Vivid *i*
Ultra-Portable
Echo System

Product Description

The Vivid i is a high-performance, battery-operated, ultra-portable diagnostic Ultrasound systems providing premium image quality. The Vivid i is designed for cardiovascular imaging, abdominal, small-parts and perioperative monitoring.

System Architecture

The Vivid i is based on GE's TruScan Architecture, which is common to all GE Ultrasound systems, EchoPAC PC Workstation, software and network solutions. It features a software-driven PC-based platform, raw data storage with unique post-processing capabilities, complete connectivity and compatibility with the GE family of Cardiovascular Ultrasound Systems. Innovative tools offer advance connectivity, remote monitoring and consultation for improved productivity and standard of care anywhere.

Advanced, energy-efficient power management designed for cool operation provides scanning with rechargeable battery power for more than one hour. Standby mode with battery allows fast boot-up anywhere.

Data Acquisition

- Programmable system architecture

- Application-specific channel architecture: the Vivid i employs a flexible, digital, beam-former architecture capable of using up to 1024 channels depending on specific application requirements

- Application-specific digital beam forming algorithm for each mode

- Supports Phased Array, Linear and Curved Array, TEE and non-imaging Pencil transducers

- Receive focusing, aperture, apodization and frequency response are all continuously variable as a function of depth

Data Processing

- Echo data processing of phase, amplitude and frequency

- Easily upgradeable for future expansions

- Digital raw data replay allows for image post processing and uncompromised offline measurement and analysis

Display Screen

- High-resolution, flat 15-inch TFT LCD screen

- Display size: 800 x 600 pixels with 260,000 simultaneous colors available

- Screen can be closed or tilted at angles ranging between 0-180°

- Wide-angle visibility

- Digital brightness, contrast and blue-tint adjustment for optimal viewing in different ambient light conditions

- Closing down the screen will automatically place system into standby mode allowing fast boot-up upon screen opening

Display Formats

- Instant-review screen displays 12 simultaneous loops/images for a quick study review

- Scanplane position indicator and probe temperature are displayed with all multi-plane TEE probes

- Image orientation marker

- Selectable display configuration of duplex and triplex modes: side-by-side or top-bottom, during live, digital replay and clipboard image recall

- Single, dual and quad-screen view

- Split screen view

Display Annotations

- Mechanical Index (MI)

- Thermal index: application dependent

- Patient name/ID and additional patient information

- Hospital name

- Time/date

- Trackball-driven annotation arrows

- Scanning parameters

- Application

- Probe name

- Stress protocol parameters

- Active mode display

- Parameter annotation follow ASE standard

- Multi-language support for user interface and reports

Tissue Imaging

General

- Variable transmit frequencies for resolution/penetration optimization

- Display zoom with zoom area control

- Variable contour filtering for edge enhancement

- Variable dynamic range and transmit power settings

- Depth range up to 30 cm – probe specific

- Selectable grayscale parameters: gain, reject, gray-maps, DDP and compress – can be adjusted in live, digital replay and image clipboard recall

- Automatically calculated TGC curves require minimal operator interaction

- Selectable Automatic Tissue Optimization (ATO) of the real-time, B-mode image

2D-mode

- Sector tilt and width control

- Coded octave imaging: second-generation harmonic tissue imaging providing improved lateral and contrast resolution over conventional imaging; features reduced noise and improved wall definition; COI gives improved axial resolution without sacrificing frame rate, making it the tissue modality of choice for all patient groups

- Confocal imaging: allows for multiple transmit focal zones over range of view and a high-vector density – probes dependent and user adjustable

- Expanded cardiology performance on the 3S probe, including five levels of harmonics and ultra-high frame rates

- Harmonic tissue imaging on all linear and convex probes (inlcuded in i^2 option)

- Speckle Reduction Imaging (SRI): performs speckle suppression on 2D images – user can control the amount of speckle suppression and the amount of image smoothing to be retained (included in i^2 option)

- Variable image width: a reduction either increases frame rate or increases the number of focal zones while maintaining the frame rate – application dependent

- Multiple-angle compound imaging (included in i^2 option): multiple co-planar images from different angles combined into a single image in real time improving border definition, contrast resolution and reducing angular dependence of border or edge (on linear probe)

- Dual focus: offers additional focal zone for added spatial and contrast resolution from heart base up to apical areas

- L/R and up/down invert in live, digital replay or image clipboard recall

- Digital replay for retrospective review or automatic looping of images allowing for adjustment of parameters such as gain, compression, reject, anatomical M-mode, persistence and replay speed

