

INLIVEN™ CRT-P

The INLIVEN™ cardiac resynchronization therapy pacemaker (CRT-P) from Boston Scientific provides cardiac resynchronization therapy for the treatment of heart failure. The INLIVEN™ pacing system from Boston Scientific offers RightRate™ – the newest generation of MV sensor technology, designed to provide your patient with optimal CRT therapy and physiological pacing¹⁻⁴. The INLIVEN™ CRT-P also offers enhanced features and diagnostics, including AP Scan™ and Respiratory Rate Trend, for risk stratification and co-morbidity management. INLIVEN™ has been designed to maximize efficiency and ease of use with PaceSafe™ auto thresholds and an easy user interface. INLIVEN™ includes the SmartDelay™ algorithm, which quickly provides recommended settings for programming AV Delay/Sensed AV Offset, with the intent of providing optimally timed CRT to maximize hemodynamic function. INLIVEN™ is LATITUDE™ NXT Remote Patient Management enabled, the only system to meet ESC Class 1 Recommendations* offering the opportunity for convenient remote patient monitoring and follow-up.



1. Mond HG, Kertes PJ: Rate-Responsive Cardiac Pacing. Englewood, CO Teletronics Pacing Systems, 1990. (in Clinical Cardiac Pacing 1st edition, 1995, Saunders; ed Ellenbogen, Wilkoff, Kay, Page 224).
 2. Kay GN, Buben SR, Epstein AE, Plimb VJ: Rate-modulated pacing based upon transthoracic impedance measurements of minute ventilation: Correlation with exercise gas exchange. J Am Coll Cardiol 15:1283, 1989.
 3. PULSAR MAX™ Blended Sensor Clinical Trial Results
 4. Chronotropic competence is defined by the Model of the Cardiac Chronotropic Response to Exercise. Wilkoff B, Corey J, Blackburn G. A mathematical model of the cardiac chronotropic response to exercise. Journal of Electrophysiology. 1989;3:176–180. Refer to the Physician's System Guide for more information on adaptive-rate therapy. Additional clinical performance was assessed using INSIGNIA™ Ultra clinical data with the AutoLifestyle™ feature programmed On. Boston Scientific. Data on file. ALTRUA™ Pacemaker System Guide. 2008;1:20–25.
- * To date Dec 2012.

Mechanical Specifications

Model	Type	Size (mm) (H × W × D)	Mass (g)	Volume (cc)	Connector
W274	CRT	61 x 44.5 x 7.5	34	15	IS-1 / LV-1
W275	CRT	61 x 44.5 x 7.5	34	15	IS-1

All Models of INLIVEN™

Shape	Modified elliptical
Envelope	Hermetically sealed titanium
Sensors	Minute-ventilation sensor, integrated circuit accelerometer
Power Supply	Lithium-manganese Dioxide Cell
Set-screw Style	Preinserted set-screws and seal plugs

AP Scan™

Diagnostic	Programmable Parameters
AP Scan™	Sleep Start Time, Sleep Duration

ZIP Telemetry Settings

Parameter	Programmable Values	Nominal Setting
Communication Mode	Enable use of ZIP Telemetry (may require limited use of wand), Use wand for all telemetry	Enable use of ZIP telemetry (May require limited use of wand)

Device Mode

Parameter	Programmable Values	Nominal Setting
Device Mode	Exit Storage, Enable Electrocautery Protection	Storage

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Pacing Therapy Parameters (Specified into 750Ω load)

