Appendix E

Specifications and Dimensions

E-1 Introduction

A brief review of ADCP operation may help you understand the specifications listed in this section.

> **NOTE**
> *The specifications and dimensions listed in this section are subject to change without notice.*

The ADCP emits an acoustic pulse called a PING. Scatterers that float ambiently with the water currents reflect some of the energy from the ping back to the ADCP. The ADCP uses the return signal to calculate a velocity. The energy in this signal is the *echo intensity*. Echo intensity is sometimes used to determine information about the scatterers.

The velocity calculated from each ping has a *statistical uncertainty*; however, each ping is an independent sample. The ADCP reduces this statistical uncertainty by averaging a collection of pings. A collection of pings averaged together is an *ensemble*. The ADCP's maximum *ping rate* limits the time required to reduce the statistical uncertainty to acceptable levels.

The ADCP does not measure velocity at a single point; it measures velocities throughout the water column. The ADCP measures velocities from its transducer head to a specified range and divides this range into uniform segments called *depth cells* (or *bins*). The collection of depth cells yields a *profile*. The ADCP produces two profiles, one for velocity and one for echo intensity.

The ADCP calculates velocity data relative to the ADCP. The velocity data has both speed and direction information. If the ADCP is moving, and is within range of the bottom, it can obtain a velocity from returns off the bottom. This is called *bottom-tracking*. The bottom-track information can be used to calculate the absolute velocity of the water. The ADCP can get absolute direction information from a heading sensor.

Table E-1 through Table E-18 lists the specifications for all Broadband DR/SC ADCP models. About the specifications:

a. All these specifications assume minimal ADCP motion - pitch, roll, heave, rotation, and translation.

b. Except where noted, this specification table applies to typical setups and conditions. Typical setups use the default input values for each parameter (exceptions include Pings Per Ensemble and Number of Depth Cells). Typical conditions assume uniform seawater velocities at a given depth, moderate shear, moderate ADCP motion, and typical echo intensity levels.

c. The total measurement error of the ADCP is the sum of:

- Long-term instrument error (as limited by instrument accuracy).
- The remaining statistical uncertainty after averaging.
- Errors introduced by measurement of ADCP heading and motion.

d. Because individual pings are independent, the statistical uncertainty of the measurement can be reduced according to the equation:

$$\frac{\text{Statistical uncertainity for one ping}}{\sqrt{\text{number of pings}}}$$

E-2 Broadband ADCP Specifications

Table E-1. Available Broadband Models

Model	Frequency	20º Concave	30º Concave	20º Convex	30º Convex
DR/SC	75			X	X
	150			X	X
	300			X	X
	300/600*	X	X		
	600			X	X
	600*			X	X
	1200	X	X	X	X
DR/SC 5-BEAM	600			X	X

*Special (smaller ceramic)

Table E-2. Broadband Frequency options

System (kHz)	75	150	300	600	1200
Actual (Hz)	76,800	153,600	307,200	614,400	1,228,800

E-2.1 Water Velocity Measurements Relative to the ADCP

Table E-3. General Broadband Water Velocity Measurement Specifications

Accuracy (long-term)	0.2% of measured velocity ±0.2 cm/s
Number of depth cells	1 to 128 cells
Depth cell size	5 to 3200 centimeters (2 inches to 105 feet)

Velocity range	±10 m/s (horizontal)

Table E-4. Broadband Precision (cm/s)

Depth cell size (m)	75	150	300	600	1200
0.12	—	—	—	—	—
0.25	—	—	—	—	10
0.5	—	—	—	10	4
1	—	—	10	4	2
2	—	10	4	2	1
3	15	4	2	1	—
8	5	2	1	—	—
16	3	1	—	—	—

Water-current velocity precision is the statistical uncertainty (1σ) of the horizontal velocities for single pings when operating in the normal mode. The precision will decrease proportional to the square root of the number of pings averaged together. Higher precision profiling modes can be used when current shear and instrument dynamics are low.

