

Electrocardiograph

BeneHeart R300/R700 Product Training

PMLS downstream mkt

Contents

1. Product overview
2. Improvements and upgrades based on ECG workflow
3. Summary



Product Families

Low-end (3-channel machine)	Medium to high end (12-channel machine)



R300



R700



R3



R12

Product Overview

12.1" HD Capacitive Touch Screen

WiFi 6 module

5“ color LCD TFT display

paper bin

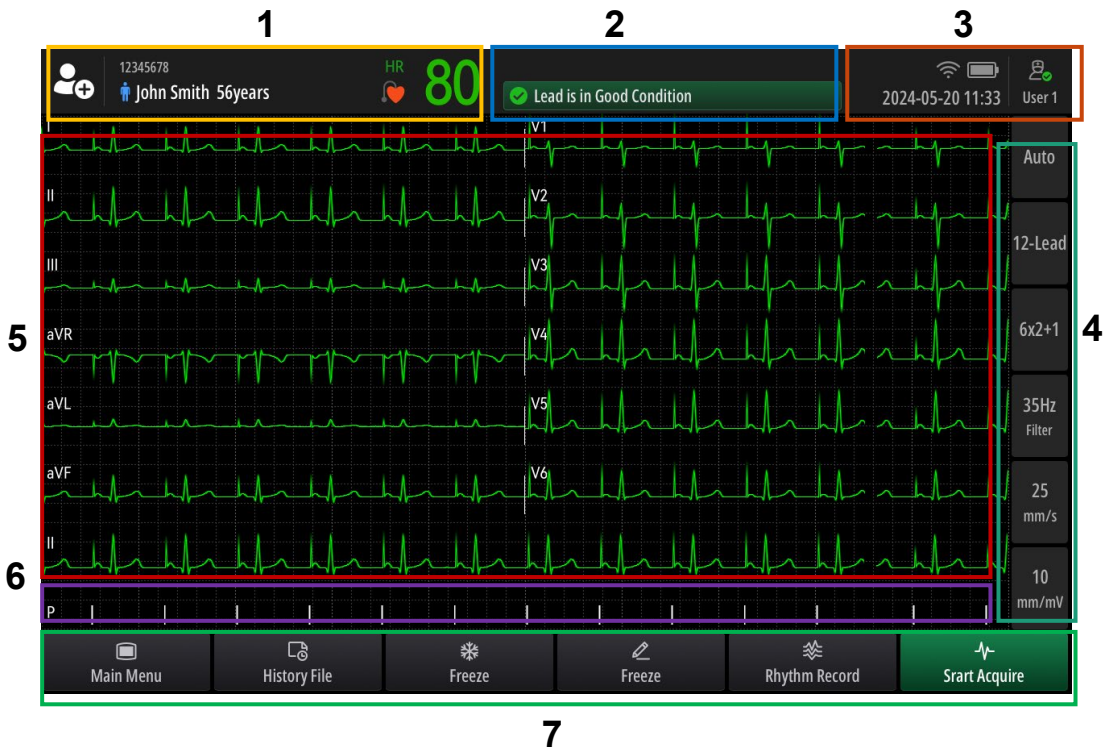
Power button
Power status indicator



BeneHeart R700

BeneHeart R300

Product Overview



1. Patient information area
2. Message area
3. System information area
4. Mode and waveform setup area
5. Waveform area
6. Pacer pulse marker area
7. Quick key area

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Workflow of a typical ECG measurement

4. Diagnostic analysis:

Assistive functions to help end-user to acquire more details

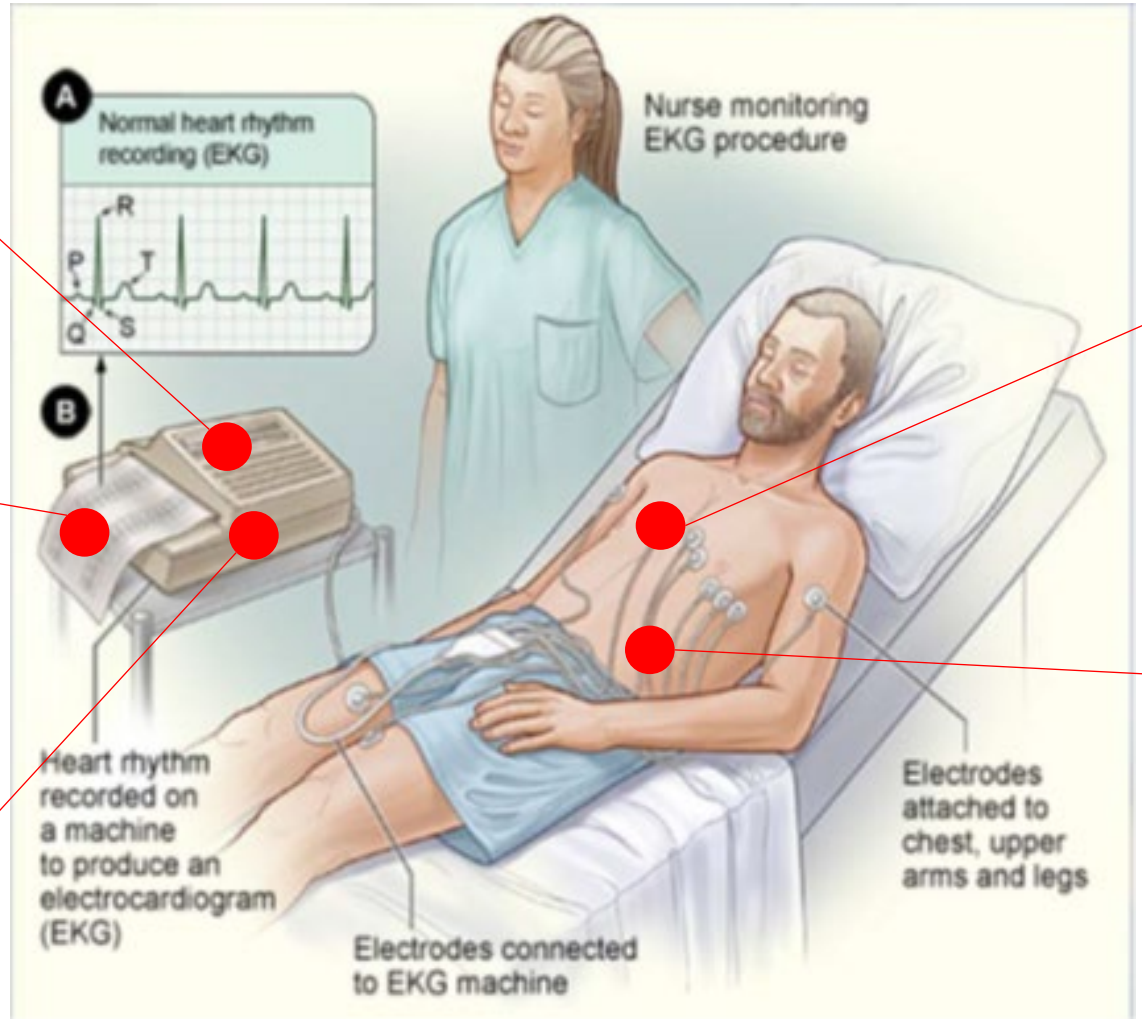
Diagnostic analysis provided by built-in algorithm

5. Report management:

Print out reports to archive
Send results digitally to other systems

3. Signal processing:

Pacemaker detection
Interference filtering



Scenario image of a typical resting ECG measurement

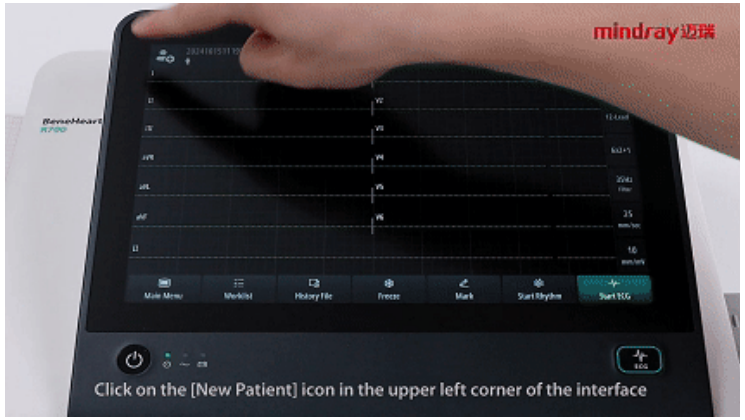
2.Signal acquisition:

Connectivity quality
High requirement on hardware platform and components

1.Prepare (connect electrodes + admit patient):

Disposable
Reusable
AgCl vs. Copper Alloy vs. Nickle plating
3L/5L/12L/15L/18L

Prepare → Signal acquisition → Signal processing → Diagnostic analysis → Report management



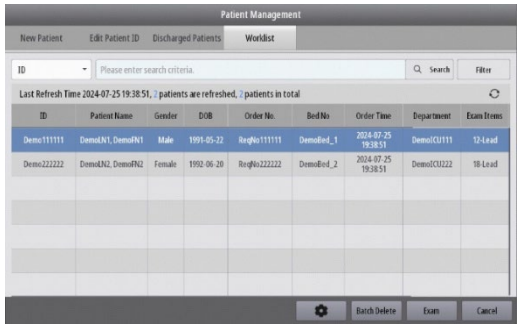
① Manually Input

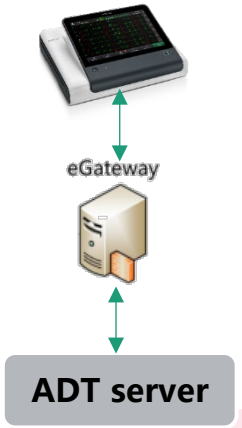


② Use Barcode Scan

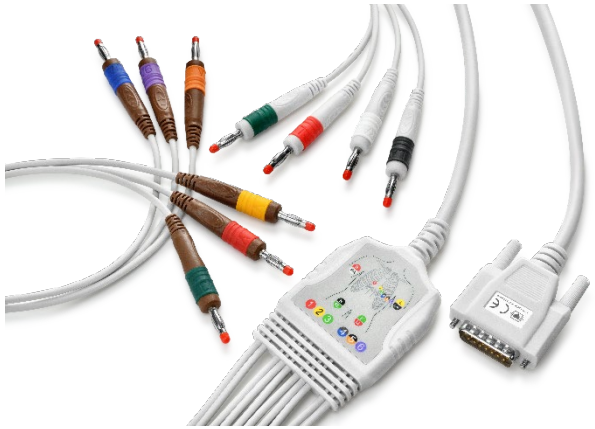


③ Load from order List





Prepare → Signal acquisition → Signal processing → Diagnostic analysis → Report management



ECG trunk cable with banana plugs



ECG trunk cable with clips

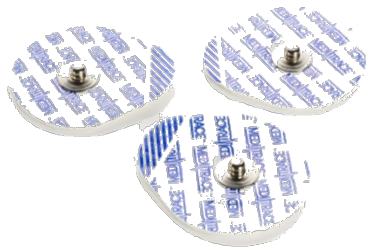
Location	Inscription	Colour	Inscription	Colour
	RA	White	R	Red
	LA	Black	L	Yellow
	RL	Green	N	Black
	LL	Red	F	Green
	V1	Brown/Red	C1	White/Red
	V2	Brown/Yellow	C2	White/Yellow
	V3	Brown/Green	C3	White/Green
	V4	Brown/Blue	C4	White/Brown
	V5	Brown/Orange	C5	White/Black
	V6	Brown/Purple	C6	White/Purple

IEC/AHA: Position, name and color



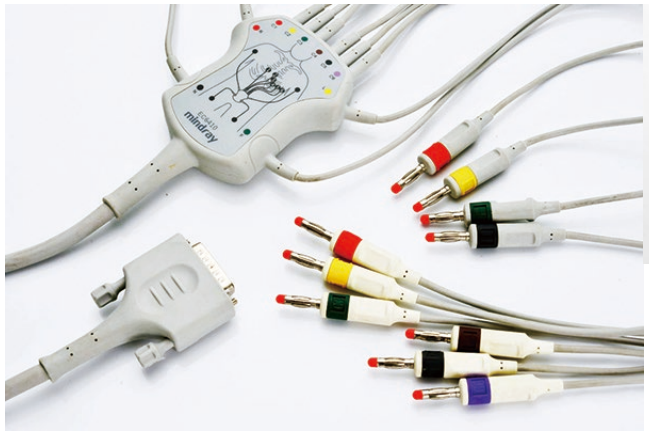
Reusable accs: limb clamps & chest bulbs

AgCl: Better signal conductivity, widely used in the industry
Copper alloy: Cost-effective option
Nickle plating: Worse than AgCl and Copper alloy, used in R3/R12



Disposable electrodes

Prepare → Signal acquisition → Signal processing → Diagnostic analysis → Report management







	Types of disinfecting reagents
GE	10
EDAN	2
NK	3
R12	28





300,000 times bending tests, ultra-durable;