- Data Dependent Processing (DDP) performs temporal processing, which reduces random noise but leaves motion of significant tissue structures largely unaffected, can be adjusted even in digital replay

- Different gray-maps and colorized 2D-mode user selectable in real-time, digital replay

M-mode

- Trackball-steerable M-mode line available with all imaging probes – max steering angle is probe dependent

- Simultaneous real-time 2D- and M-mode

- M-mode PRF 1 kHz: all image data acquired are combined to give high-quality recording regardless of display scroll speed

- Digital replay for retrospective review of spectral data

- Several top-bottom formats, side-by-side format and time-motion only format – can be adjusted in live or digital replay

- Selectable horizontal scroll speed: 1, 2, 3, 4, 6, 8, 12, 16 seconds across display

- Horizontal scroll can be adjusted in live or digital replay

Anatomical M-mode

- M-mode cursor can be adjusted at any plane

- Can be activated from real-time scan, digital replay or image clipboard recall

- Anatomical color M-mode available in real-time scan, digital replay or image clipboard recall

- Measurement and analysis capability

- Anatomical tissue velocity M-mode (option)

Color Doppler

General

- Steerable color Doppler available with all imaging probes – max steering angle is probe dependent

- Trackball-controlled ROI

- Removal of color map from the tissue during digital replay

- Digital replay for retrospective review of color or color M-mode data allowing for adjustment of parameters, such as color/tissue priority and color gain, even on stored data

- PRF settings: user selectable

- Advanced regression wall filter gives efficient suppression of wall clutter

- For each encoding principle, multiple-color maps can be selected in live and digital replay including variance maps

- More than 65,000 simultaneous colors processed providing smooth display, 2D color maps containing a multitude of color hues

- Simultaneous display of grayscale 2D and 2D with color flow

- Color invert: user selectable in live and digital replay

- Variable color baseline: user selectable in live and digital replay

- Multivariate color priority function gives reliable delineation of disturbed flows even across bright areas of the 2D-mode image

- Color Doppler frequency can be changed independently from 2D for optimal flow

Color Doppler Imaging

- Digital signal processing power maintains high frame rates with large ROIs even for very low PRF settings

- Variable ROI size in width and depth

- User-selectable radial and lateral averaging for reduction of statistical uncertainty in the color velocity and variance estimates

- Data Dependent Processing (DDP) performs temporal processing and display smoothing with reduced possibility for loss of transient events of hemodynamic significance

- Digital replay for retrospective review or automatic looping of color images allowing for adjustment of parameters such as DDP, baseline shift, color maps, color/tissue priority and color gain even on frozen/recalled data

- Application-dependent multivariate motion discriminator reduces flash artifacts

Color Angio (Color Intensity Imaging)

- Angle-independent mode for visualization of small vessels with increased sensitivity compared to standard color flow

Color M-mode

- Variable ROI length and position – user selectable

- User-selectable radial averaging for reduction of statistical uncertainty in the color velocity and variance estimates

- Selectable horizontal scroll speed

- 1, 2, 3, 4, 6, 8, 12, 16 seconds across display – can be adjusted during live, digital replay or image clipboard recall

- Real-time 2D image while in color M-mode

- Same controls and functions available as in standard 2D color Doppler

Anatomical Color M-mode

- Vingmed-patented, any plane color M-mode display derived from color Doppler cine loop

- Also applicable to Tissue Velocity Imaging (option)

- Measurement and analysis capability

Spectral Doppler

General

- Operates in PW, HPRF and CW modes

- Trackball-steerable Doppler available with all imaging probes – max steering angle is probe dependent

- Selectable Doppler optimization

- Real-time duplex or triplex operation in PW Doppler mode for all velocity settings

- Frame rate control for optimized use of acquisition power between spectrum, 2D and color Doppler modes in duplex or triplex modes

- Spectral analysis with an equivalent DFT rate of 0.2 ms

- Automatic Spectrum Optimization (ASO) provides a single press, automatic, real-time optimization of PW or CW spectrum scale and baseline display (included in i^2 option)

- Dynamic gain compensation for display of flows with varying signal strengths over the cardiac cycle

- Dynamic reject gives consistent suppression of background – user selectable in real-time, digital replay or image clipboard recall

- Digital replay for retrospective review of spectral Doppler data

- Several top-bottom formats, side-by-side format and time-motion only format – can be adjusted in live or digital replay