Table E-5. Broadband Minimum Time Between Pings (seconds)

System frequency (kHz)				
75	150	300	600	1200
1.00	0.65	0.50	0.20	0.10

Based on 1.57 ms × nominal bottom-track range

Table E-6. Broadband Maximum Profiling Range (meters)

Frequency (kHz)	75	150	300	300	600	600	1200
Beamwidth (degrees)	3	3	3	1.5	3	1.5	1.5
Depth cell size (m)	16	8	4	4	2	2	1
High-power mode	500	300	—	—	—	—	—
Low-power mode	410	230	110	130	50	60	20

Ranges are for systems using the indicated frequency, transducer beamwidth, depth cell size, and power mode in typical water conditions. Range decreases about 10% each time cell size is halved.

Table E-7. Broadband Minimum Range to Start of First Depth Cell (meters)

System frequency (kHz)				
75	150	300	600	1200
8	4	2	1	0.5

Table E-8. Broadband Loss of Profiling Range Near a Boundary

30 beam angle	13.4% of range to boundary + one depth cell
20 beam angle	6% of range to boundary + one depth cell

NOTE: ADCP pitch and roll may reduce range.

E-2.2 ADCP Velocity Measurements Relative to the Bottom and Bottom Depth Measurements

Table E-9. Broadband General Bottom-Track Specifications

Accuracy (long-term)	0.2% of measured velocity ±0.2 cm/s
Precision (cm/s)	0.0003V + (a + 0.003V)/(1 + bAF), where: a = 1 cm/s b = 0.0001 $kHz^{-1}m^{-1}$ A = Altitude in Meters F = System Frequency in kHz V = Velocity in cm/s
Altitude accuracy (meters)	1% of measured altitude ±120/Frequency (kHz)
Velocity range	± 10 m/s (horizontal)

Note: bottom-track velocity precision is the statistical uncertainty (1σ) of the horizontal velocities for single pings when operating in the normal mode. The precision will decrease proportional to the square root of the number of pings averaged together.

Table E-10. Broadband Maximum and Minimum Altitudes (meters)

Frequency (kHz)	75	150	300	300	600	600	1200
Beamwidth (degrees)	3	3	3	1.5	3	1.5	1.5
Max. altitudes							
High-power mode	950	525	—	—	—	—	—
Low-power mode	850	450	225	260	95	110	35
Min. altitudes	5	3	2	2	1.4	1.4	0.8

Altitudes are for systems using the indicated frequency, transducer beamwidth, and power mode in typical seawater conditions.

E-2.3 Echo Intensity Measurements

Table E-11. Broadband Echo Intensity Specifications

Accuracy	±2 dB
Profiling range (meters)	85% of water-profiling range
Number of depth cells	1 to 128 cells
Depth cell size	5 to 3200 centimeters (2 inches to 105 feet)
Dynamic range	80 dB

E-2.4 Data Communication

Table E-12. Broadband Data Communications Specifications

Interface	Serial communications at 300 to 115,200 baud using two RS-422 cables, or one RS-232 cable and one RS-422 cable (see Appendix-A)
Input data format	ASCII commands (see Appendix-C)
SC data storage capacity (Standard)	10 to 80 megabytes of solid-state memory
SC data storage capacity (Optional)	90 to 320 megabytes of solid-state memory. This optional unit fits into the power module section of the SC-BBADCP and takes up to 72 millimeters of space. You may use either the standard solid state memory or the optional memory pack. The units may not be combined.

E-2.5 Power

Table E-13. Broadband Power Specifications

Deck box external power	20 to 60 VDC 98 to 264 VAC, 50-60 Hz 12 VDC
External (DR models)	20 to 60 VDC
Internal (SC models)	Alkaline battery packs supplying 45 to 60 VDC

Table E-14. Broadband Dissipation (watts)

Source / Mode	Standby	Operate
20–60 VDC - High-power	5	300
20–60 VDC - Low-power	5	100
12 VDC	10	75
AC - High-power	10	500
AC - Low-power	10	150

E-2.6 Sensors

Table E-15. Broadband Internal Sensor Specifications

Sensor	Accuracy	Resolution
Heading	*±5	0.2
Tilt	±1	0.01
Temperature	±0.5° C	0.01° C
Depth	±1% FS	0.03% FS

10 to 10,000-m full-scale (fs) depth sensors available.