Support up to **48** cleaning and disinfecting reagents, best in the industry;

Compatible with R3/R12

Product Name	Product Type
Alpet® D2 Surface Sanitizing Wipes	Wipes
CIDEX® OPA	Liquid
Clorox Dispatch® Hospital Cleaner Disinfectant Towels with Bleach	Wipes
Clorox Healthcare® Bleach Germicidal Wipes	Wipes
Clorox Healthcare® Hydrogen Peroxide Cleaner Disinfectant Wipes	Wipes
Diversey Oxivir® TB Wipes	Wipes
Metrex CaviCide1™	Liquid, spray
Metrex CaviWipes™	Wipes
PDI Sani-Cloth® AF3 Germicidal Disposable Wipe	Wipes
PDI Sani-Cloth® Bleach Germicidal Disposable Wipe	Wipes

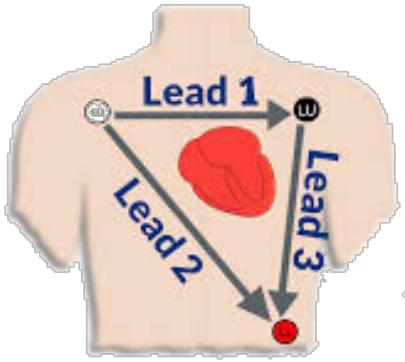
Product Name
PDI Sani-Cloth® Plus Germicidal Disposable Cloth
PDI Super Sani-Cloth® Germicidal Disposable Wipe
Virex® II 256 (1:256)
Virex® TB
JIAN ZHI SU Disinfectant Tablets
JIAN ZHI SU Surface Disinfectant Spray
JIAN ZHI SU Disinfectant, Double-chain Quaternary Ammonium
DIAN'ERKANG Surface Wipes
DIAN'ERKANG Surface Disinfectant
DIAN'ERKANG Disinfectant Spray
Clinell® Universal Wipes

Product Name
Tristel Duo™
Tristel Jet
Tristel Fuse For Surfaces, 196ppm
Surfanios Premium, 0.25%
Surfa 'safe
Wip' Anios premium
Aniosurf ND premium, 0.25%
Mikrobac® Tissues
Cleanisept® Wipes
mikrozid® PAA Wipes
mikrozid® Sensitive Wipes
Ecolab Incidin® OxyWipe S
Glutaraldehyde, 2%
Ethanol, 70%
Isopropanol, 70%
Sodium hypochlorite bleach, 0.5%

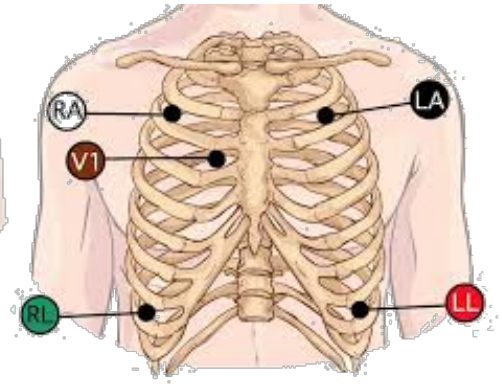
Product Name	Product Type	Manufacturer
Hydrogen peroxide, 3%	Liquid	/
Rely+On™ Virkon® High Level surface Disinfectant, 1%	Powder	Antec International Ltd
1-Propanol, 50%	Liquid	/
Descosept® forte	Liquid	Dr. Schumacher GmbH
Descosept® AF	Liquid	Dr. Schumacher GmbH
Dismozon® plus, 0.4%	Powder	BODE Chemie GmbH
mikrozid® AF Wipes	Wipes	Schülke & Mayr GmbH
Terralin® Liquid	Liquid	Schülke & Mayr GmbH
Perform® Classic Concentrate OXY, 0.5%	Powder	Schülke & Mayr GmbH

R700 disinfection reagents list. Ops manual 13.4

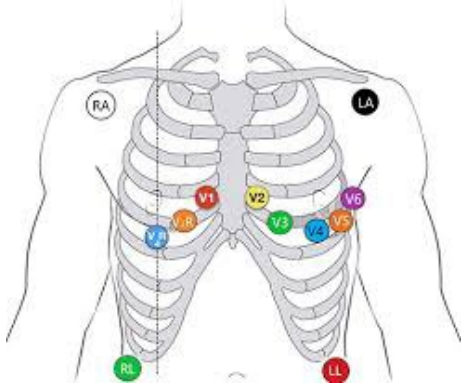
Prepare → Signal acquisition → Signal processing → Diagnostic analysis → Report management



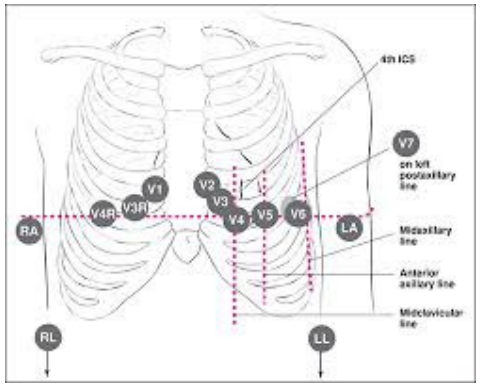
3L ECG



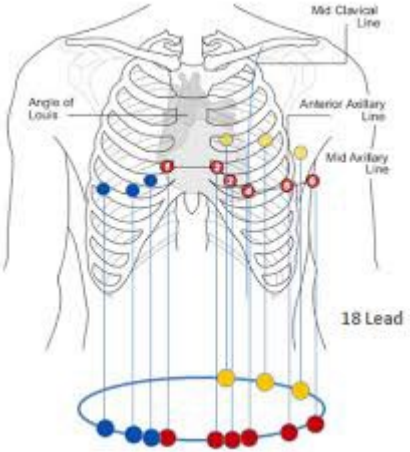
5L ECG



12L ECG



15L ECG



18L ECG

I/II/III

aVR/ aVL/ aVF/ V

V1/V2/V3/V4/V5/V6

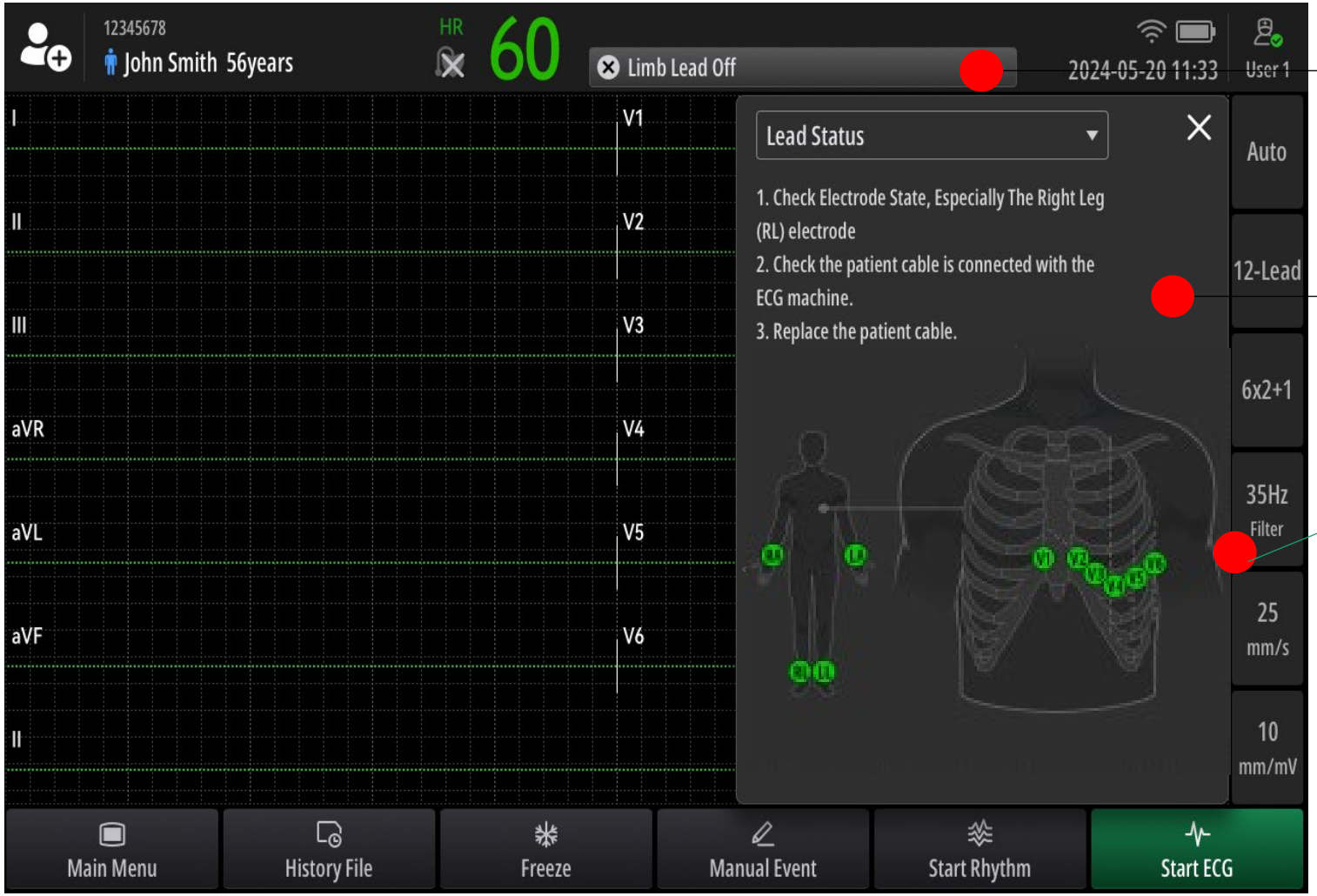
V3R/ V4R/ V5R

V7/V8/V9

The increasing number of leads provide a multi-dimensional view of the cardiac activity. Also, more expensive.

15L/18L ECG measurements are used in institutions or university hospitals

Prepare → **Signal acquisition** → Signal processing → Diagnostic analysis → Report management



Prompt box:
- Lead off indication, same as R12
- **Lead reversal prompt** is available

Lead guide:
- Intuitive graphical guidance
- Detailed / comprehensive notes

Color coded indication:
- Show the condition and signal quality of each ECG lead in real-time

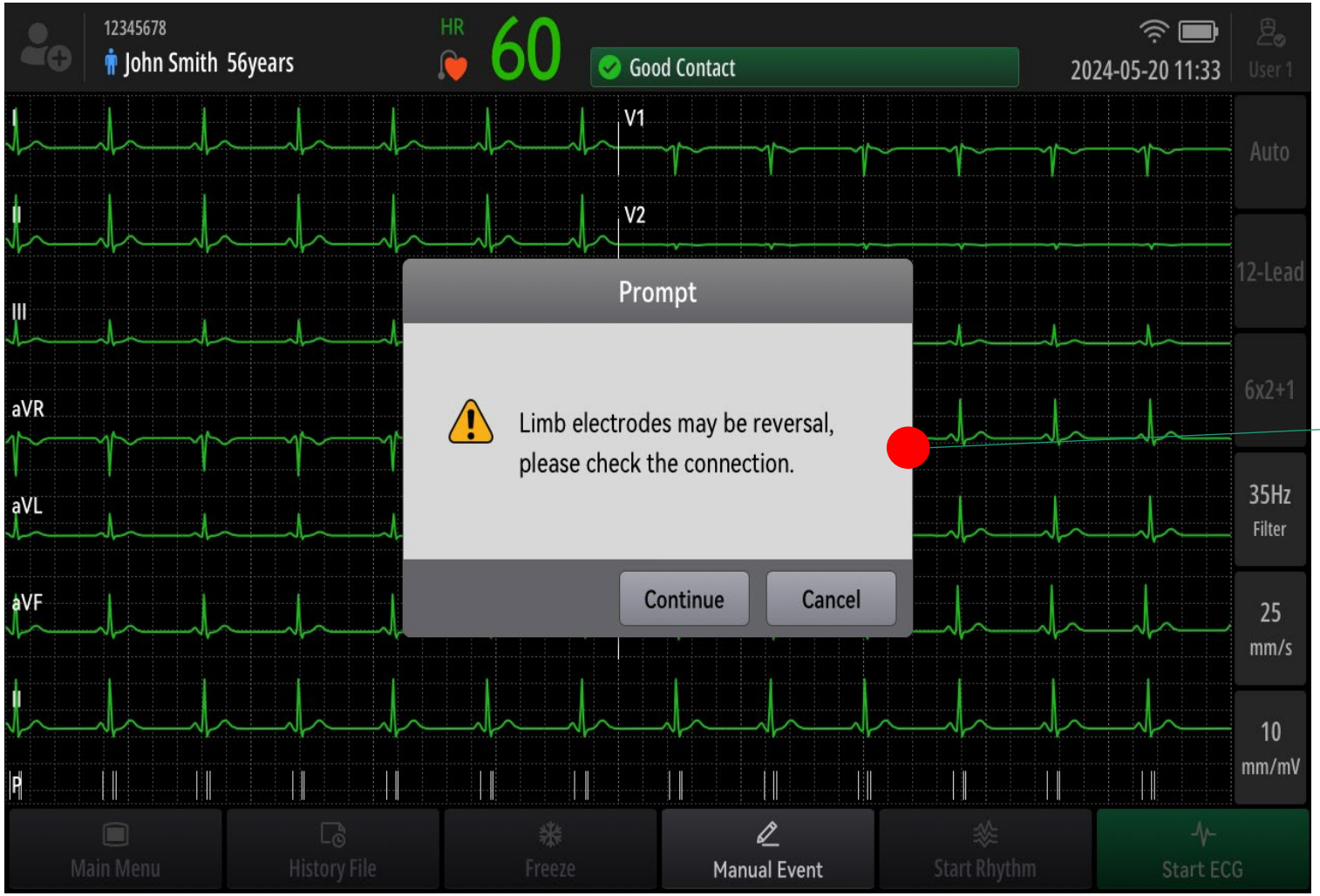
Good signal quality

Interference exists

Poor contact with patient

Lead off

Prepare → **Signal acquisition** → Signal processing → Diagnostic analysis → Report management

