controller to send the raw target. For this example, the master requests the raw target from a controller channel at address 01, which returns a raw target of 25939 (259.39 inches) and a checksum of 6C.		
	Request from Master	Response from controller	
	>aaRDssr	Addddddddssr	Format
	>01RDF7r	A00259396Cr	Example

VII.   MAINTENANCE

There is no preventative maintenance required for the unit.

It is recommended that the face of the sensor be cleaned every three months. The sensor should be wiped off with a clean towel.

If the transducer sensor is 3A approved it requires COP cleaning; Clean Out of Place (COP) cleaning requires the removal of soil when the equipment is partially or totally disassembled. Soil removal is effected by circulating chemical solutions and water rinses in a wash tank, which may be fitted with circulating pump(s).

VIII. TROUBLESHOOTING

Problem	Solution

You applied power to the unit, but the display does not come on.	1. Check fuse F1. If blown, replace.
	
	2. If the fuse is okay, check to see if the green power LED (in the middle of the motherboard inside the enclosure) is illuminated. If it is not illuminated:
	
	  a. Check if the power switch (inside the enclosure in the upper right corner next to the AC connection) is on. Turn on if necessary.
	
	  b. Check if there is voltage coming to the unit. Fix power supply or wiring to the unit if necessary.
	
	3. Check the contrast setting for the display. It could be set too light for you to view the display. Follow this exact sequence to check and increase the contrast.
	
	  a. Press the Scan/Hold key to put the controller in Manual Mode.
	
	  b. Press the Menu key to access the Main/Display Menu.
	
	  c. Press 17
	
	  d. Press Enter
	
	  e. Press the Up/Down Arrow keys repeatedly to darken the contrast. You may need to press them 20 to 40 times to see any effect on the display.
	
	4. Turn off the unit, then while holding the period key, turn unit back on.
	
	5. If the display still does not illuminate, contact the Bindicator Service Department.

You applied power to the unit and want to perform the Startup Procedure to set up the controller, but the controller does not display the Startup Procedure. Another individual may have previously powered up the unit and pressed some keys, entering inappropriate values in the Startup Procedure.	Follow the procedure below to repeat the Startup Procedure.
	
	  a. Press the Scan/Hold key to put the controller in manual Mode.
	
	  b. Press the menu key to access the main menu.
	
	  c. Scroll with the arrow keys to the 90 Service Menu. Press Entr.
	
	  d. Press the arrow keys to access the 92 Default Menu.
	
	  e. Enter the Niagara Service Code, which is 9111. Press the Enter key.
	
	  f. Press the arrow keys to select Yes when the controller requests verification that you want to default all of the channels.
	
	The controller will the repeat the Startup Procedure, allowing you to set up the channels again. Follow the appropriate Startup Procedure in Chapters 4, 5 or 6.

Problem	Solution
The controller is displaying data while channel monitoring, but the value does not agree with the known measured level in the vessel.	1. Check the raw target value to compare it to the known measured level in the vessel. The raw target is the 'raw' distance from the face of the transducer to the target, before averaging, tracking, filtering, etc. are applied. The raw target has units of inches (or centimeters). • To obtain the raw target, press the F1 Key while in Manual Mode. The top line of the display now shows the raw target. Press F1 again to turn off. If the raw target value agrees with the measured level, the values input for averaging or filtering parameters, plan or fullpoint may be causing the problem with the displayed data. Contact the Bindicator® Service Department. In order to allow us to help you with troubleshooting over the phone, first write down all of the parameters you entered during the Startup Procedure, and in the Calibration and Service Menus. See Appendix D. 2. Disconnect the transducer and reconnect it directly to the controller. Aim it at a target of a known distance that is greater than the minimum range of the transducer (the target must be farther than 3.5' (1.1m) away). If the level reads correctly, reconnect the transducer into the application and aim the transducer to ensure proper level. Refer to Chapter III, System Installation, for installation and aiming information. 3. Check the cable to ensure that there are no ground points within the cable. 4. Turn the AC power off. Measure the resistance across the transducer leads: • 25' Transducers - Verify resistance is between 180 and 220K ohms • All other Transducers - Verify resistance is between 90 and 110K ohms. Resistance of 0 ohms indicates a short. Resistance above the specified range indicates a transducer or cable open or a bad connection to the controller. • Check the connection of the transducer cable to the controller. A common error is wires inserted in the wrong side of the crew terminal connector clamps. Also check polarity and shield wire. 5. Verify that the frequency of operation of the channel matches the transducer used for the application. The frequency selection can be viewed and modified in Transducer Menu. Refer to Chapter IV, Monitor. 6. Verify that the maximum range is below the bottom of the vessel. Maximum range can be viewed and modified in Range/Filters. Refer to Chapter IV. 7. Adjustments to the power and gain settings may be required. These adjustments should only be made by trained operators or Bindicator® personnel. Contact the Bindicator Service Department. 8. If you have followed the above steps and the displayed data still does not agree with the known measured level in the vessel, contact the Bindicator® Service Department. In order to allow us to help you with troubleshooting over the phone, first write down all the parameters you entered during the Startup Procedure and calibration.