Heading accuracy assumes you are working in an environment where the horizontal magnetic field strength is 10,000 to 40,000 nt (nano-teslas) and the operational temperature of 0 - 30°C.

External Sensors - RS-485 serial interface at 300-19200 baud (future)

E-2.7 Environmental

Table E-16. Broadband Environmental Specifications

Temperature	Operating: -5 to +35°C Storage : -50 to +80°C
Humidity	Must be non-condensing
Vibration	Meets MIL-STD-167-1, type 1
Shock	20 g static
DR/SC depth ratings	200 m, 1000 m, 3000 m, or 6000 m

E-2.8 Broadband ADCP Physical Characteristics

NOTE

See outline drawings for dimensions and weights for specific ADCP frequencies.

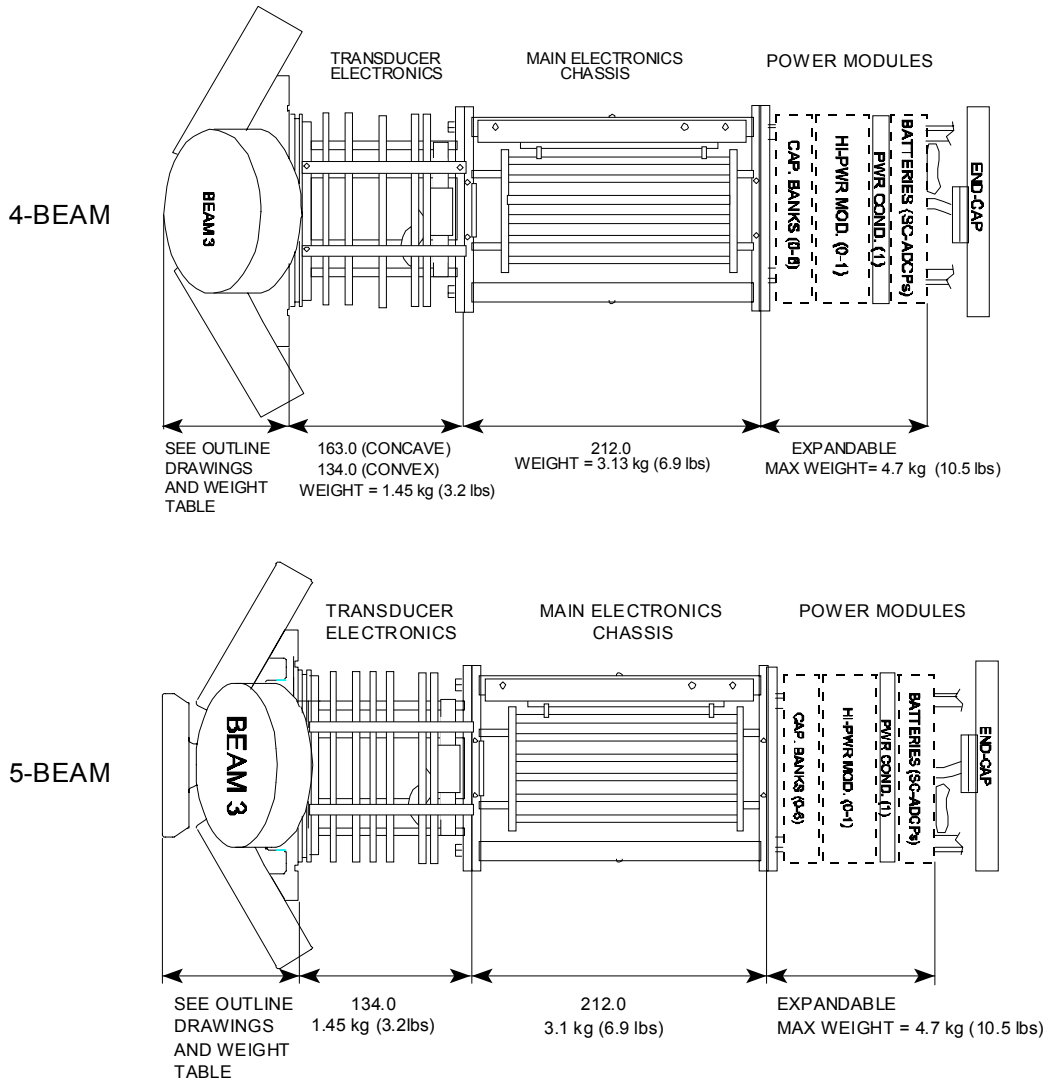


Figure E-1. Broadband Electronics Chassis Dimensions Overview

Table E-17. Broadband Power Module Dimensions and Weights

Description	Width (mm)	Weight (kg)
Capacitor bank	72.0	0.97
Hi-Power module	116.0	1.27
Power conditioner module (earlier Revision ADCPs)	42.0	0.55
Power conditioner module	36.8	0.48
Single battery pack module	119.3	3.23
Double battery pack module	224.7	5.30
Triple battery pack module	330.2	9.19
Single battery pack (earlier revision ADCPs)	119.0	3.20
Optional memory module (up to 160 MB)	42.0	0.59
Optional memory module (up to 320 MB)	72.0	1.35
DR-BBADCP Slider Plate (earlier revision ADCPs)	31.0	0.27
SC-BBADCP Slider plate (earlier revision ADCPs)	44.0	0.28
Latch	33.0	0.04
Lock bracket	N/A	0.0009
Slider rail	N/A	0.00079334/mm

NOTE

See configuration drawings for power module locations.

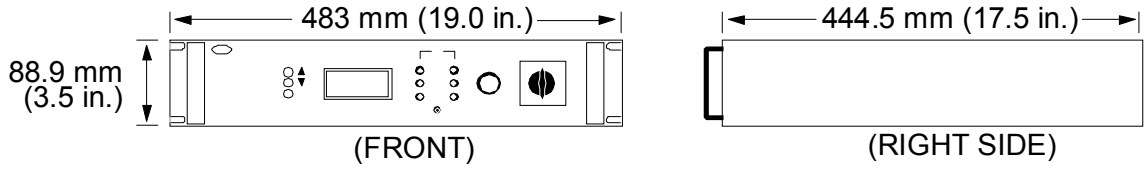


Figure E-2. DR-BBADCP Deck Box Dimensions (Earlier Revision Deck Box)

NOTE

See outline/Installation drawing 961-6031 for dimensions of present deck box.

E-2.9 Broadband ADCP Standard Configuration Drawings

SC-BBADCP users may convert their systems to a DR-BBADCP configuration by installing the following components:

- DR-BBADCP end cap
- DR-BBADCP slider plate (if your ADCP uses a slider plate)
- Capacitor banks

See the configuration drawings for standard configurations. *The order in which the modules are placed is important: Do not change.*