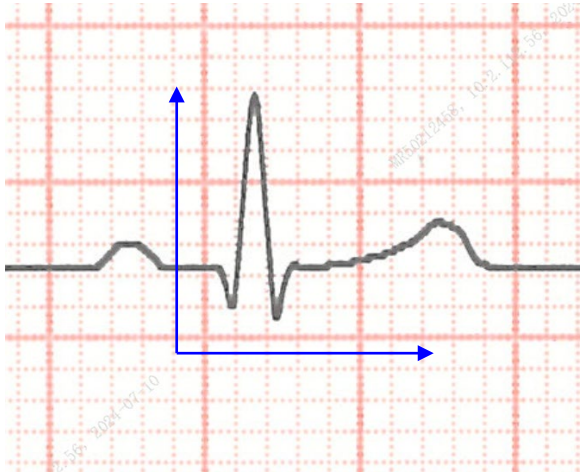


Lead reversal prompt:

The equipment automatically prompts you reversal lead in the following conditions:

1. Left and right limbs are inversely connected (configured with Mindray algorithm)
2. Left and right, upper and lower limbs are inversely connected (configured with Glasgow algorithm)

Prepare → **Signal acquisition** → Signal processing → Diagnostic analysis → Report management



AD conversion:

The capability to convert analog signal into digital signal. The higher, the better.

Sample rate:

Sampling rate or sampling frequency defines the number of samples per second (or per other unit) taken from a continuous signal to make a discrete or digital signal.

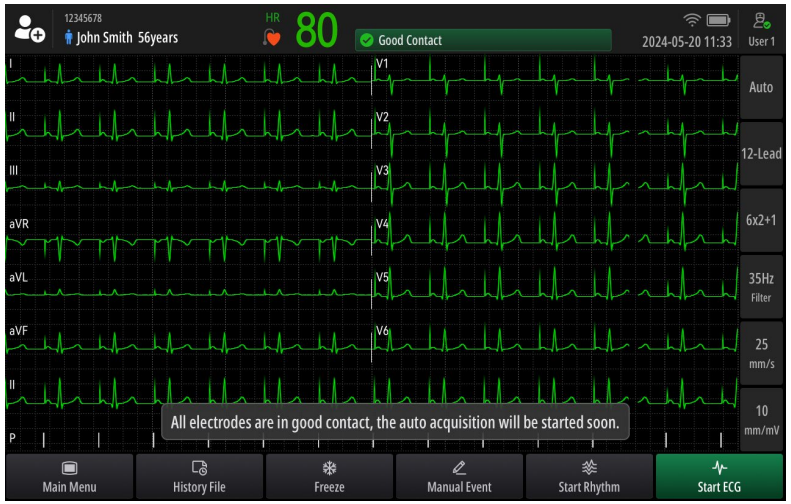
Signal resolution:

Amplitude resolution specifies the vertical precision of the digitizer

	Edan1202	GE MAC 7	R300/R700
AD rate	24bit	24bit	24bit
Sample rate	64000Hz	2000Hz	64000Hz
Signal resolution	0.1192uV/LSB	1.22uV/LSB	0.1192uV/LSB

Prepare → **Signal acquisition** → Signal processing → Diagnostic analysis → Report management

(1) Auto mode



User presses ECG button to acquire a 10-sec 12L report with diagnostic interpretation.

Auto Acquisition

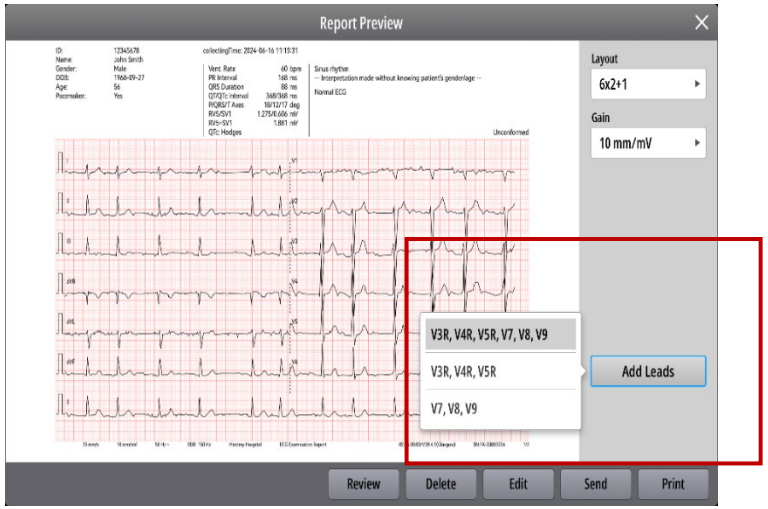
Device automatically acquires an ECG when a new patient bas connected with all leadwires well for more 10 seconds.

*Active once for a same patient

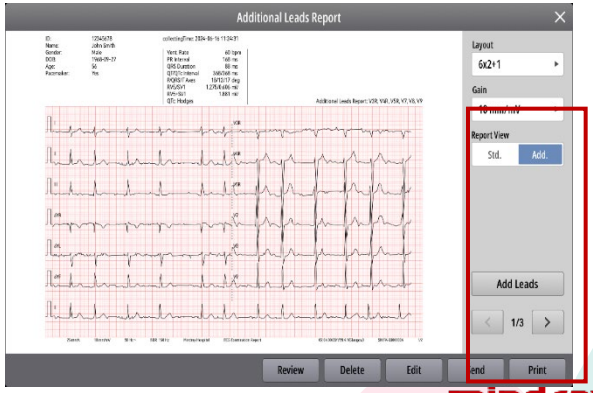
Acquiring Additional leads

BeneHeart R700 supports acquisition of additional leads than conventional 12L ECG.

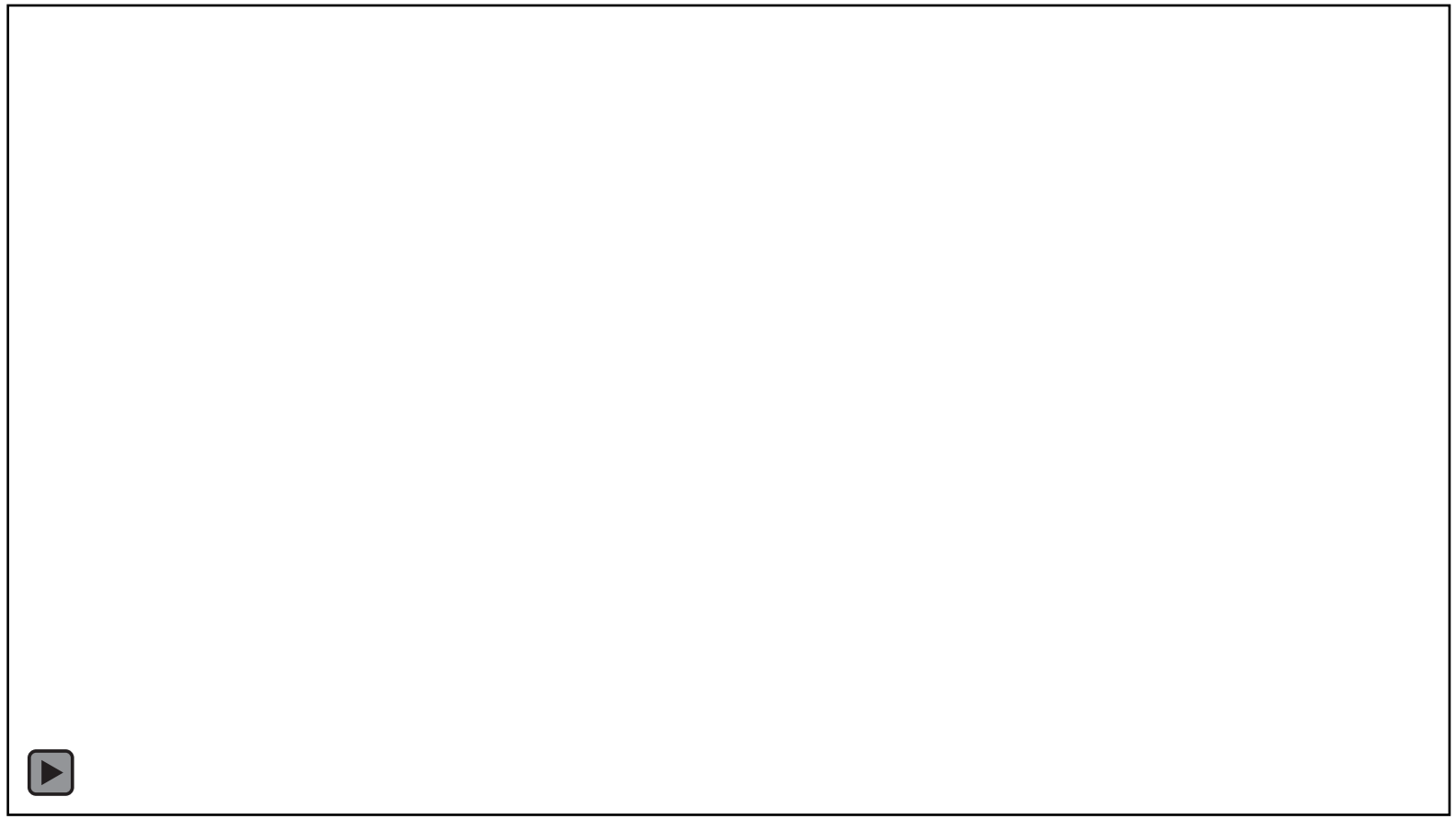
User can experience the same clinical benefit that was only available in other expensive 15/18L ECG machines







Additional leads measurement

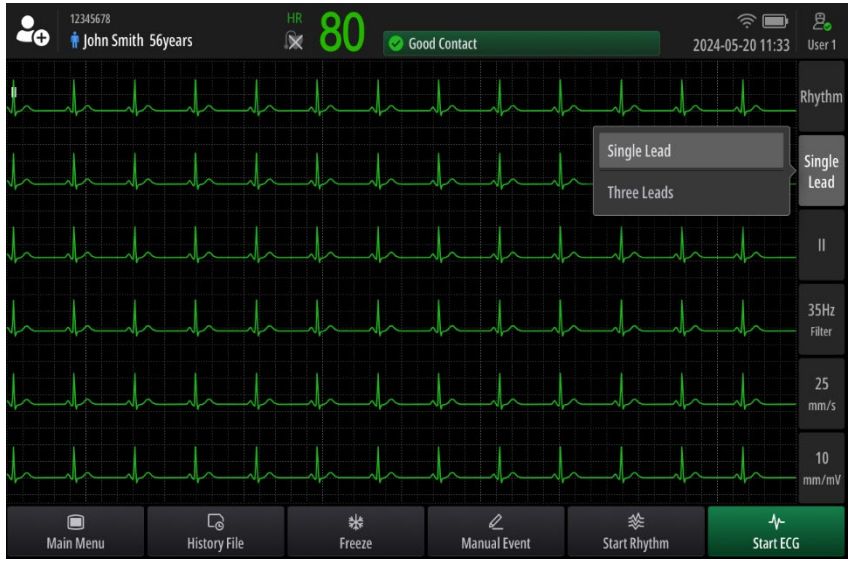


Note:

1. For additional measured leads, only waveforms are available, no extra diagnostic interpretation. This is different from the REAL 15/18 lead ECG machine, e.g. Philips TC70 and Edan SE-18.
2. More cost-effective and user-friendly for doctors who need to read V3R/V4R/V5R/V7/V8/V9.
3. Lead names on report and display will change automatically when performing V3R/V4R/V5R/V7/V8/V9 measurement.