Parameter	Programmable Values	Nominal Setting
Mode ^{a, b, d}	DDD(R), DDI(R), DOO, VDD(R), VVI(R), VOO, AAI(R), AOO, Off; Temporary: DDD, DDI, DOO, VDD, VVI, VOO, AAI, AOO, Off	DDD
Ventricular Pacing Chamber ^{a, d}	RV Only, LV Only, BiV	BiV
LV Offset (ms) ^{a, d}	-100, -90, ..., 100	0 (Tolerance ± 5 ms)
BiV Trigger ^f	Off, On	Off
BiV Trigger/VRR Maximum Pacing Rate ⁱ (min ⁻¹)	50, 55, ..., 185	130 (Tolerance ± 5 ms)
Lower Rate Limit (LRL) ^{a, c, d} (min ⁻¹)	30, 35, ..., 185	45 (Tolerance ± 5 ms)
Maximum Tracking Rate (MTR) ^{a, d} (min ⁻¹)	50, 55, ..., 185	130 (Tolerance ± 5 ms)
Maximum Sensor Rate (MSR) ^f (min ⁻¹)	50, 55, ..., 185	130 (Tolerance ± 5 ms)
Pulse Amplitude (atrium) ^{a, d, e} (V)	Auto, 0.1, 0.2, ..., 3.5, 4.0, ..., 5.0 Temporary: 0.1, 0.2, ..., 3.5, 4.0, ..., 5.0	3.5 (Tolerance ± 15% or 100 mV, whichever is greater)
Pulse Amplitude (right ventricle) ^{a, d, e} (V)	Auto, 0.1, 0.2, ..., 3.5, 4.0, ..., 7.5; Temporary: 0.1, 0.2, ..., 3.5, 4.0, ..., 7.5	3.5 (Tolerance ± 15% or 100 mV, whichever is greater)
Pulse Amplitude (left ventricle) ^{a, d, e} (V)	0.1, 0.2, ..., 3.5, 4.0, ..., 7.5 Temporary: 0.1, 0.2, ..., 3.5, 4.0, ..., 7.5	3.5 (Tolerance ± 15% or 100 mV, whichever is greater)
Pulse Amplitude Daily Trend (independently programmable in atrium and right ventricle) ^g	Disabled, Enabled	Disabled
Pulse Width (atrium, right ventricle, left ventricle) ^{a, d, e, h} (ms)	0.1, 0.2, ..., 2.0	0.4 (Tolerance ± 0.03 ms at < 1.8 ms; ±0.08 ms at ≥ 1.8 ms)
Accelerometer ^f	On, Passive	Passive
Accelerometer Activity Threshold	Very Low, Low, Medium Low, Medium, Medium High, High, Very High	Medium
Accelerometer Reaction Time (sec)	10, 20, ..., 50	30
Accelerometer Response Factor	1, 2, ..., 16	8
Accelerometer Recovery Time (min)	2, 3, ..., 16	2
Minute Ventilation ^f	On, Passive, Off	Passive
Minute Ventilation Response Factor	1, 2, ..., 16	3
Minute Ventilation Fitness Level	Sedentary, Active, Athletic, Endurance Sports	Active
Patient's Age	≤5, 6–10, 11–15, ..., 91–95, ≥ 96	56–60
Patient's Gender	Male, Female	Male
Ventilatory Threshold (min ⁻¹)	30, 35, ..., 185	120 (Tolerance ± 5 ms)
Ventilatory Threshold Response (%)	Off, 85, 70, 55	70
Respiration-related Trends ⁱ	Off, On	On
Tracking Preference ^f	Off, On	On
Rate Hysteresis Hysteresis Offset ^f (min ⁻¹)	-80, -75, ..., -5, Off	Off (Tolerance ± 5 ms)
Rate Hysteresis Search Hysteresis ^f (cycles)	Off, 256, 512, 1024, 2048, 4096	Off (Tolerance ± 1 cycle)
Rate Smoothing (up, down) ^f (%)	Off, 3, 6, 9, 12, 15, 18, 21, 25	Off (Tolerance ± 1%)
Rate Smoothing Maximum Pacing Rate (min ⁻¹)	50, 55, ..., 185	130 (Tolerance ± 5 ms)
Sudden Brady Response (SBR) ^f	Off, On	Off
SBR Atrial Paces Before Therapy	1, 2, ..., 8	3
SBR Atrial Pacing Rate Increase (min ⁻¹)	5, 10, ..., 40	20
SBR Therapy Duration (min)	1, 2, ..., 15	2
SBR Inhibit During Rest	Off, On	On

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Pacing Therapy Parameters (Specified into 750Ω load) (continued)