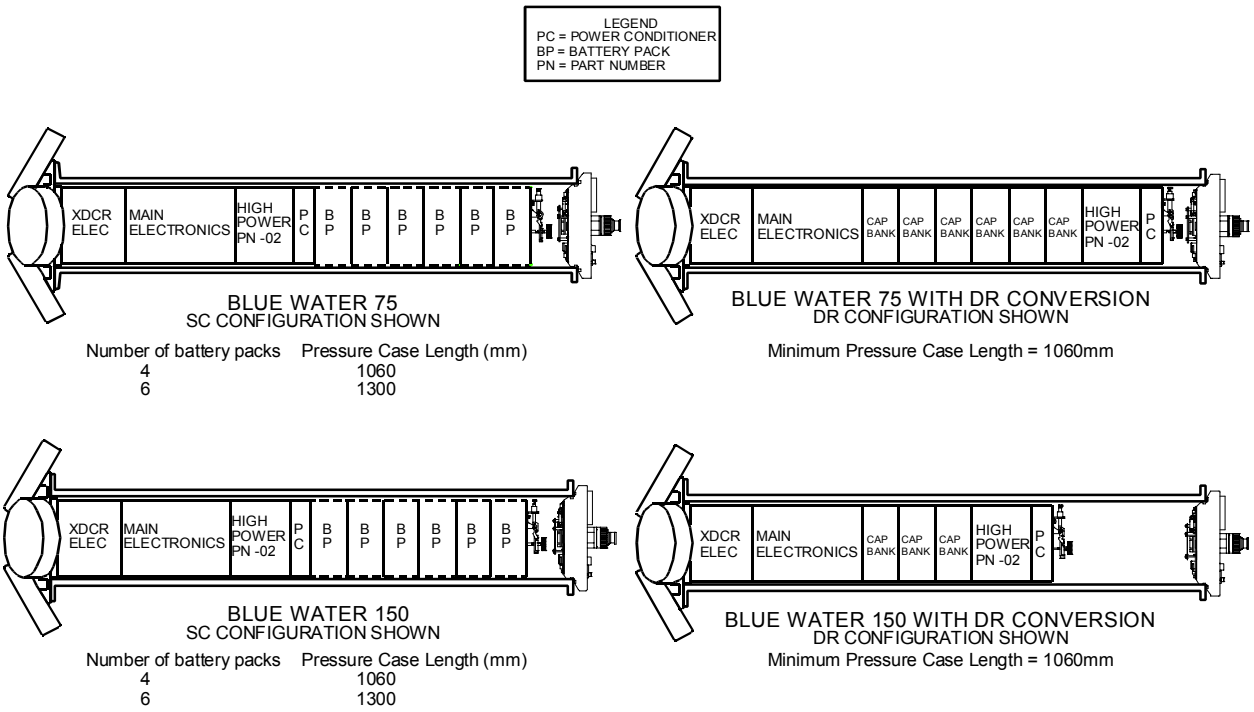