Prepare → **Signal acquisition** → Signal processing → Diagnostic analysis → Report management

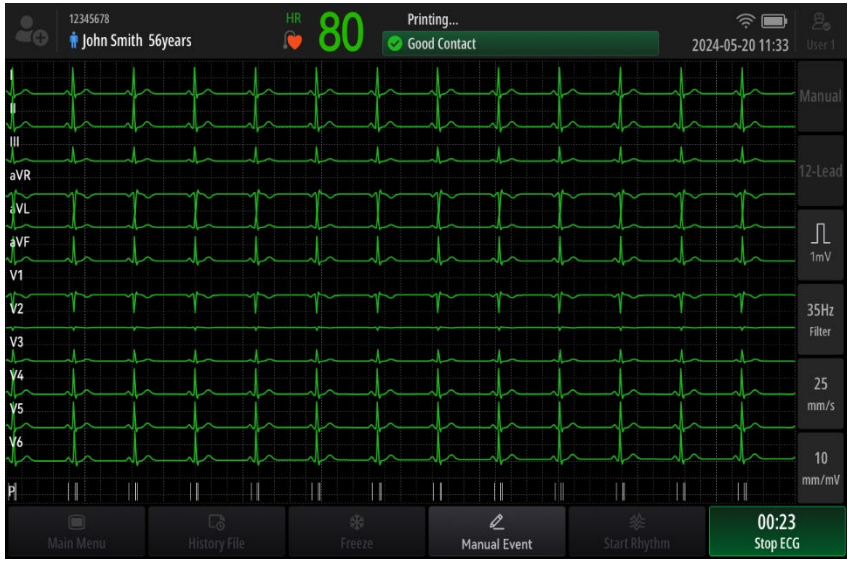
(2) Rhythm mode



During the rhythm mode, the equipment acquires **1800s (30min)** of 12-lead ECG and prints the waveforms of the rhythm lead.

	Rhythm mode duration
R12	60s
R700	1800s
SE1202	1800s

(3) Manual mode

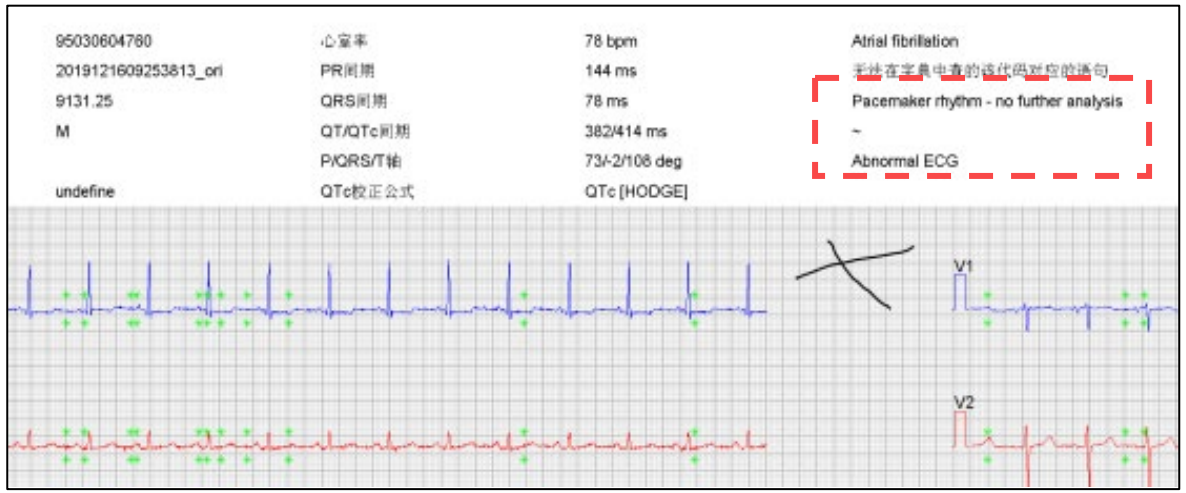


In the Manual mode, the equipment continuously acquires the **real-time** ECG waveforms.

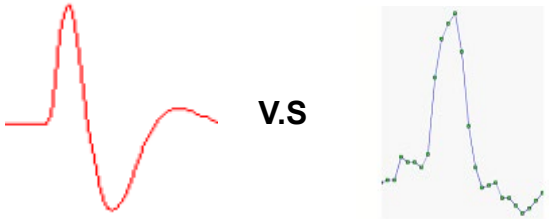
NO measurement values and diagnostic interpretation in rhythm mode and manual mode.

Prepare → Signal acquisition → **Signal processing** → Diagnostic analysis → Report management

Pacemaker signal detection



With old technology and hardware platform, the interference is likely to be wrongly detected as pacemaker signal, which leads to analysis failure.



Interference **V.S** Pace pulse signal



Modern pacemakers generate pulses of 2-5 mV which last for about 0.5-2 ms in an ECG recording, high sampling rates around 16kHz was used to capture the pace pulse.

However, technology is upgrading in an unexpectedly fast speed, now some of advanced packers are able to provide pulses less than 0.4ms, which requires a high pacemaker detection rate.

Prepare → Signal acquisition → **Signal processing** → Diagnostic analysis → Report management

Performance Study of Digital Pacer Spike Detection as Sampling Rate Changes

S Luo, P Johnston, W Hong

Cardiac Science, Deerfield, WI, USA

Abstract

In this study, we first collected ECG data at 32 ksps and 500 sps from 51 patients with an implanted cardiac pacemaker. We also included 16 non paced ECGs with severe motion artifact and static interference. We then annotated the pacer pulses (locations and classifications) using special viewing software and divided the data into training and testing sets. We developed three digital pacemaker stimulus detection algorithms, one for each of three different sampling rates (500 sps, 8 ksps, and 32 ksps) by using similar detection concepts. After tuning them on the training sets at the corresponding sampling rates, we investigated their performances. Results showed that the detection algorithm based on the 12-lead 500-sps data stream has a good performance (Sensitivity or Se=77.51%; Positive Productive Value, or +P=90.32%). The 8-ksps detector has a better performance (Se=95.37; +P=99.77). The digital pacemaker detection algorithm for 32 ksps or higher data provided almost 100% true pacer spike detection (Se=99.51 and +P=100%). In [illegible], high speed sampling at 32ksps can provide accurate detection of modern pacers and leads to a significant improvement in detection of pacemaker stimuli compared to the reduced sampling rates used previously.

spike detection solutions and their performance especially when different sampling rates are adopted.

2. Methods

(1) Data Collection

The digital data was acquired by Cardiac Science Atria 3100/6100 ECG units through the standard 12-lead hookup.

- This commercial product over-samples data at 8 ksps (kilo-samples per second) and then down-samples/decimates to 500 sps (samples per second) for traditional ECG processing, whereby the decimated 500-sps data stream can be directly used to identify the pacer spikes;
- The front end data acquisition also includes a high speed sampling module, i.e. 64/32-ksps, with a digital pacemaker spike detection system.

Both 500-sps and 32-ksps data streams were dumped onto memory media. The 8-ksps data stream in this study was decimated data generated from the 32-ksps data. The 500-sps data stream consisted of 8 leads, where the 8 ksps and the 32 ksps were acquired 2 leads at a time (II&V_1, II&V_2, II&V_3, II&V_4, II&V_5, and I&V_6) but included all 8 independent leads for every patient.

(2) Datasets

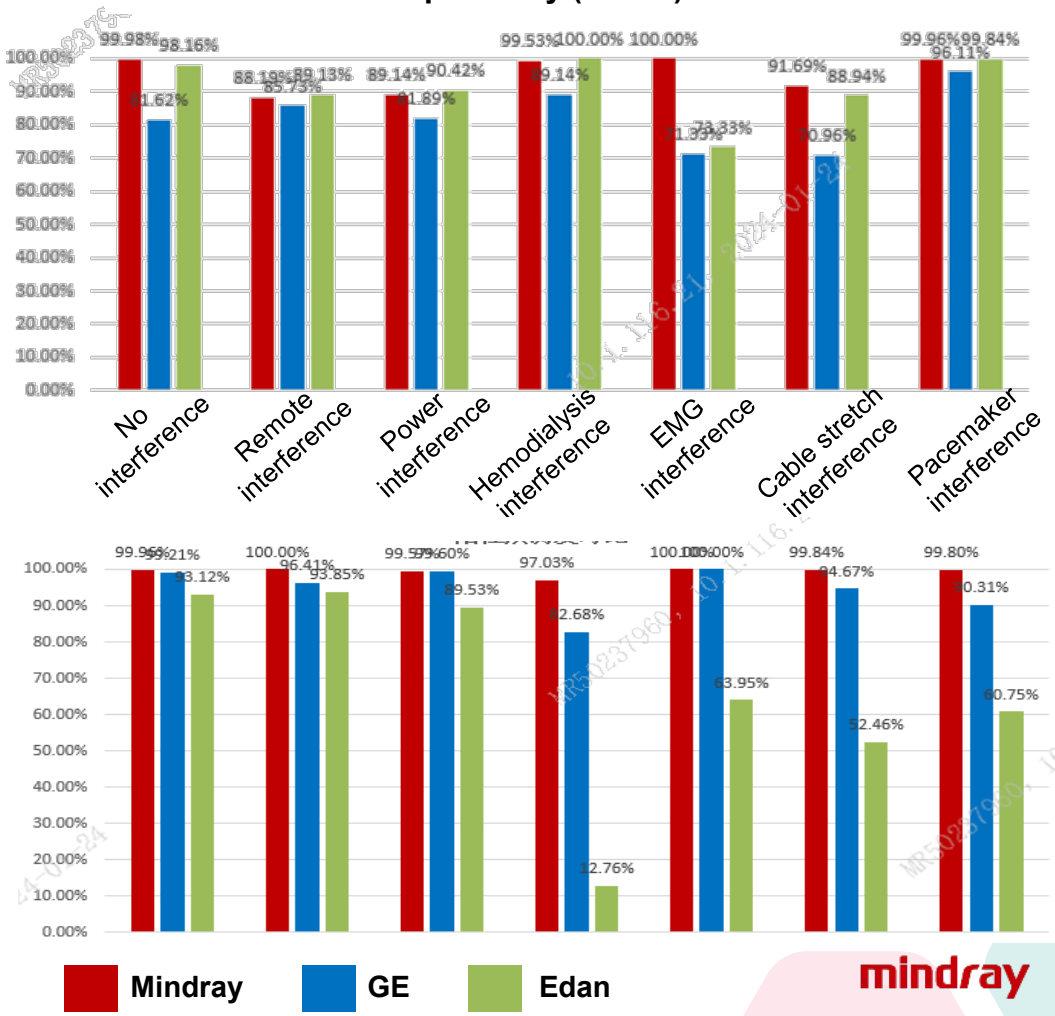
All data was acquired from live patients.

*high speed sampling at **32ksps** can provide accurate detection of modern pacers and leads to a **significant improvement in detection of pacemaker stimuli** compared to the reduced sampling rates used previously*

75k EDAN 80k NIHON KOHDEN 8k

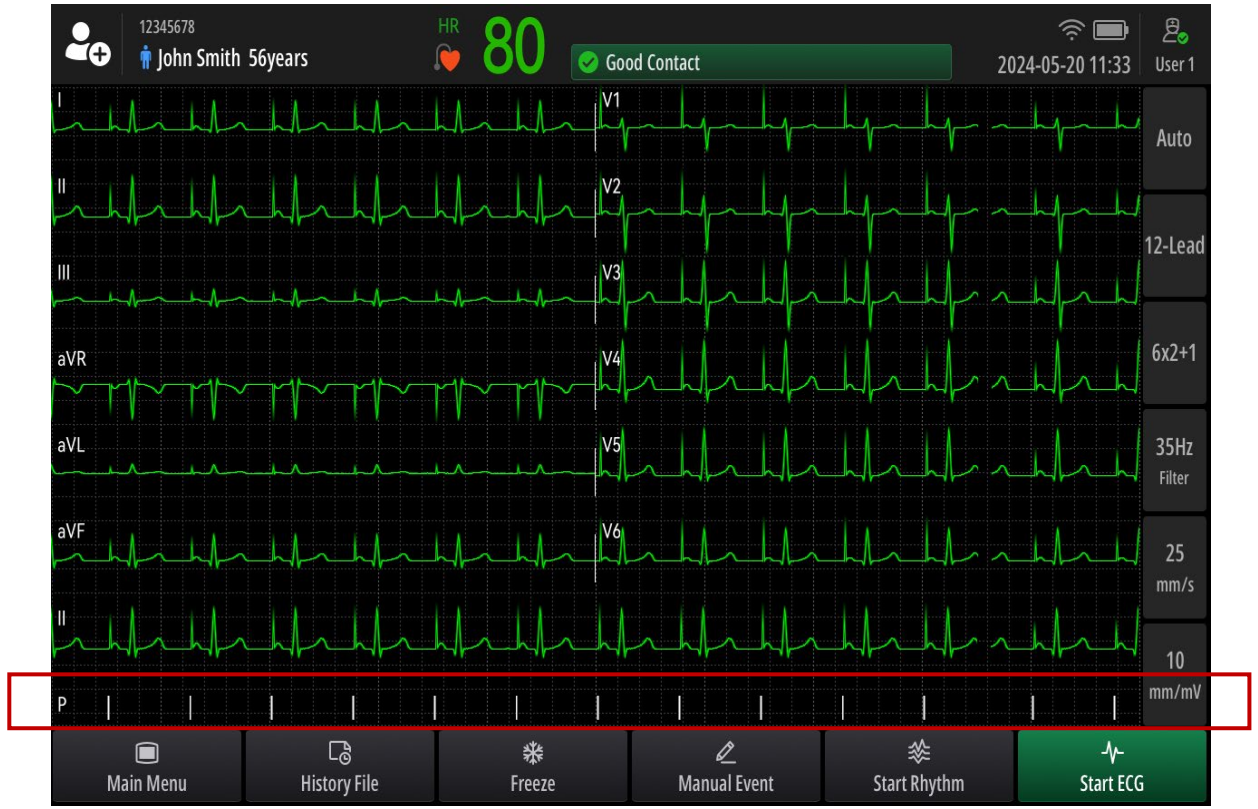
Industry leading PACE sampling rate: **96k** samples/second