- Selectable horizontal scroll speed: 1, 2, 3, 4, 6, 8, 12, 16 seconds across display – can be adjusted in live or digital replay

- Adjustable spectral Doppler display parameters: gain, reject, compress, color maps – can be adjusted in live or digital replay

- User-adjustable baseline shift in live, digital replay and image clipboard recall

- Adjustable velocity scale

- Wall filters with a range of 10-3000 Hz (velocity scale dependent)

- Angle correction with automatic adjustment of velocity scale in live, digital replay and image clipboard recall

- Stereo speakers mounted in the front panel

- Display annotations of frequency, mode, scales, Nyquist limit, wall filter setting, angle correction and acoustic power indices

PW/HPRF Doppler

- Automatic HPRF Doppler maintains its sensitivity even for shallow depths and with the highest PRFs

- Digital velocity tracking Doppler employs processing in range and time for high-quality spectral displays

- Adjustable sample volume size of 1-15 mm (probe dependent)

- Maximum sample volume depth 30 cm

Tissue Doppler imaging

- Myocardial PW Doppler provides real-time Doppler spectral information for specified myocardial motion allowing for instantaneous tissue velocity measurement

CW Doppler

- Highly sensitive steerable CW available with all phased array probes

Tissue Velocity Imaging and Tissue Tracking (option)

Tissue Velocity Imaging

- Myocardial Doppler imaging with color overlay on tissue image

- Tissue Doppler data can be acquired in background during regular 2D imaging

- Segmental wall motion analysis can be obtained with use of anatomical M-mode from digital replay or image clipboard recall

- Tissue color overlay can be removed to show just the 2D image, still retaining the tissue velocity information

- Quantitative profiles (Q-Analysis) can be derived on data transferred to EPPC workstation

Tissue Tracking

- Real-time display of the time integral of TVI for quantitative display of myocardial systolic displacement

- Myocardial displacement is calculated and displayed as a color-coded overlay on the grayscale and M-mode image – different colors represent different displacement ranges

Cine Memory

- High-fidelity loops and images may be reviewed by scrolling or by running cine loops

- TruScan architecture offers broad post-processing capabilities of recalled images and loops allowing manipulation of parameters such as gain, baseline, color maps, sweep speeds, audio gain and cine speed

- "Image Clipboard" for thumbnail storage and review of saved images and loops

- Trackball-controlled cine review

Fast Power-Up

- Standby mode to support fast boot-up

- Turn off into standby following power source interruption using battery power backup

Physiological Traces

- Integrated ECG or external ECG lead input

- High-resolution display of the ECG trace

User Interface

Operator Keyboard

- Easy-to-learn user interface with intelligent keyboard

- Keyboard with application-specific push buttons for primary controls

- Interactive back-lighting of application-specific push buttons

- Full-size, alphanumeric keyboard with adjustable backlighting

- Application-specific secondary controls available through slide bars operated by a four-way rocker

- Slide pot TGC curve with six pots

- Overall gain for 2D-mode and active mode on same rotary

- Digital harvesting of images and loops into image clipboard

- Patient browser screen for registration of demographic data and quick review of image clipboard contents

- Fully programmable user presets for probe/application default settings

- Support for international (European) keyboard character sets (ISO 8859)

- Integrated speakers

Analysis Program

- Personalized measurement protocols allow individual set and order of measurement and analysis items

- Measurements can be labeled seamlessly by using protocols or post assignments

- Bodymark icons for location and position of probe

- Cardiac calculation package including extensive measurements and display of multiple repeated measurements

- Vascular measurements package

- Measurements assignable to protocol capability

- Parameter annotation follow ASE standard

- Measurements assignable to report generator

- Doppler auto trace function with automatic calculations in both live and digital replay

- Seamless data storage and report creation

- Measurements are summarized in worksheets – individual results can be edited or deleted

- User-assignable parameters

- Report templates can be customized on board

- ASE-based default text modules (English) – user customizable

- Image view during reporting

- Insite™ capability

- Ilinq™ capability

i^2 Performance Package (option)

This premium performance enhancement package includes:

- Harmonics on linear/curved array probes

- Speckle Reduce Imaging (SRI)

- Automatic Spectrum Optimization (ASO)

- Coded Phase Inversion (CPI)

- Compound imaging on linear probes

- Mandatory for SmartStress or TVI/TT options

Echo Stress (option)

- Stress package with memory buffer offers pharmaceutical, exercise and bicycle stress exam protocols with user-configurable templates and shuffle mode