ERROR MESSAGES

For each error message, one or more possible explanations and suggested solutions are provided.

Note: Write down all existing system parameters before you change the Form or Units. If you change the Form or Units you must adjust system parameters to correspond to the new Form or Units.

1. AN EXCLAMATION POINT (!) ON THE DISPLAY

Explanation: 77 Echo Loss/Mode allows you to select the echo loss indication mode — Timed or Temporary. If you selected Temporary, the display shows an exclamation point (!) every time an echo loss is detected, even if only momentarily. The display continues to show the last valid level (or flow) until the target is 'found' again. Communications links, setpoints, and current outputs continue to operate normally, based on the last valid level.

77 Echo Loss/Timer allows you to set the amount of time from when an echo loss is first detected to when it is reported on the display with an asterisk (*), reported over any communications links, and causes fail-safe conditions (Echo Loss Mode) to apply for setpoints and current outputs. If an echo loss continues for Timer, the exclamation point changes to an asterisk (*). Note that if Timed is selected, the display gives no indication of the echo loss (no exclamation point) until the echo loss continues for Echo Loss/Timer.

Solution: Momentary echo loss will occur occasionally, due to noise, vibration, fill, etc. Set Mode to Timed if you do not want to be notified of momentary echo loss.

2. AN ASTERISK (*) ON THE DISPLAY

Explanation: 77 Echo Loss/Timer allows you to set the amount of time from when an echo loss is first detected to when it is reported on the display with an asterisk (*), reported over any communications links, and causes fail-safe conditions (Echo Loss Mode) to setpoints and current outputs. The display continues to show the last valid level (or flow) until the target is 'found' again. The default for Timer is 60 seconds.

Solution: Echo loss will occur occasionally while filling. Other situations that can cause echo loss include foam on a liquid. If echo loss frequently occurs, you may need to adjust power, Near 6 or TVG to improve the system performance; contact Bindicator.

3. A BOX (☞) ON THE DISPLAY

Explanation: A box (p) displays while vessel monitoring to indicate that the system senses a temperature greater than 300º F (149º C) or less than -100º F (-73º C). The over- or under-temperature condition is most likely caused by a short in the temperature probe. Current outputs and setpoint relays are put in a fail-safe condition (ELM) and the temperature condition is reported over any communication links. When an over- or under-temperature condition occurs, the controller uses 68º F (20º C), instead of the data from the temperature probe, to calculate the level.

Solution: Verify if there is a short in the temperature probe. Replace the temperature probe if necessary.

4. UNITS OVERRANGE

Explanation: The calculated level exceeds the maximum number for a 16-bit system (65535).

Solution a. If you selected special display units (Spec Display in the Display Menu) for the channel, check the Format and Maximum Value. A Format of xxx.xx yields a maximum value of 65.535, while a Format of xxxxx00 yields a maximum value of 6553500. Make sure that the Format and Maximum Value is consistent with the maximum expected value.

Solution b. Check the calibration for the channel, fullpoint and span.