Pacemaker signal detection sensitivity (above) and specificity (below)



S. Luo, P. Johnston, W. Hong, Performance Study of Digital Pacer Spike Detection as Sampling Rate Changes, Proceedings of CinC 2008

Prepare → Signal acquisition → **Signal processing** → Diagnostic analysis → Report management



Pacemaker channel

Automatically detect the pacing signal and prompt whether the patient is wearing a pacemaker. Pacemaker signal will be marked in a separate channel for a clearer observation

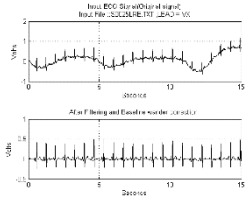
Prepare → Signal acquisition → **Signal processing** → Diagnostic analysis → Report management

Signal processing: Filter



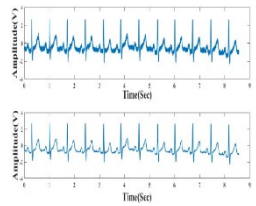
EMG (electromyography) signal obtained from the neuromuscular activities.

High frequency | **>100Hz** | **Muscle activation**



Baseline drift/wandering, the low frequency fluctuations in an ECG signal that are not of cardiac origin. It is typically below 0.5Hz and can distort the ECG waveform, usually led by breath or body movement.

Low frequency | **Breathing** | **Subject movement** | **Affect ST reading**

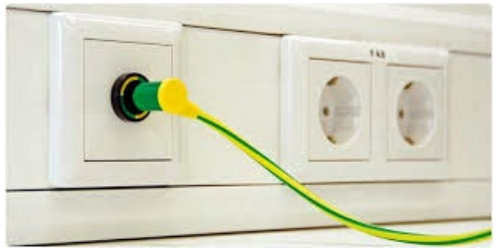


Lowpass filter, allows lower-frequency signals to pass through and block any frequencies above a certain threshold.

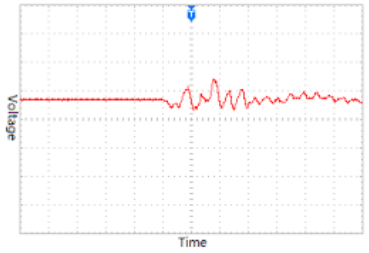
Most of the ECG character signals fall below 150Hz, while more options are available now to meet different clinical requirements.

150Hz? | **250Hz?** | **350Hz?**

Prepare → Signal acquisition → **Signal processing** → Diagnostic analysis → Report management



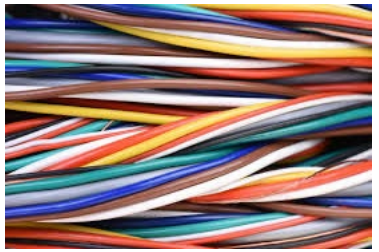
1. Poor ground connection (scenario are simulated in the lab by powering the device without ground cable)



2. EFT(electrical fast transient) interference (simulate the case when other highly powered devices is being used, e.g. **CT/MR**)

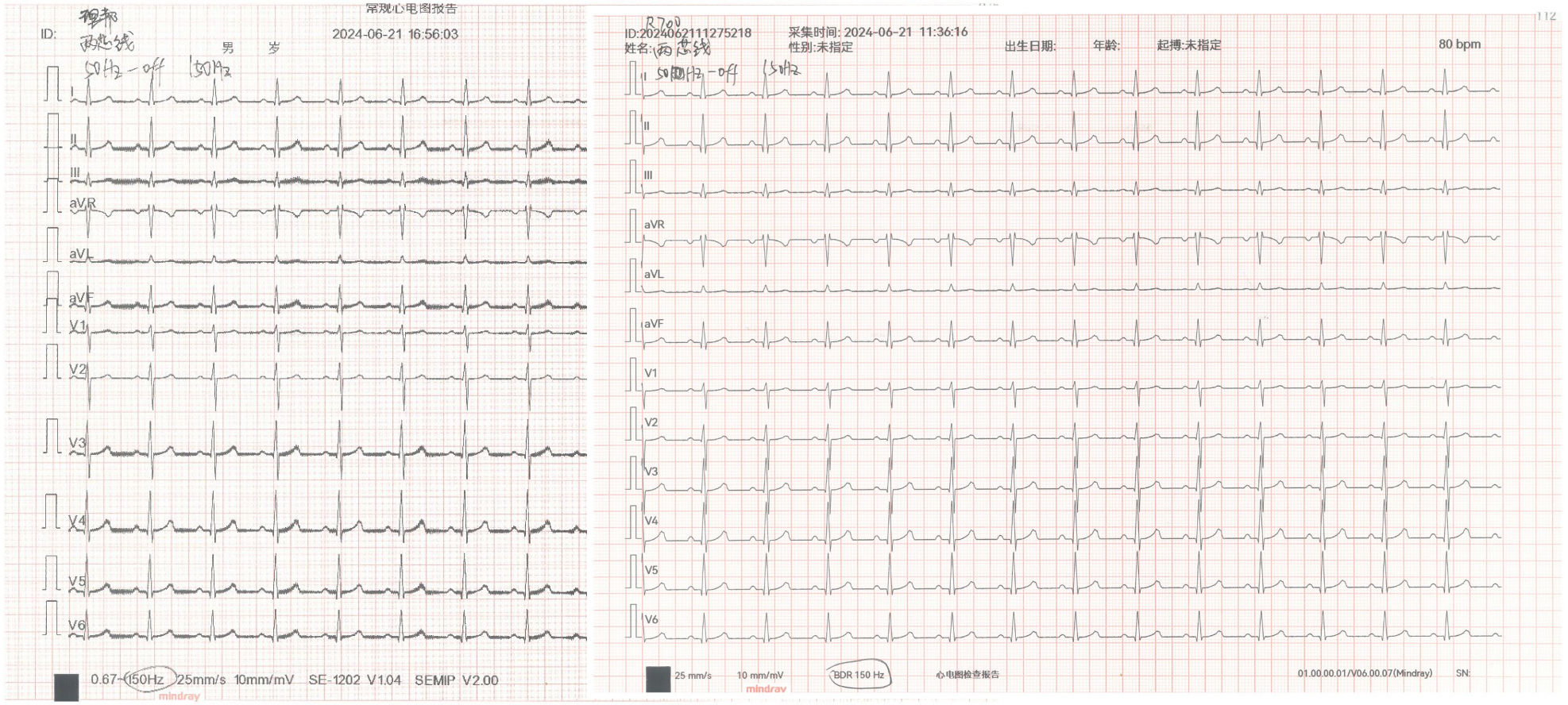


3. Interference generated from other devices connected to the patient (e.g. patient monitor)



4. Interference caused by the twisting of power cable and ECG cable

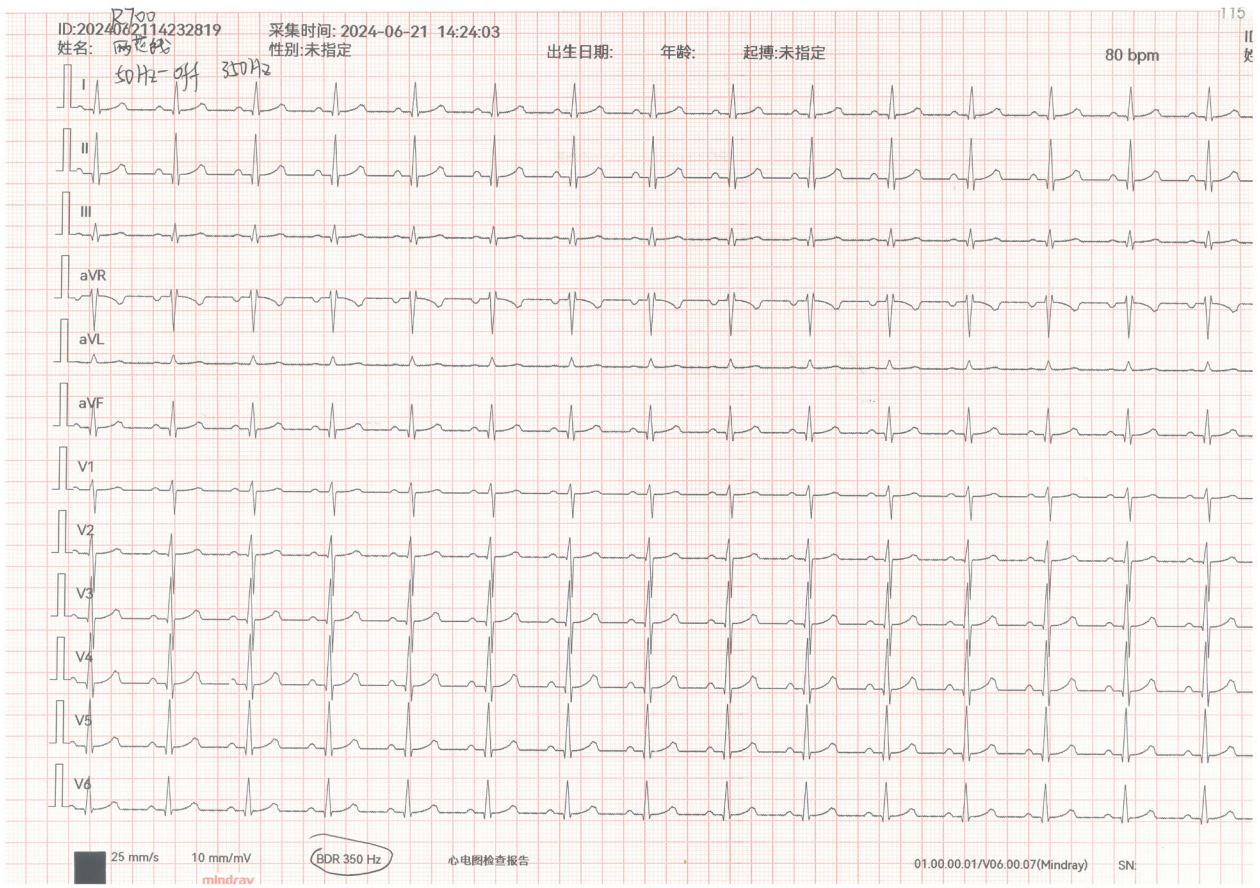
Prepare → Signal acquisition → **Signal processing** → Diagnostic analysis → Report management



Poor ground connection: SE1202, R700

Prepare → Signal acquisition → **Signal processing** → Diagnostic analysis → Report management



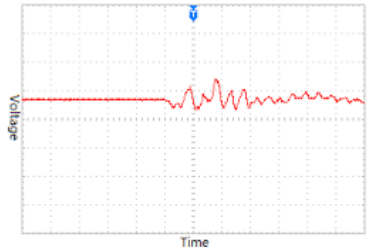


Cable twisting: SE-1202, R700

Prepare → Signal acquisition → **Signal processing** → Diagnostic analysis → Report management



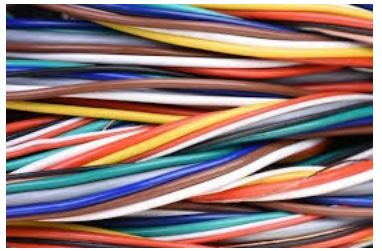
Poor ground connection (scenario are simulated in the lab by powering the device without ground cable)



EFT(electrical fast transient) interference
(simulate the case when other highly powered devices is being used, e.g. CT/MR)



Interference generated from other devices connected to the patient (e.g. patient monitor)



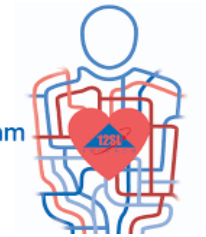
Interference caused by the twisting of power cable and ECG cable