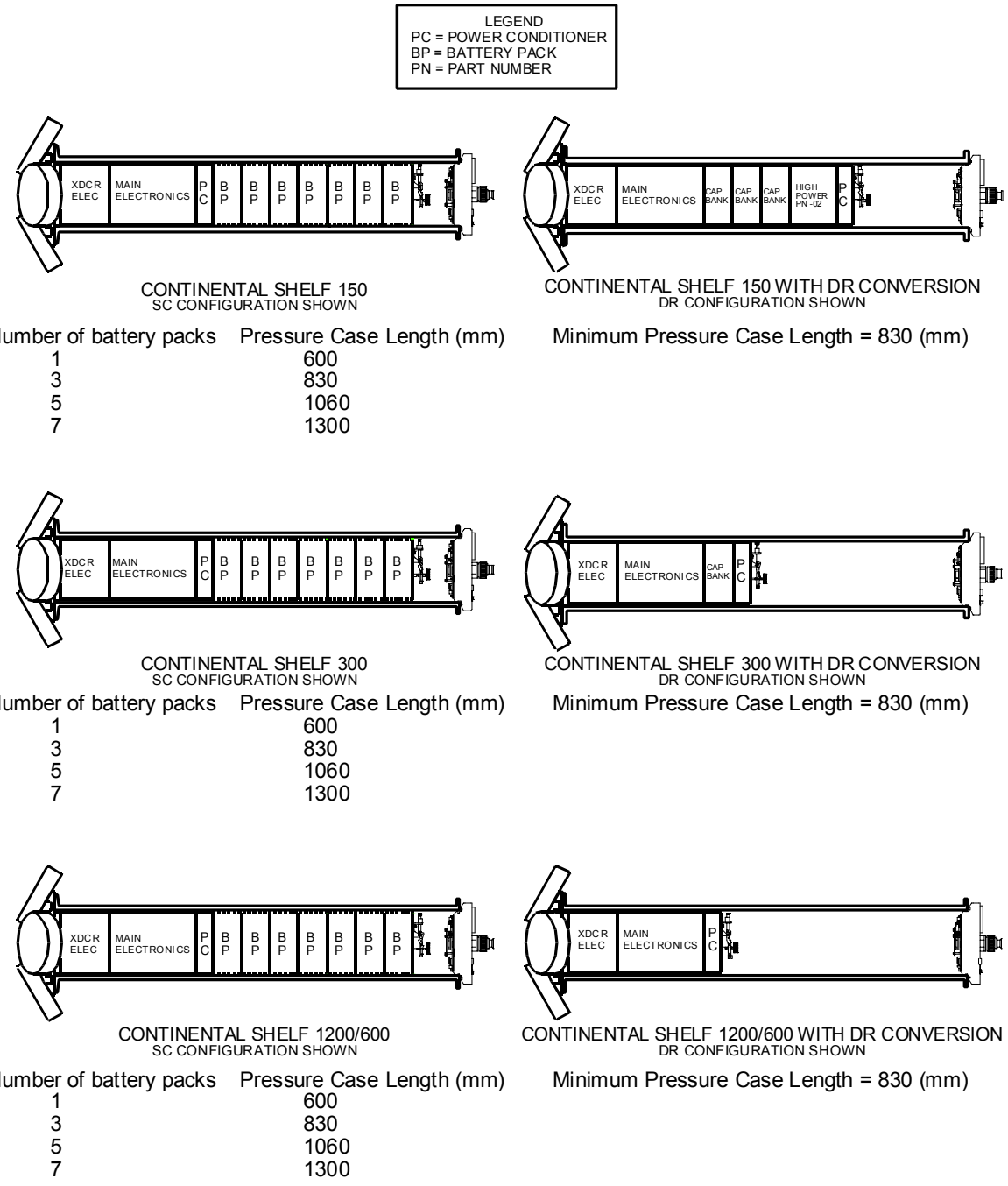