5. MATH ERROR # OR SCRIPT COMPILE ERROR

Explanation: These messages apply to math channels only. They indicate a problem with the input equation.

Solution: See appendix F, for a detailed list of the math error messages and solutions.

6. NVRAM FAILURE

Explanation: This error message will only occur at power-up. NVRAM data has been corrupted.

Solution: Contact Bindicator® Technical Support at 1-800-426-9010 or 864-574-2763 or default the unit.

7. NOISE ^

Explanation: The amount of noise exceeds noise limit.

ERROR CODES

If you make an error entering an equation in a math channel, the controller will respond in one of two ways:

- After you enter the equation and press the Enter Key, the controller will not be able to compile the equation, and will respond with a compile error code.

- After you enter the equation and press the Enter Key, the controller will respond with Script Compile Successful. However, when you switch to vessel monitoring for the math channel, the controller will not be able to perform the calculation and will respond with a run time error code.

COMPILE ERROR CODES

A brief explanation is provided of the possible cause for each error code. Suggestions for correcting the error are included where applicable.

1. Equal sign not found after math channel number.

2. Equation exceeds maximum number of characters allowed (40).

   Solution: Simplify equation or break it up into multiple equations, using multiple math channels.

3. Equation exceeds maximum number of constants allowed (3) OR a constant includes more than the maximum number of characters allowed (11).

   Solution: Simplify equation or break it up into multiple equations, using multiple math channels.

4. Incorrect channel ID assigned to this channel (for example, the equation says C10=, but you are in channel 9).

5. Object buffer pointer exceeds maximum limit.

   Solution: Simplify equation or break it up into multiple equations, using multiple math channels.

6. Parenthesis mismatch (i.e., the number of left and right parentheses are not equal).

7. All data registers are used up, insufficient memory is available for this channel.

   Solution: Simplify equation or break it up into multiple equations, using multiple math channels.

8. Equation includes spaces between characters.

9. Equation tries to take a square root of a negative number (i.e., square root of -4).

10. Equal sign in incorrect place (e.g., C9=C2+C3=C4).

11. Equation includes an illegal character, such as a '.' or a '+', at the end (e.g., C1=C2+2. is illegal but C9=C2+2.0 or C5=C2+2 are allowable).

12. Incorrect, duplicated character (e.g., C9=CC2+2).

13. Incorrect use of an operator (e.g., C9=C2+*2).

14. Operator missing (e.g., C9=C2C2).

RUN TIME ERROR CODES

A brief explanation is provided of the possible cause for each error code; suggestions for correcting the error are included where applicable.
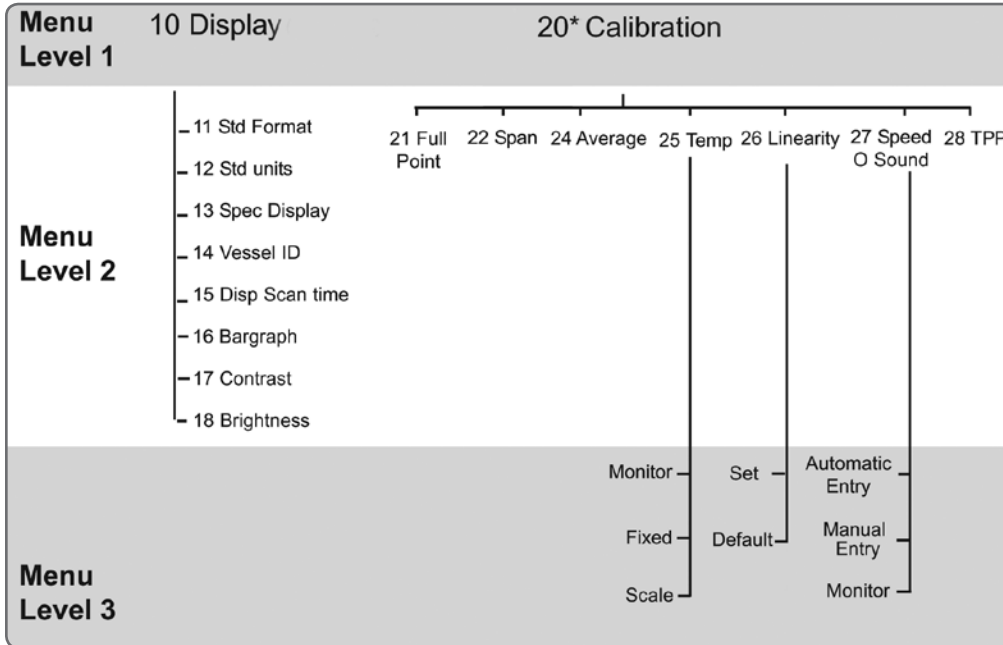
1. Equation tries to divide by zero.