	R12	R300/R700	SE-1202	MAC 7
Poor grounding	Noisy V2	No impact	Noticeable noise	No impact
EFT interference	No impact	No impact	Noticeable noise	No impact
Patient monitor	No impact	No impact	No impact	No impact
Cable twisting	Slight noise	Slight noise	Slight noise	Noticeable noise

Prepare → Signal acquisition → Signal processing → **Diagnostic analysis** → Report management

Manufacturers with their own ECG algorithm

Marquette 12SL Algorithm
Connected Clinical Excellence





MAC 7



MAC 5

PHILIPS

DXL



TC 35



TC 10

SCHILLER
he Art of Diagnostics

ETM



AT-102 G2



AT-1 G2

NIHON KOHDEN

ECi/SynECi-18



ECG-3250



ECG-3150

Manufacturers equipped with Glasgow

Dräger

SPACELABS HEALTHCARE

AMPS
Analyzing Medical Parameters for Solutions

Dr. Gerhard Schmidt GmbH
Computerkardiographie

CARDIOLEX
EASY TO USE ECG

stryker

MEDIANA HEARTON AED

EDAN

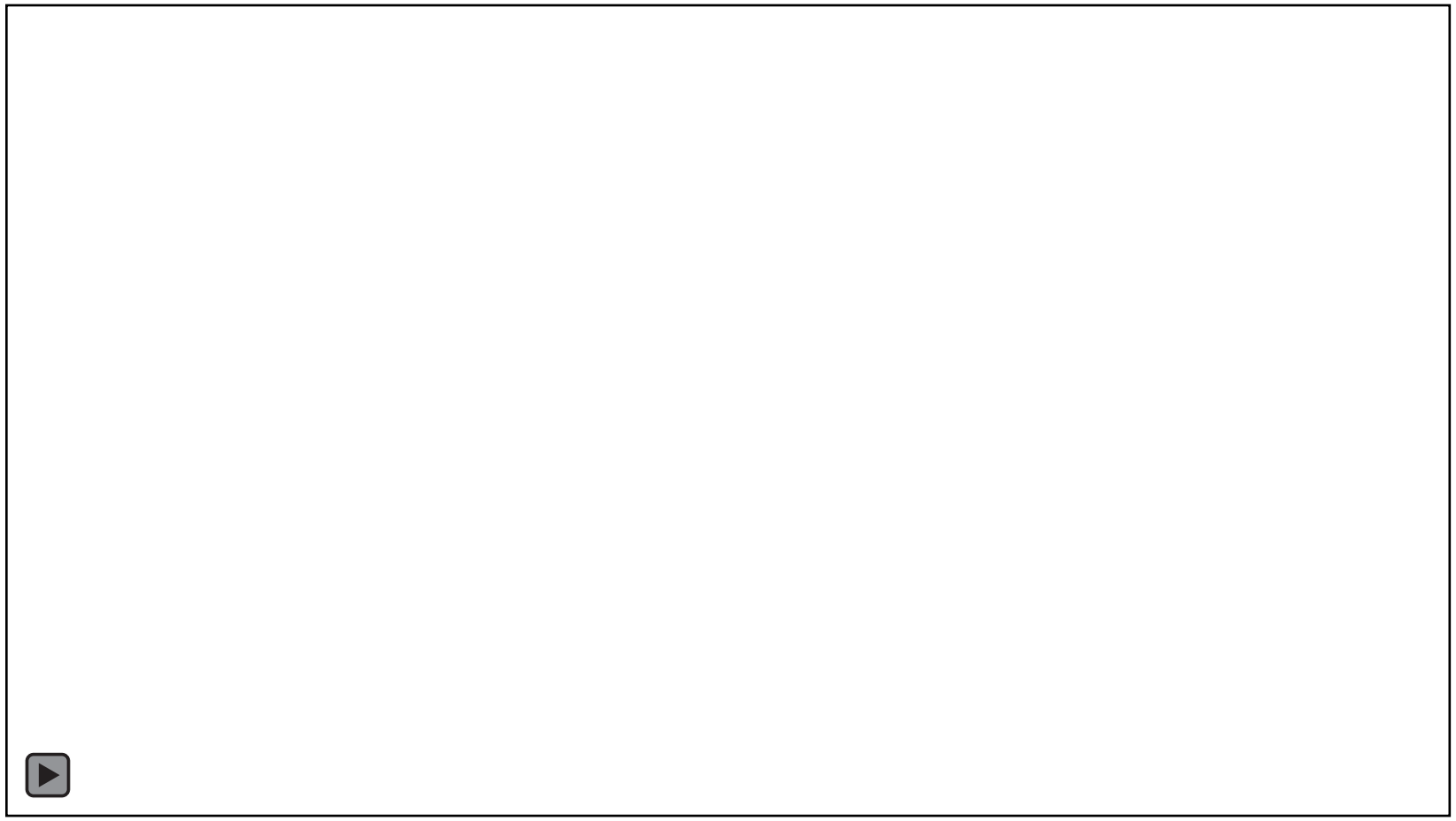
TELEMED

CARDIOLINE

BPL Medical® Technologies

corpuls

New features in R700: Abnormal beats marker (optional)



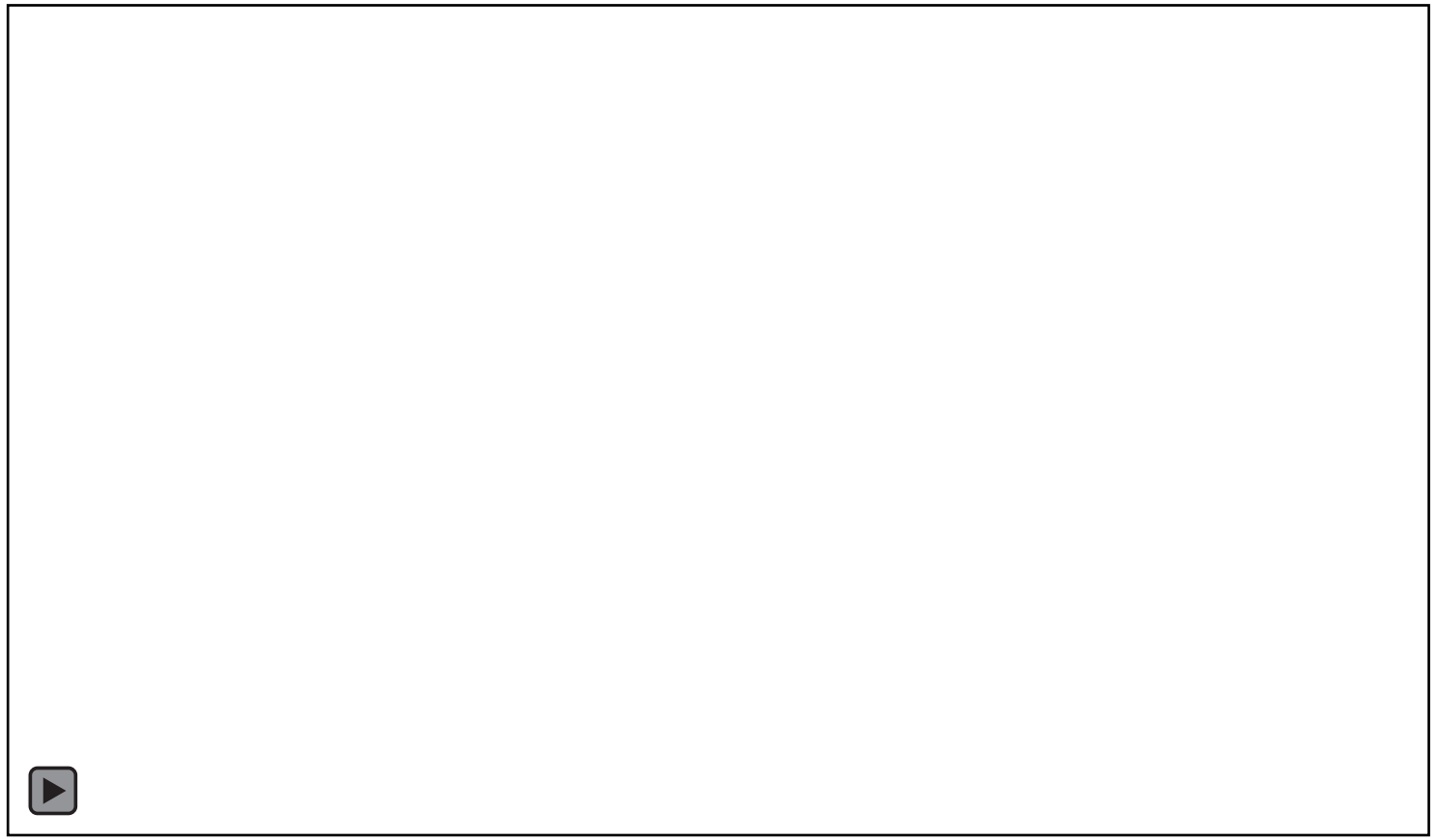
Abnormal waveforms mark

Abnormal segments will be marked in red if patient has PVC or supraventricular premature beats.

The number of abnormal beats will be displayed at the top right of the freeze quick key.

Available in Auto, Manual and Rhythm modes

New features in R700: Freeze waveform and re-analyze



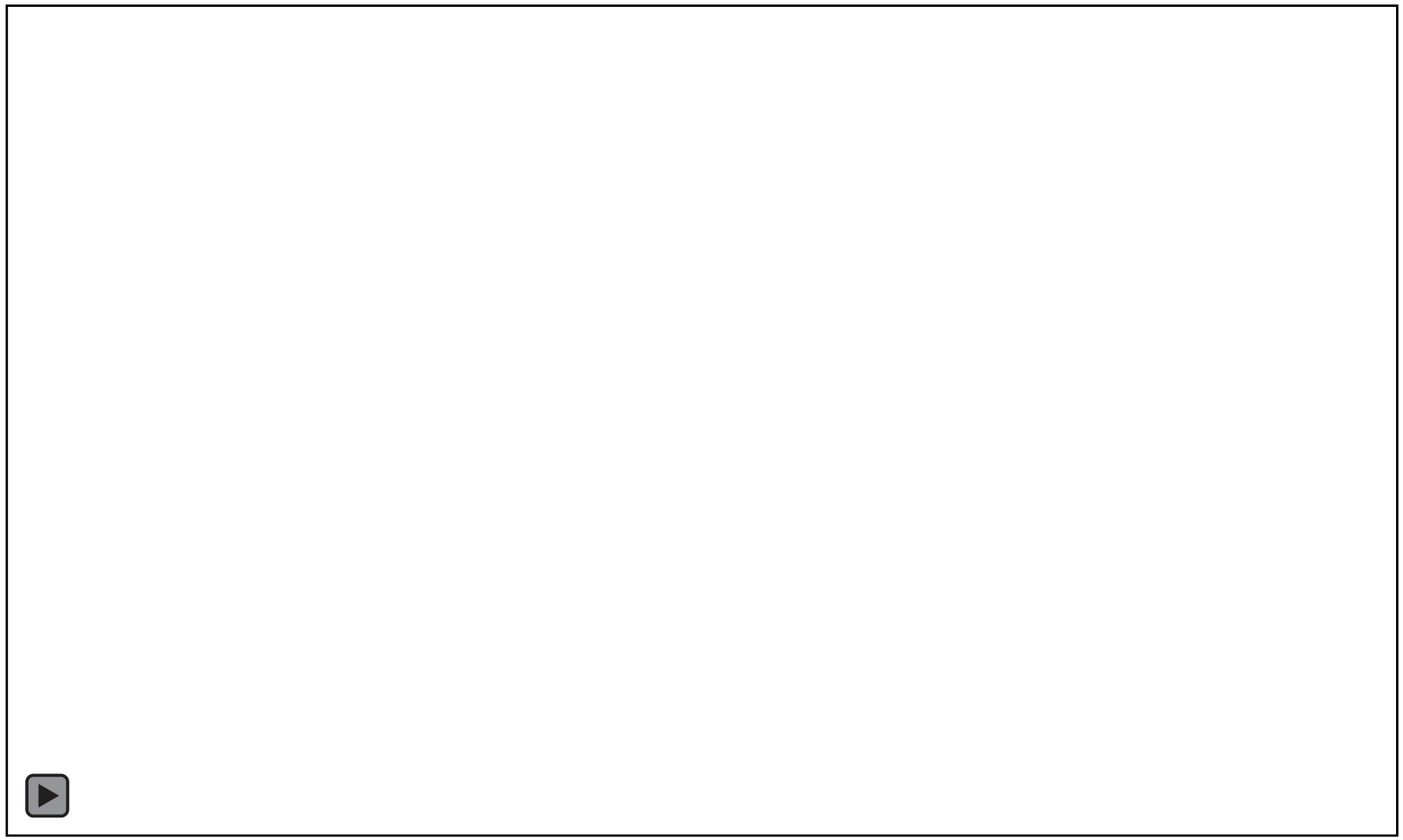
Freeze waveform

Select any frozen waveform for analysis and printing. At most 10 minutes of frozen waveforms can be reviewed