- "Smart Stress" function with the ability to save over 17 imaging parameters from each imaging plane – these imaging parameters are recalled at each stress level, thereby requiring no system adjustments

- Advanced and flexible stress-echo examination capabilities

- Image acquisition, review, wall-segment scoring and reporting

- Stress exercise with more than 90 seconds of raw data continuous capture

- Possibility of extensive post-processing of images under review

- Reference scan display during acquisition for stress level comparison (dual screen)

- Wall motion scoring (bulls-eye and segmental)

- Show reference for comparing resting images to each stress level

- Template Editor to customize the number of stress levels, number of views, number of heart cycles and systolic or full-cycle capture

IMT Measurement Program (option)

- Automatic measurements (patent pending) of carotid artery Intima-Media Thickness (IMT) on any acquired frame

- On-board IMT package provides non-interrupted workflow – fully integrated with M&A, worksheet, archiving and reporting functions

- Robust algorithm provides quick, reliable measurements, which can be stored to the on-board archive for review and reporting

- IMT measurement can be made from frozen images or images retrieved from archive

- IMT package supports measurements of different regions of the intima in the carotid vessel (e.g., Lt./Rt./CCA/ICA etc.)

- Frame for IMT measurement can be selected in relation to the ECG waveform

Advanced Options

Contrast Imaging

All use of contrast agents should be used as described on the label by the contrast agent manufacturers.

LVO Contrast (option)*

LV Contrast (3S and 6T) enhances delineation of the LV border in combination with ultrasound contrast agents. The new implementation of GE's Coded Phase Inversion (CPI) provides high-resolution detection of contrast in the LV cavity and excellent suppression of myocardial tissue signals.

Vascular/Abdominal Contrast (option)**

- Vascular Contrast (8L probe): Coded Phase Inversion enables excellent detection and resolution of vascular contrast imaging

- Abdominal Contrast (4C probe): using Coded Phase Inversion, optimized for abdominal contrast imaging

Wideband Probes

- Electronic selection between one solid-state connector and one stand-alone Doppler connector

 * Harmonic imaging for supporting contrast agent imaging was developed by Schering.

** GE Healthcare's Vivid *i* is designed for compatibility with commercially available contrast agents. Because the availability of these agents is subject to government regulation and approval, product features intended for use with these agents may not be commercially marketed nor made available before the contrast agent is approved for use. Advanced contrast features are only enabled on systems for delivery in countries or regions where the agents are approved for use or for investigational or research use.

PROBE	FREQUENCY RANGE	CATALOG #
Phased Array Sector Probes		
3S RS	1.5 – 3.6 MHz	H4000PD
5S RS	2.0 – 5.0 MHz	H4000PC
7S RS	3.5 – 8.0 MHz	H4000PE
10S RS	4.5 – 11.5 MHz	H4000PF
Linear Array Probes		
8L RS	4.0 – 13.0 MHz	H40402LT
12L RS	6.0 – 13.0 MHz	H40402LY
Convex (Curved) Array Probes		
4C RS	1.8 – 6.0 MHz	H4000SR
8C RS	4.7– 11.0 MHz	H40402LS
Doppler Pencil Probes		
P2D RS	2.0 MHz	H45021C
P6D RS	6.0 MHz	H45021CA
Multi-Plane Transesophageal Phased Array Probes		
6T RS	2.9 – 8.0 MHz	H45531MZ
9T RS	4.0 – 10.0 MHz	H45531YM
TEE Probe Adaptor		
Allow to use multi-plane TEE probe on other Vivid systems		H45021KP

Image Management and Archiving

- Raw data workflow: ultimate workflow with instant access data management

- DICOM 3.0 Image Format: DICOM incorporates raw image data information with all its data management flexibility into the image communication standard DICOM

- 2D, CFM and TVI data at maximum frame rate may be reviewed by scrolling or by running cine loops

- Image clipboard for stamp-sized storage and review of stored images and loops

- Built-in patient archive with images/loops, patient information, measurements and report

- Configurable HTML-based report function

- Report template designer package

- Internal archive data can be exported to removable image storage through DVD/CD-RW, USB Flash Card (option) Magnet-Optical Disk and DICOM Media (option)

- Internal hard disk: for storing programs, application defaults, ultrasound images and patient archive

- Over 40 Gbyte disk space for exam archive storage

- All data storage is based on ultrasound raw data allowing to change gain, baseline, color maps, sweep speeds, etc. for recalled images and loops

- Raw-Data, DICOM, AVI, MPEG and JPEG export

- DVD writer (supports CD-R and DVD-R)