2. Equation tries to take a square root of a negative number that is calculated as part of the equation (i.e., square root of (8-12).

3. Equation tries to take a natural log (ln) of a negative number or of 0.

4. Result from intermediate channel being input into this channel is too large. Solution: Correct and/or scale the equation for the intermediate channel.

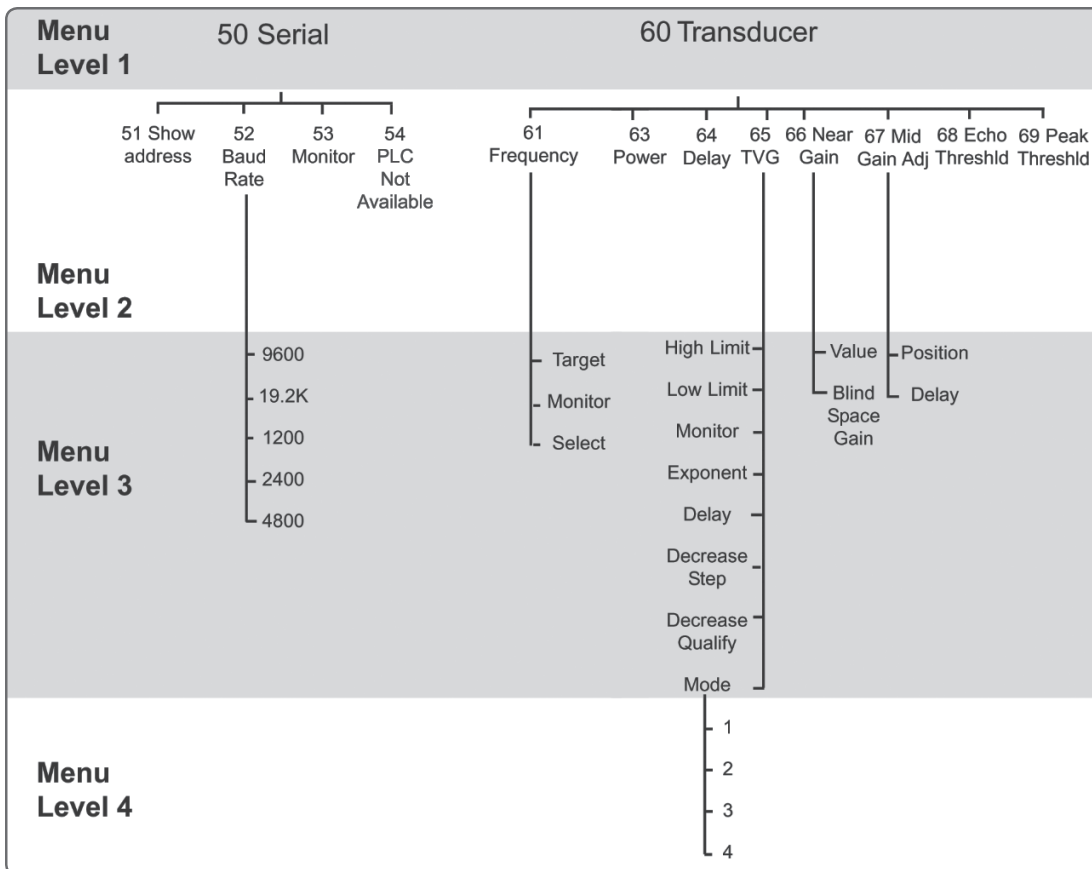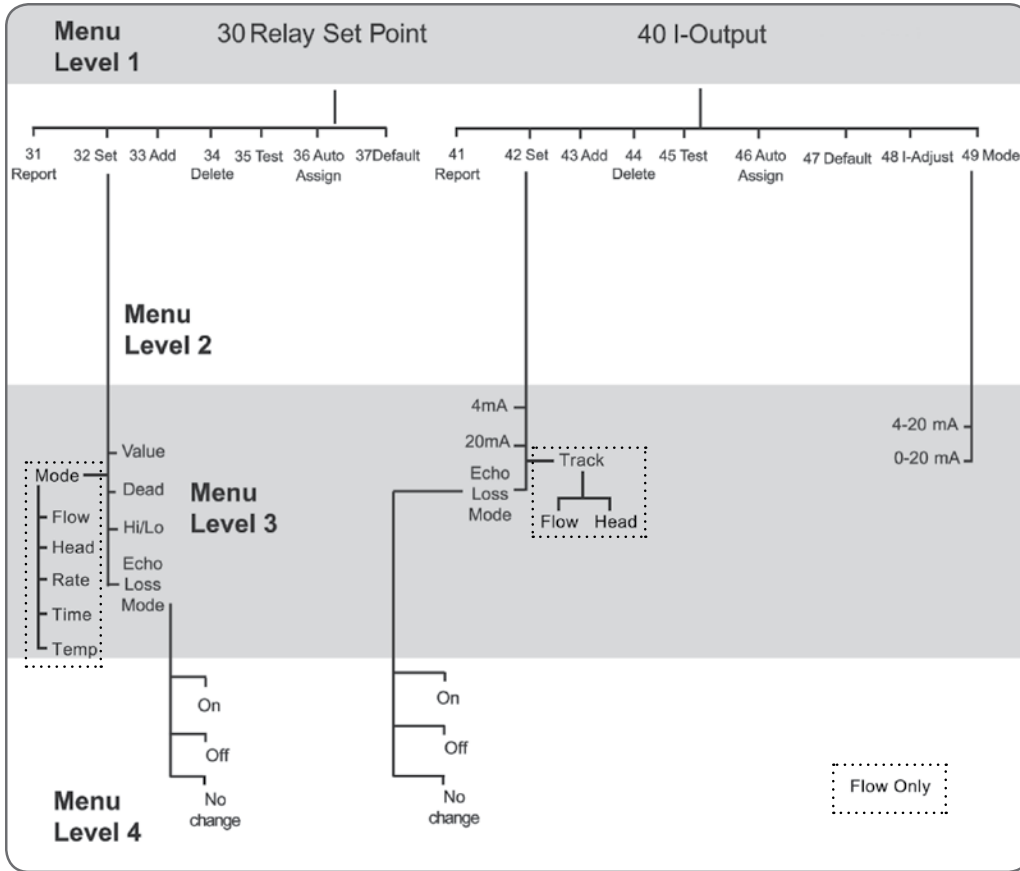5. Result