Re-analyze the segment of interest

Select any frozen waveform for printing. At most 10 minutes of frozen waveforms can be reviewed

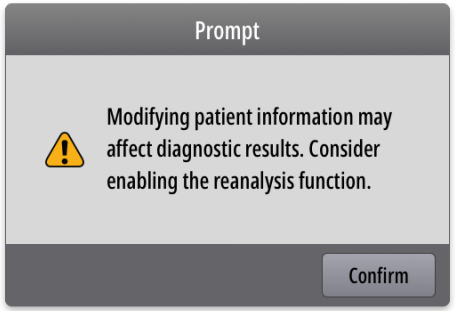
New features in R700: Save events



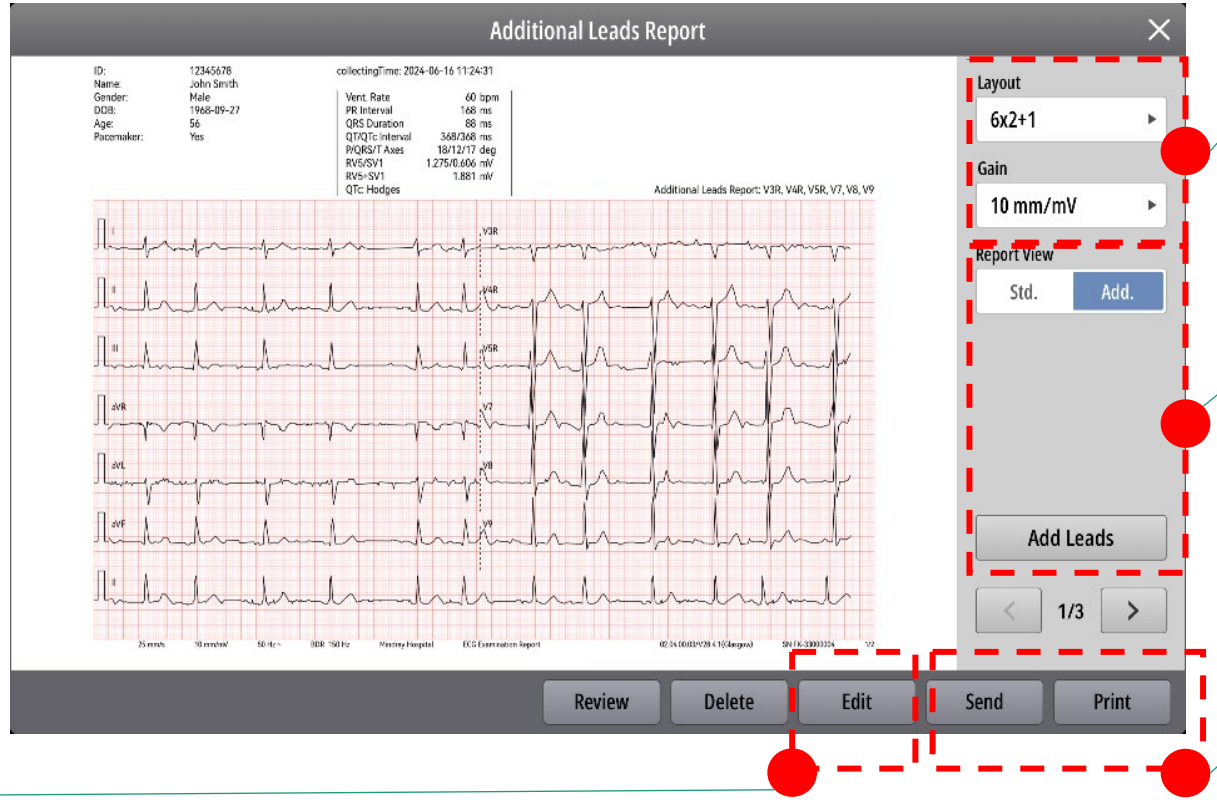
Save events

Save events and medication during the measurement. User can either choose the notes/drug from the build-in options or manually type in the notes.

Prepare → Signal acquisition → Signal processing → Diagnostic analysis → **Report management**



Edit patient information if needed. Please note, modify patient information may change the diagnostic results.



Adjust the layout and gain of report

Take additional leads measurement if necessary and review the report

Print out the report
Or send it digitally to other ECG systems/CMS

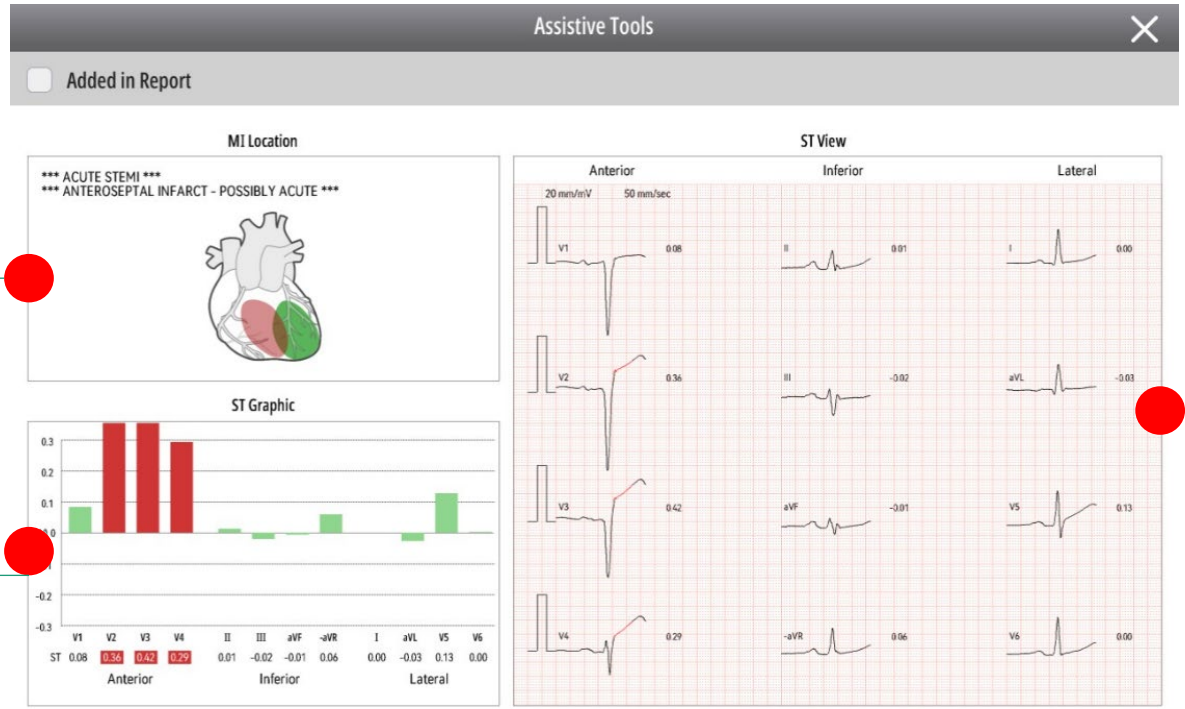
Prepare → Signal acquisition → Signal processing → Diagnostic analysis → Report management

ST analysis tool

If “ST abnormality” (ST elevation or depression) is displayed in a standard 12-lead ECG report, you can select **Assistive Tools** in the report preview to view diagnostic results with graphics.

(1) Myocardial infraction (MI) location diagram: graphically indicates the MI location and area.

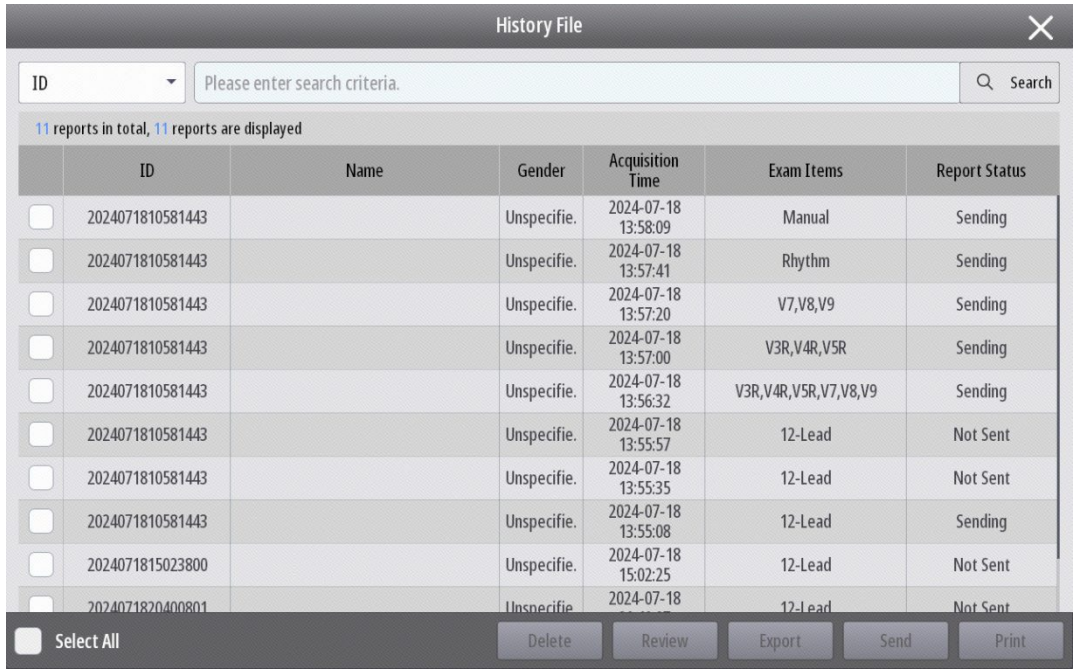
(2) ST Graphic: displays ST value for each lead.



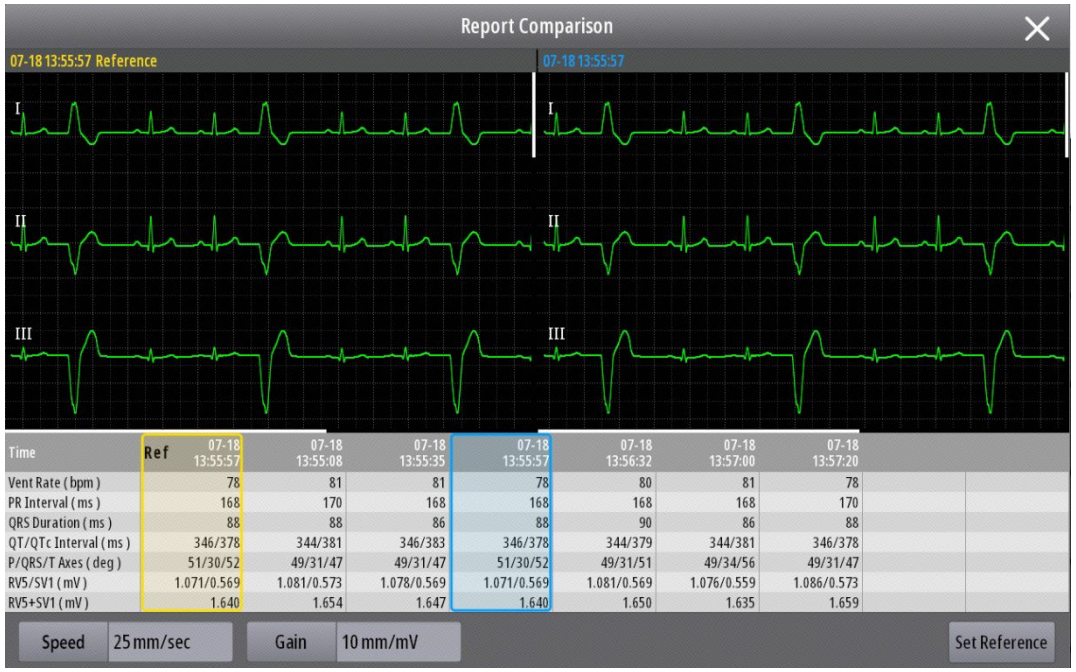
(3) ST View: displays a complete QRS segment for each lead.

Report comparison

Select two reports of interest and make a comparison.

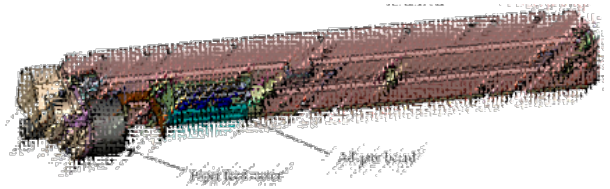


If multiple files are saved for a discharged patient, you can choose two reports for a comparison



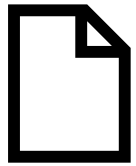
Historical report area: displays acquisition time and measured values for all saved report.