Excel Export

- Allows export of all archived measurement and textual patient information in standard Microsoft Excel files

DICOM Network Connectivity (option)

- Ethernet network connection

- DICOM support

- Storage to DICOM server

- DICOM structured report SCU

- Storage commitment

- Performed procedure step

- Verify: provides verification of an active connection between the scanner and another DICOM device

Modality Worklist (option)

- Modality worklist: gives access to a list of patients from a worklist server (usually HIS)

DICOM Print (option)

DICOM Media Support (option)

- DICOM media: read/write images on DICOM format

EchoPAC Connectivity

- Connectivity and image analysis capability of Vivid *i* from EchoPAC PC

- EchoPAC PC allows Instant access to ultrasound raw data provided by the system

- Comprehensive review, analysis and post-processing capabilities on EchoPAC PC

- Advanced quantitative analysis and post-processing capabilities

- Q-Analysis on raw data from Vivid *i* on EchoPAC PC

- Three user levels help organizing data security requirements

Virtual Printer (option – patent pending)

- Provides the ability to send "Print" commands to any of two printers even when not connected to a printer – upon re-connection of printer, the system automatically produces hard copies from print images saved in chronological succession on disk

MPEGvue (option)

- Using MPEGvue, exams may be stored onto removable media or on remote networked system together with integrated MPEGvue player for viewing on standard PC

- Smart email feature allows transparent transmission of images via email using resident Outlook email client

- Patient management utility on standard PC provides ability to organize the exams on different sub-directories on the user's hard disk

eVue (Option)

- Allows interactive viewing of images, loops or full exams from remote location on any PC, using LAN or wireless LAN

Peripherals (options)

- Super VHS VCR (requires video scan converter)

- USB black and white video printer with control from system panel

- USB color video printer with control from system panel

- USB inkjet printer

- Bluetooth inkjet printer

- MO 5.25" drive

- Secondary DVD/CD-RW

- USB global modem

- USB flash memory card

- Wireless network interface

Accessories (options)

- Replacement battery

- External battery charger

- Replacement hard disk

- Safety lock

- Video scan converter

- Splash-proof protective keyboard cover

- GoPac portable carrying case or RollPac on wheels

SafeLock Cart (optional)

- Probe and gel holder

- Hand rest and handles

- Anti-theft locking device

- Four swivel wheels – front wheel breaks

- Two peripheral shelves

Inputs and Outputs

- SVGA video out

- Connectors:
  - USB-2 (to support CD-RW, video printers, MOD, USB flash-card, etc.)

  - LAN Ethernet

  - PCMCIA (wireless LAN card)

  - DC power input

Dimensions and Weight

- Depth: 313 mm (12.4 in)

- Width: 358 mm (14.2 in)

- Height: 59 mm (2.3 in)

- Weight: approximately 5 kg (11 lbs) without battery

Electrical Power

- Battery or main-line operation

- Input rating: 100-240 VAC/2.3 -1.1A

- Frequency: 50/60 Hz

Safety

Built to meet the requirements of:

- IEC/EN/UL 60601-1 (1988) Class I, Type BF (electrical safety)

- IEC/EN 60601-1-2 (2001) Group I Class A (EMC)

- IEC/EN 60601-2-37 (2001) (Ultrasound)

- IEC/EN 60601-2-27 (2001) (ECG)

- The European Medical Devices Directive (MDD) 93/42/EEC (CE Mark)

Virus Protection

To minimize virus vulnerability, Vivid i is configured with a minimal set of open ports and with all network services, not actively used by the system, closed down. This significantly reduces the risk of a virus attack on Vivid i.

GE is continuously judging the need for additional actions to reduce vulnerability of equipment. This includes vulnerability scanning of our products and evaluation of new security patches for the third-party technology used. Microsoft and other security patches that address serious issues with Vivid i will be made available to customers after GE verification of those patches.

Healthcare Re-imagined

GE is dedicated to helping you transform healthcare delivery by driving critical breakthroughs in biology and technology. Our expertise in medical imaging and information technologies, medical diagnostics, patient monitoring systems, drug discovery, and biopharmaceutical manufacturing technologies is enabling healthcare professionals around the world discover new ways to predict, diagnose and treat disease earlier. We call this model of care "Early Health." The goal: to help clinicians detect disease earlier, access more information and intervene earlier with more targeted treatments, so they can help their patients live their lives to the fullest. Re-think, Re-discover, Re-invent, Re-imagine.

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imagination at work