Figure E-3. Blue Water Systems Standard Configuration



CONTINENTAL SHELF 150
SC CONFIGURATION SHOWN

Number of battery packs	Pressure Case Length (mm)
1	600
3	830
5	1060
7	1300

CONTINENTAL SHELF 150 WITH DR CONVERSION
DR CONFIGURATION SHOWN

Minimum Pressure Case Length = 830 (mm)

CONTINENTAL SHELF 300
SC CONFIGURATION SHOWN

Number of battery packs	Pressure Case Length (mm)
1	600
3	830
5	1060
7	1300

CONTINENTAL SHELF 300 WITH DR CONVERSION
DR CONFIGURATION SHOWN

Minimum Pressure Case Length = 830 (mm)

CONTINENTAL SHELF 1200/600
SC CONFIGURATION SHOWN

Number of battery packs	Pressure Case Length (mm)
1	600
3	830
5	1060
7	1300

CONTINENTAL SHELF 1200/600 WITH DR CONVERSION
DR CONFIGURATION SHOWN

Minimum Pressure Case Length = 830 (mm)

Figure E-4. Continental Shelf Systems Standard Configuration

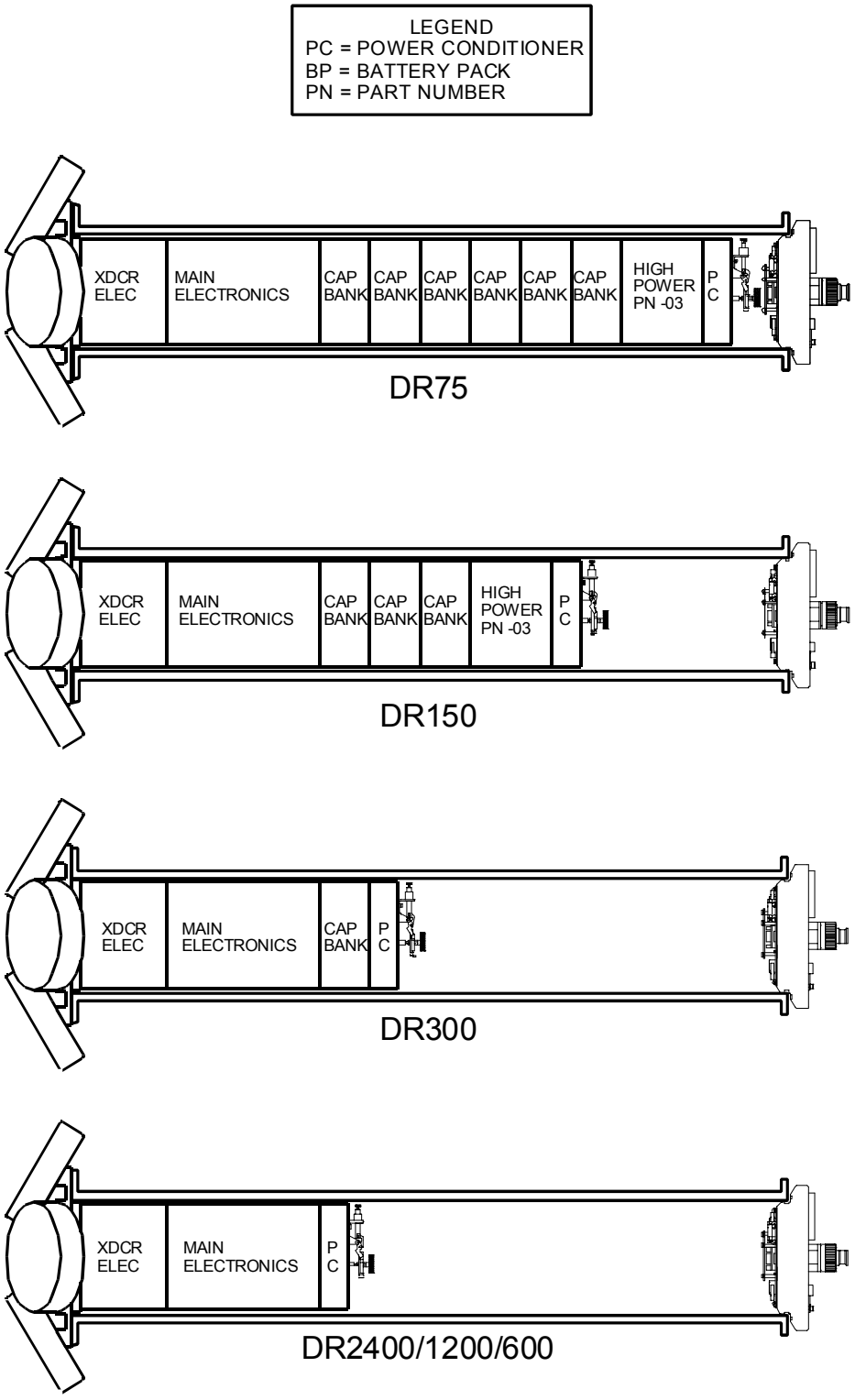
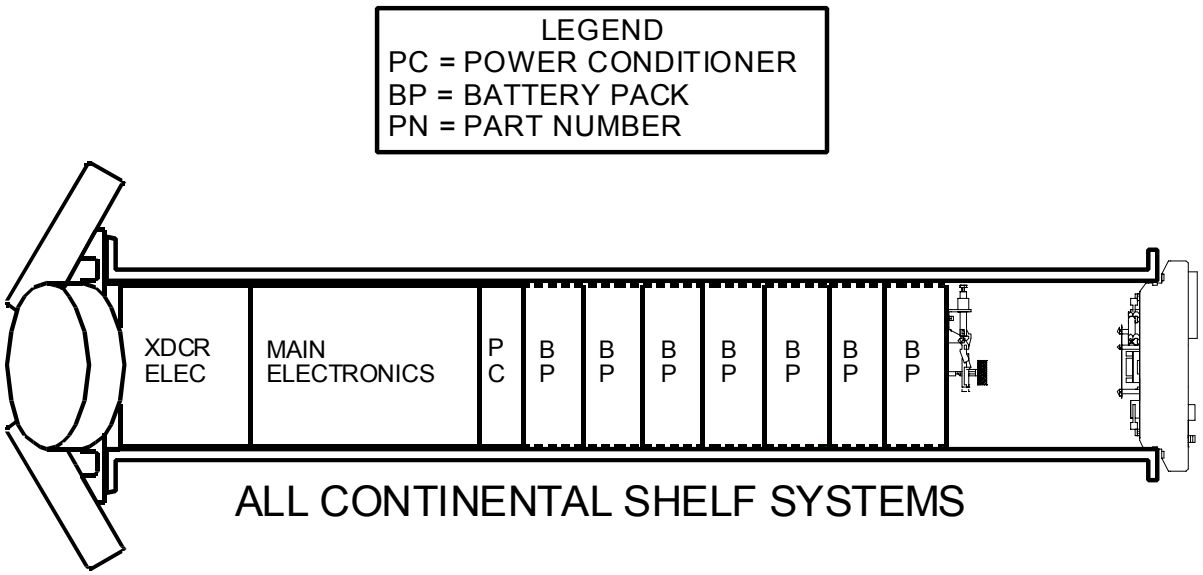
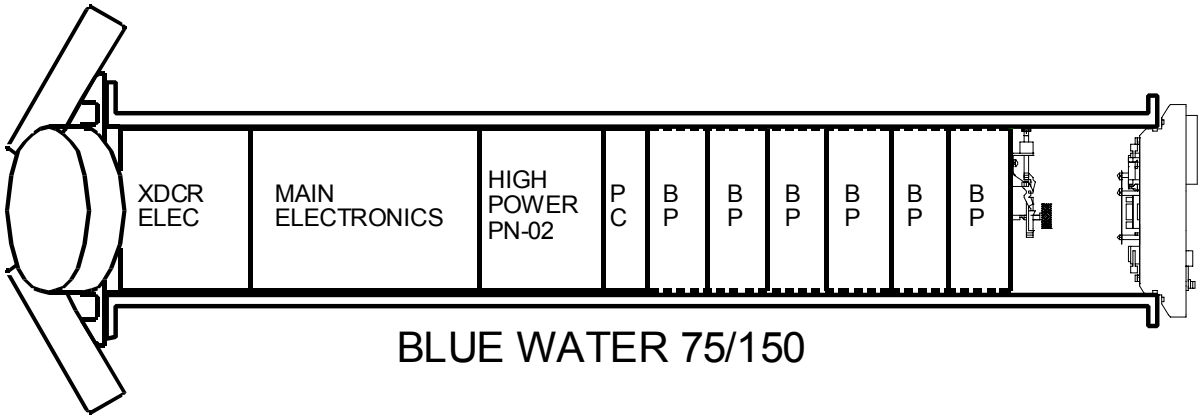