Parameter	Programmable Values	Nominal Setting
Atrial Pace/Sense Configuration ^{a, d}	Unipolar, Bipolar, Bipolar/Unipolar, Unipolar/Bipolar, Unipolar/Off, Bipolar/Off	Bipolar
Right Ventricle Pace/Sense Configuration ^{a, d}	Unipolar, Bipolar, Bipolar/Unipolar, Unipolar/Bipolar	Bipolar
Left Ventricular Electrode Configuration ^a	Dual, Single, None	None
Left Ventricular Pace Configuration ^{a, d}	Single or Dual: LVtip >> Can, LVtip >> RV, Dual Only: LVring >> Can, LVring >> RV, LVtip >> LVring, LVring >> LVtip	Single: LVtip >> RV Dual: LVtip>>LVring
Left Ventricular Sense Configuration ^{a, d}	Single or Dual: LVtip >> Can, LVtip >> RV, Off Dual Only: LVring >> Can, LVring >> RV, LVtip >> LVring	Single: LVtip >> RV Dual: LVtip>>LVring
Safety Switch (independently programmable in each chamber)	Off, On	On
Maximum Paced AV Delay ^{a, d} (ms)	30, 40, ..., 300	180 (Tolerance ± 5 ms)
Minimum Paced AV Delay ^{a, d} (ms)	30, 40, ..., 300	180 (Tolerance ± 5 ms)
Maximum Sensed AV Delay ^{a, d} (ms)	30, 40, ..., 300	120 (Tolerance ± 5 ms)
Minimum Sensed AV Delay ^{a, d} (ms)	30, 40, ..., 300	120 (Tolerance ± 5 ms)
Maximum A-Refractory (PVARP) ^{a, d} (ms)	150, 160, ..., 500	280 (Tolerance ± 5 ms)
Minimum A-Refractory (PVARP) ^{a, d} (ms)	150, 160, ..., 500	240 (Tolerance ± 5 ms)
Maximum RV-Refractory (RVRP) ^{a, d} (ms)	150, 160, ..., 500	250 (Tolerance ± 5 ms)
Minimum RV-Refractory (RVRP) ^{a, d} (ms)	150, 160, ..., 500	230 (Tolerance ± 5 ms)
LV-Refractory (LVRP) ^{a, d} (ms)	250, 260, ..., 500	250 (Tolerance ± 5 ms)
LV Protection Period (LVPP) ^a (ms)	300, 350, ..., 500	400 (Tolerance ± 5 ms)
PVARP After PVC ^a (ms)	Off, 150, 200, ..., 500	400 (Tolerance ± 5 ms)
A-Blank after V-Pace ^{a, d} (ms)	Smart, 85, 105, 125, 150, 175, 200	Smart (Tolerance ± 5 ms)
A-Blank after RV-Sense ^{a, d} (ms)	Smart, 45, 65, 85	Smart (Tolerance ± 5 ms)
RV-Blank after A-Pace ^{a, d} (ms)	45, 65, 85	65 (Tolerance ± 5 ms)
LV-Blank after A-Pace ^{a, d} (ms)	Smart, 45, 65, 85	Smart (Tolerance ± 5 ms)
Noise Response ^a	A00, V00, D00, Inhibit Pacing	D00 for DDD(R) and DDI(R) modes; V00 for VDD(R) and VVI (R) modes; A00 for AAI(R) mode
Magnet Response	Off, Store EGM, Pace Async	Pace Async

a. The programmed Normal Brady values will be used as the nominal values for Temporary Brady pacing.

b. Refer to the NASPE/BPEG codes below for an explanation of the programmable values. The identification code of the North American Society of Pacing and Electrophysiology (NASPE) and the British Pacing and Electrophysiology Group (BPEG) is based on the categories listed in the table.

c. The basic pulse period is equal to the pacing rate and the pulse interval (no hysteresis). Runaway protection circuitry inhibits bradycardia pacing above 205 min⁻¹.

Magnet application may affect pacing rate (test pulse interval).

d. Separately programmable for Temporary Brady.

e. Values are not affected by temperature variation within the range 20°C–43°C.

f. This parameter is disabled during Temporary Brady.

g. This parameter is automatically enabled if Auto is selected for the Pulse Amplitude.

h. When the Pulse Amplitude is set to Auto or Pulse Amplitude Daily Trend is enabled the Pulse Width is fixed at 0.4 ms.

i. This value is located on the Lead Setup screen.

j. The BIV/VRR Maximum Pacing Rate is shared by BIV Trigger and VRR, changing the value for BIV MPR will also change the value for VRR MPR.

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Brady Mode Values Based on NASPE/BPEG Codes

Position	I	II	III	IV	V
Category	Chambers Paced	Chambers Sensed	Response to Sensing	Programmability, rate modulation	Antitachyarrhythmia Functions
Letters	0–None	0–None	0–None	0–None	0–None
	A–Atrium	A–Atrium	T–Triggered	P–Simple Programmable	P–Pacing (Antitachyarrhythmia)
	V–Ventricle	V–Ventricle	I–Inhibited	M–Multiprogrammable	S–Shock
	D–Dual (A&V)	D–Dual (A&V)	D–Dual (T&I)	C–Communicating	D–Dual (P&S)
	--	--	--	R–Rate Modulation	--
Mfrs. Designation Only	S–Single (A or V)	S–Single (A or V)	--	--	--