is too large to display. Solution: Scale down the result by using the divide function.
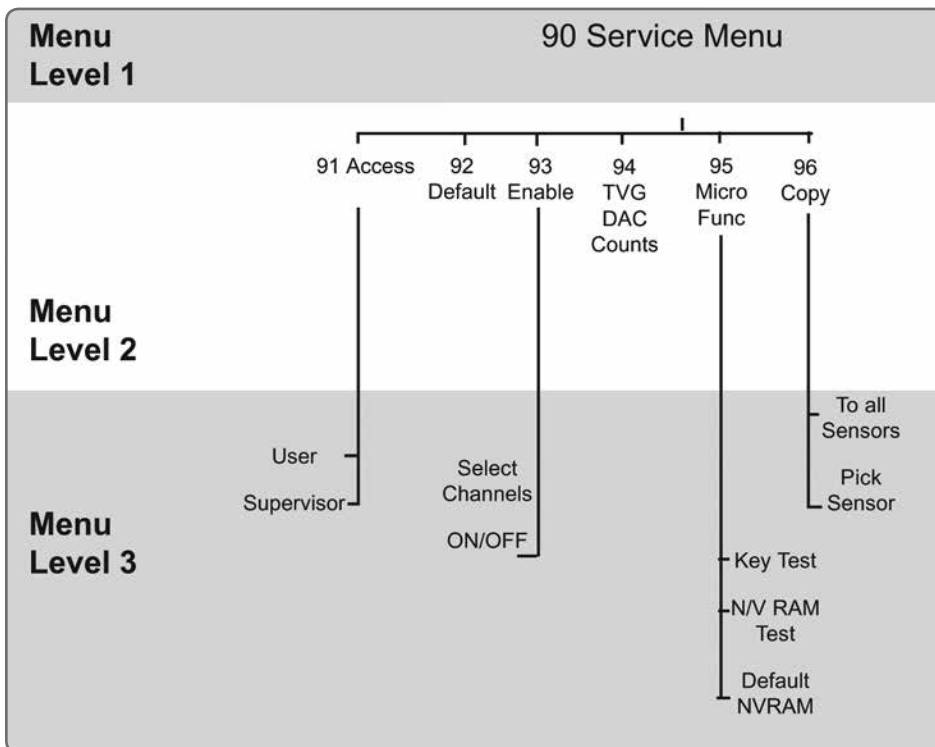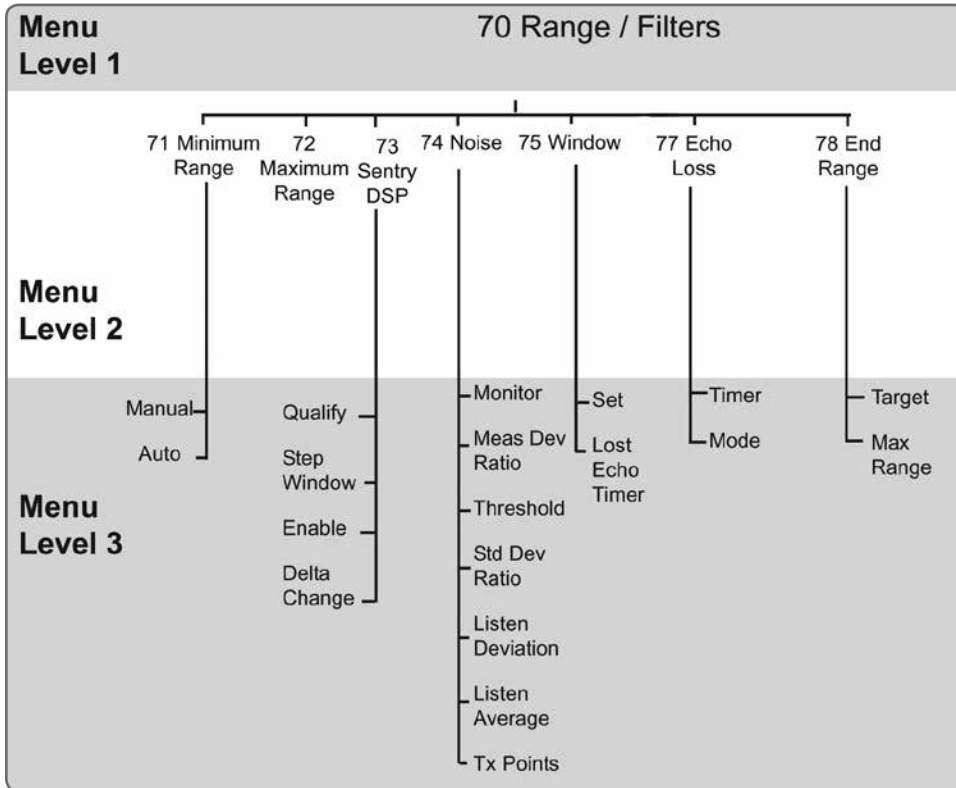
MENU TREE & HOT KEYS