Figure E-5. Direct-Reading Systems Standard Configurations



Number of battery packs	Pressure Case Length (mm)
1	600
3	830
5	1060
7	1300



Number of battery packs	Pressure Case Length (mm)
4	1060
6	1300

Figure E-6. Self-Contained Systems Standard Configuration

E-2.10 Outline Installation Drawings

Table E-18. Outline Installation Drawings

Description	Drawing Number
DR/SC 1200kHz 20° Concave	961-6010
DR/SC 1200kHz 30° Concave	961-6011
DR/SC 1200kHz 20° Convex	961-6012
DR/SC 1200kHz 30° Convex	961-6013
DR/SC 600kHz 20° Convex, small ceramic	961-6014
DR/SC 600kHz 30° Convex, small ceramic	961-6015
DR/SC 600kHz 20° Convex	961-6016
DR/SC 60kHz 30° Convex	961-6017
DR/SC 300/600kHz 20° Concave, small ceramic	961-6018
DR/SC 300/600kHz 30° Concave, small ceramic	961-6019
DR/SC 300kHz 20° Convex	961-6020
DR/SC 300kHz 30° Convex	961-6021
DR/SC 150kHz 20° Convex	961-6022
DR/SC 150kHz 30° Convex	961-6023
DR/SC 75kHz 20° Convex	961-6024
DR/SC 75kHz 30° Convex	961-6025
DR/SC 600kHz 30° Convex, 5-beam	961-6026
DR/SC 600kHz 20° Convex, 5-beam	961-6027
DR/SC 1000 meter Pressure Case	961-6028
DR/SC 3000/6000 meter Pressure Case	961-6029
DR/SC 90° Adapter Elbow	961-6030
DR Deck Box	961-6031