Sensor Trending

Parameter	Programmable Values	Nominal Setting
Recording Method	Beat To Beat, Off, 30 Second Average	30 second average
Data Storage	Continuous, Fixed	Continuous

Ventricular Tachy EGM Storage

Parameter	Programmable Values	Nominal Setting
Ventricular Tachy EGM Storage	Off, On	On
VT Detection Rate ^a (min ⁻¹)	90, 95, ..., 210, 220	160 (Tolerance ± 5 ms)

a. The VT Detection Rate must be $\geq 5 \text{ min}^{-1}$ higher than the Maximum Tracking Rate, Maximum Sensor Rate, and the Maximum Pacing Rate, and must be $\geq 15 \text{ min}^{-1}$ higher than the Lower Rate Limit.

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Atrial Tachy Parameters

Parameter	Programmable Values	Nominal Setting
ATR Mode Switch ^a	Off, On	On
ATR Trigger Rate ^{a, e} (min ⁻¹)	100, 110, ..., 300	170 (Tolerance ± 5 ms)
ATR Duration ^a (cycles)	0, 8, 16, 32, 64, 128, 256, 512, 1024, 2048	8 (Tolerance ± 1 cardiac cycle)
Entry Count ^a (cycles)	1, 2, ..., 8	8
Exit Count ^a (cycles)	1, 2, ..., 8	8
ATR Fallback Mode ^f	VDI, DDI, VDIR, DDIR	DDI
ATR Fallback Time ^a (min:sec)	00:00, 00:15, 00:30, 00:45, 01:00, 01:15, 01:30, 01:45, 02:00	00:30
ATR Fallback LRL ^a (min ⁻¹)	30, 35, ..., 185	70 (Tolerance ± 5 ms)
ATR Ventricular Rate Regulation (VRR) ^a	Off, Min, Med, Max	Min
ATR BiV Trigger ^a	Off, On	On
ATR Maximum Pacing Rate (MPR) ^{a, d} (min ⁻¹)	50, 55, ..., 185	130 (Tolerance ± 5 ms)
Atrial Flutter Response ^b	Off, On	On
Atrial Flutter Response Trigger Rate ^a (min ⁻¹)	100, 110, ..., 300	170 (Tolerance ± 5 ms)
PMT Termination ^b	Off, On	On
Ventricular Rate Regulation (VRR) ^b	Off, Min, Med, Max	Off
BiV/VRR Maximum Pacing Rate (MPR) ^e (min ⁻¹)	50, 55, ..., 185	130 (Tolerance ± 5 ms)
APP/ProACT ^b	Off, On	Off
APP/ProACT Max Pacing Rate (min ⁻¹)	50, 55, ..., 185	80 (Tolerance ± 5 ms)

a. The programmed Normal Brady values will be used as the nominal values for Temporary Brady pacing.

b. This parameter gets disabled during Temporary Brady.

c. The BiV/VRR MPR is shared by VRR and BiV Trigger. Changing this parameter for VRR will also change the MPR value for BiV Trigger.

d. The ATR MPR is shared by ATR VRR and ATR BiV Trigger. Changing this parameter for ATR VRR will also change the MPR value for ATR BiV Trigger.

e. ATR Trigger Rate and Atrial Flutter Response Trigger Rate are linked. If either of these rates is reprogrammed, the other will automatically change to the same value.

f. If Normal Brady ATR Fallback Mode is DDIR or DDI, then Temporary Brady ATR Fallback Mode is DDI and If Normal Brady ATR Fallback Mode is VDIR or VDI, then Temporary Brady ATR Fallback Mode is VDI.