Following is a summary of the keyboard functions (hot keys) you can use when vessel monitoring.

•   Switch from Auto Mode to Manual Mode or vice versa.

    Press the Scan/Hold Key (Auto LED illuminates when the SonoTracker Series is in Auto Mode).

•   Scroll through the Channels when in Manual Mode (Auto LED off)

    Press the Up Arrow or Down Arrow Key.

•   Switch from Channel Monitoring to Menu Tree

    Press the Menu Key while in the Manual Mode.

•   Switch from Numerical display to Bar Graph display or vice versa for a particular channel

    If you set up the bar graph (see Chapter 6, Display Menu), press the Enter Key while in the Manual Mode to toggle between numerical display and bar graph display.

•   View Raw Target (level applications only)

    Press the F1 Key while in the Manual Mode to change the top line of the display to show the raw target. The raw target is the 'raw' distance from the face of the transducer to the target, before averaging, tracking, filtering, etc. are applied.

•   View Temperature of current Level channel (level applications only)

    Press the F2 key while in manual mode to change the top line of the display, showing the airspace temperature.

•   View other Flow Parameters (flow applications only)

    While in the Manual Mode you can change the display to show any of the following parameters: Head (current head), Temperature (current temperature), Total (total flow since the last time you reset the total flow to 0), MaxF (maximum flow since the last time you reset), MinF (minimum flow since the last time you reset), AvgF (average flow since the last time you reset), and RLY (number of setpoint relays for the channel). Press the F1 Key to cycle the top line of the display, the F2 Key to cycle the bottom line of the display and the F3 key to cycle both at once.

•   View Factory-Set ID

    If you input a customer-defined ID, but want to see the factory-set ID for a channel, press the Esc Key while in the Manual Mode.

- View Serial Address for a channel

  Press the Esc Key while in the Manual Mode.

- Display Current SonoTracker Series Software Revision letter and Date of Release

  Press the "." Key briefly while in the Manual Mode.

- Enter 6600 to Default

  Defaults the system; as well as Pressing ENTER at power up.

Menu Level 1 30 Relay Set Point   40 I-Output

31 Report 32 Set 33 Add 34 Delete 35 Test 36 Auto Assign 37 Default   41 Report 42 Set 43 Add 44 Delete 45 Test 46 Auto Assign 47 Default 48 I-Adjust 49 Mode

Menu Level 2

Menu Level 3

Mode — Value
— Dead
Flow — Hi/Lo
Head — Echo
Rate — Loss
Time — Mode
Temp

4mA
20mA
Echo Loss Mode — Track
                — Flow Head

4-20 mA
0-20 mA

Menu Level 4

On
Off
No change

On
Off
No change

Flow Only

Menu Level 1 50 Serial   60 Transducer

51 Show address 52 Baud Rate 53 Monitor 54 PLC Not Available   61 Frequency 63 Power 64 Delay 65 TVG 66 Near Gain 67 Mid Gain Adj 68 Echo Threshld 69 Peak Threshld

Menu Level 2

Menu Level 3

9600
19.2K
1200
2400
4800

Target
Monitor
Select

High Limit
Low Limit
Monitor
Exponent
Delay
Decrease Step
Decrease Qualify
Mode

Value
Blind Space Gain

Position
Delay

Menu Level 4

1
2
3
4

Menu Level 1

70 Range / Filters

71 Minimum Range
72 Maximum Range
73 Sentry DSP
74 Noise
75 Window
77 Echo Loss
78 End Range

Menu Level 2

Menu Level 3

- Manual
- Auto

- Qualify
- Step Window
- Enable
- Delta Change

- Monitor
- Meas Dev Ratio
- Threshold
- Std Dev Ratio
- Listen Deviation
- Listen Average
- Tx Points

- Set
- Lost Echo Timer

- Timer
- Mode

- Target
- Max Range

Menu Level 1

90 Service Menu

91 Access
92 Default
93 Enable
94 TVG DAC Counts
95 Micro Func
96 Copy

Menu Level 2

Menu Level 3

- User
- Supervisor

- Select Channels
- ON/OFF

- Key Test
- N/V RAM Test
- Default NVRAM

- To all Sensors
- Pick Sensor

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