Prepare → Signal acquisition → Signal processing → Diagnostic analysis → Report management

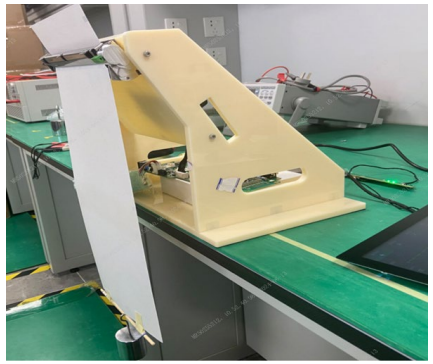


Upgraded thermal head with longer life span.

100,000m printing =

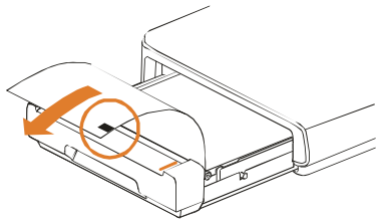
336,700 X  A4: 29.7cm width

10 years consecutive working with 100 patients a day



Stronger driving force of thermal head

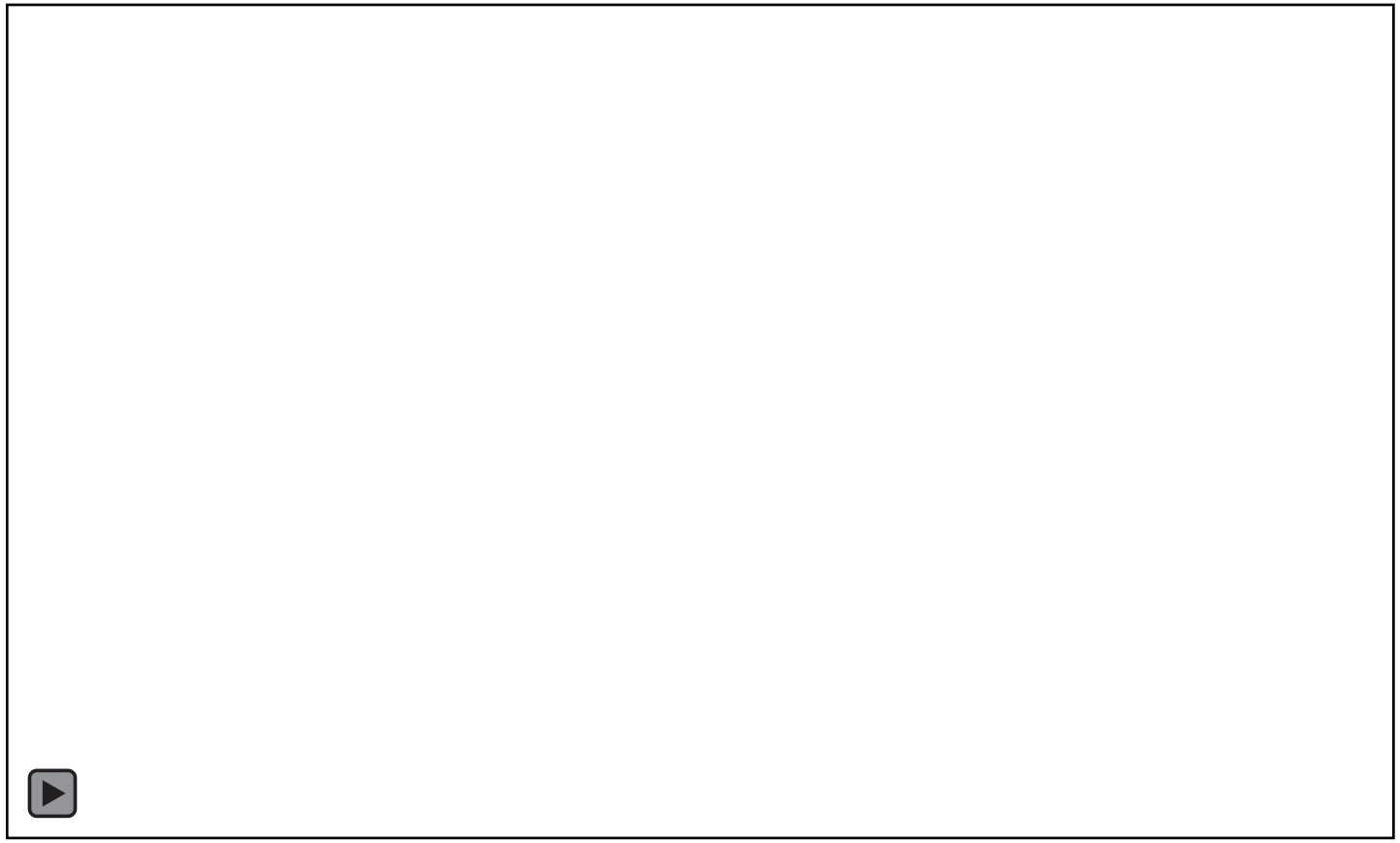
4 times stronger than R12, easily overcoming paper jams



Upgraded paper tray with less resistance in recording

2 times smoother than R12 in printing

Prepare → Signal acquisition → Signal processing → Diagnostic analysis → **Report management**



Reverse recording

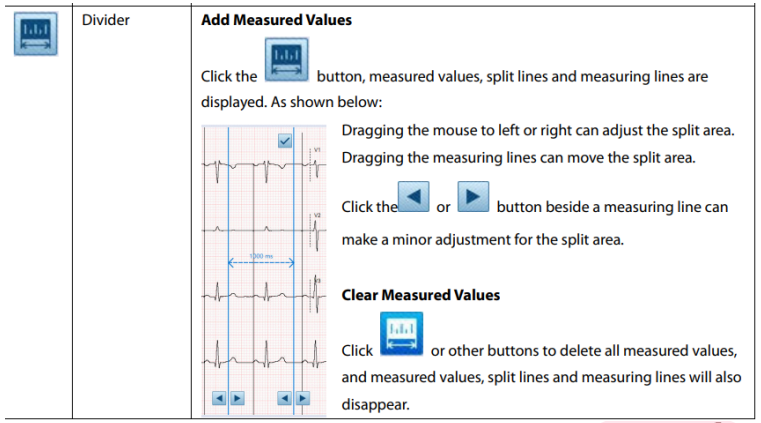
Save the 1st page of paper.

Make sure you hide the black mark inside of the recorder

Prepare → Signal acquisition → Signal processing → Diagnostic analysis → Report management

What's new in CardioVista 2.0

- OS compatibility: Microsoft Windows XP/Windows7/Windows10/Windows11
- Installation compatibility: USB drive
- If the patient is wearing a pacemaker, '|' will be there on the waveform or at the bottom indicates that the pacing signals are detected.
- More precise measurement in within a selected segment with '**Divider**' function.
- Updated EMG filtering options.
- Clearing invalid data.

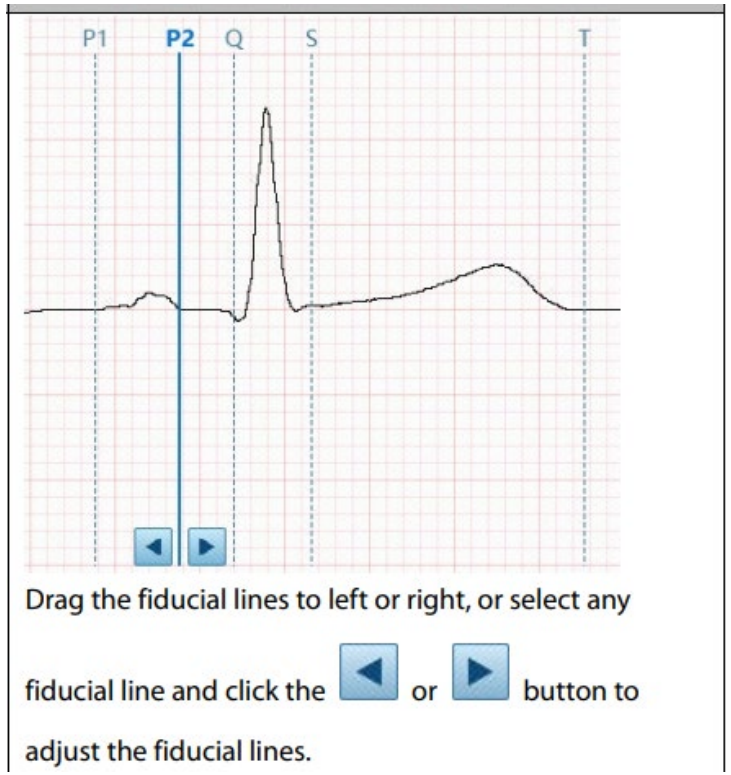


Divider	**Add Measured Values** Click the button, measured values, split lines and measuring lines are displayed. As shown below: Dragging the mouse to left or right can adjust the split area. Dragging the measuring lines can move the split area. Click the or button beside a measuring line can make a minor adjustment for the split area. **Clear Measured Values** Click or other buttons to delete all measured values, and measured values, split lines and measuring lines will also disappear.

Prepare → Signal acquisition → Signal processing → Diagnostic analysis → Report management

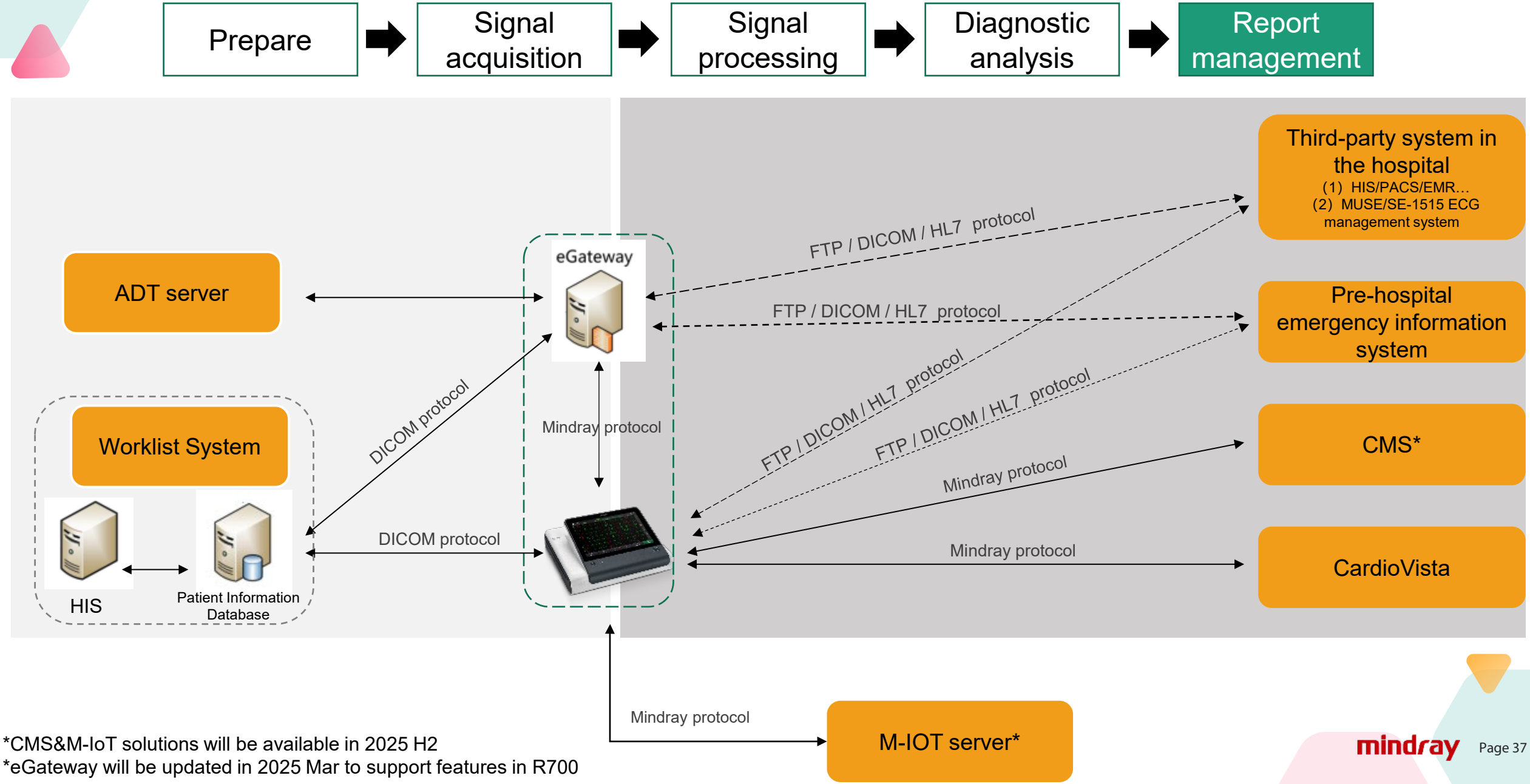
What's new in CardioVista 2.0

- Upgrade fiducial point to fiducial lines for ST analysis.





- View Assist Tool



*CMS&M-IoT solutions will be available in 2025 H2
*eGateway will be updated in 2025 Mar to support features in R700



Thanks!