Sensitivity

Parameter ^{a, b, c}	Programmable Values	Nominal Setting
Sensing Method ^c	AGC, Fixed	Fixed
Atrial Sensitivity (AGC)	AGC 0.15, AGC 0.2, AGC 0.25, AGC 0.3, AGC 0.4, ..., AGC 1.0, AGC 1.5	AGC 0.25
Right Ventricular Sensitivity (AGC)	AGC 0.15, AGC 0.2, AGC 0.25, AGC 0.3, AGC 0.4, ..., AGC 1.0, AGC 1.5	AGC 0.6
Left Ventricular Sensitivity (AGC)	AGC 0.15, AGC 0.2, AGC 0.25, AGC 0.3, AGC 0.4, ..., AGC 1.0, AGC 1.5	AGC 1.0
Atrial Sensitivity (Fixed)	Fixed 0.15, Fixed 0.25, Fixed 0.5, Fixed 0.75, Fixed 1.0, Fixed 1.5, ..., Fixed 8.0, Fixed 9.0, Fixed 10.0	Fixed 0.75
Right Ventricular Sensitivity (Fixed)	Fixed 0.25, Fixed 0.5, Fixed 0.75, Fixed 1.0, Fixed 1.5, ..., Fixed 8.0, Fixed 9.0, Fixed 10.0	Fixed 2.5
Left Ventricular Sensitivity (Fixed)	Fixed 0.25, Fixed 0.5, Fixed 0.75, Fixed 1.0, Fixed 1.5, ..., Fixed 8.0, Fixed 9.0, Fixed 10.0	Fixed 2.5

a. Separately programmable for Temporary Brady.

b. The programmed Normal Brady values will be used as the nominal values for Temporary Brady pacing.

c. The programmed value for Sensing Method determines the applicable values (AGC or Fixed) in each chamber.

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Backup EP Test

Parameter	Programmable Values	Nominal Setting
Backup Pacing Mode ^a	Off, On	On
Backup Pacing Lower Rate Limit ^{a, b} (min ⁻¹)	30, 35, ..., 185	45 (Tolerance ± 5 ms)
Backup Pacing V Refractory ^{a, b} (ms)	150, 160, ..., 500	250 (Tolerance ± 5ms)
Backup Pacing Ventricular pacing Chamber ^a	BiV (non programmable)	BiV
EP Test Pacing Outputs Atrial Amplitude (when test is in the atrium) (V)	Off, 0.1, 0.2, ..., 3.5, 4.0, ..., 5.0	5.0 (Tolerance ± 15% or 100 mV, whichever is greater)
EP Test Pacing Outputs RV Amplitude (V)	Off, 0.1, 0.2, ..., 3.5, 4.0, ..., 7.5	7.5 (Tolerance +/- 15% or 100 mV, whichever is greater)
EP Test Pacing Outputs LV Amplitude (V)	Off, 0.1, 0.2, ..., 3.5, 4.0, ..., 7.5	7.5 (Tolerance +/- 15% or 100 mV, whichever is greater)
EP Test Pacing Outputs Atrial Pulse Width (when test is in the atrium) (ms)	0.1, 0.2, ..., 2.0	1.0 (Tolerance ± 0.03 ms at < 1.8 ms; ± 0.08 ms at ≥ 1.8 ms)
EP Test Pacing Outputs RV Pulse Width (ms)	0.1, 0.2, ..., 2.0	1.0 (Tolerance ± 0.03 ms at < 1.8 ms; ± 0.08 ms at ≥ 1.8 ms)
EP Test Pacing Outputs LV Pulse Width (ms)	0.1, 0.2, ..., 2.0	1.0 (Tolerance ± 0.03 ms at < 1.8 ms; ± 0.08 ms at ≥ 1.8 ms)

a. This parameter only applies when the test is in the atrium.

b. The programmed Normal Brady value will be used as the nominal value.

PES (Programmed Electrical Stimulation)

Parameter ^a	Programmable Values	Nominal Setting
Number of S1 Intervals (pulses)	1, 2, ..., 30	8
S2 Decrement (ms)	0, 10, ..., 50	0
S1 Interval (ms)	120, 130, ..., 750	600 (Tolerance ± 5 ms)
S2 Interval (ms)	Off, 120, 130, ..., 750	600 (Tolerance ± 5 ms)
S3 Interval (ms)	Off, 120, 130, ..., 750	Off (Tolerance ± 5 ms)
S4 Interval (ms)	Off, 120, 130, ..., 750	Off (Tolerance ± 5 ms)
S5 Interval (ms)	Off, 120, 130, ..., 750	Off (Tolerance ± 5 ms)

a. Applied to the atrium or ventricle as commanded by the programmer.

Manual Burst Pacing

Parameter ^a	Programmable Values	Nominal Setting
Burst Interval (ms)	100, 110, ..., 750	600 (Tolerance ± 5 ms)
Minimum Interval (ms)	100, 110, ..., 750	200 (Tolerance ± 5 ms)
Decrement (ms)	0, 10, ..., 50	50 (Tolerance ± 5 ms)

a. Applied to the atrium or ventricle depending on the chamber selected.

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CRM-125710-AA-Dec12 Printed in Germany by medicalvision.

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DINCRM0782EA