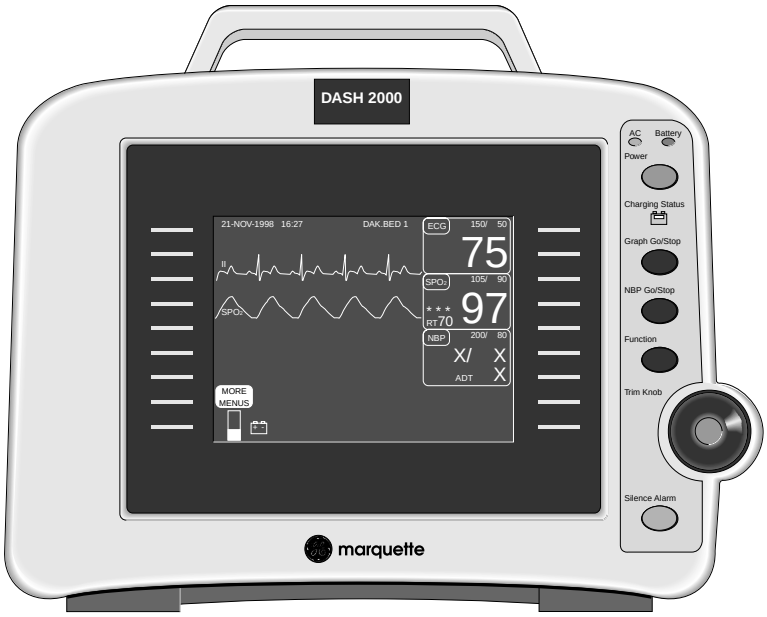
Dash 2000
Patient Monitor
Service Manual

2000 412-001 Revision A



marquette

A GE Medical Systems Company

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How to Reach Us . . .

Service Calls and Product Support

To open a service call or obtain product support call the numbers below:

Service calls	All products	800-558-7044	(U.S.& Canada)
		561-575-5000	(outside U.S.)
Product support	Monitors	800-558-7044	(U.S. & Canada)
		561-575-5000	(outside U.S.)
	Cardiology	800-558-5120	(U.S)
		414-355-5000	(outside U.S.)

or contact your local sales and service representative:

Name: _____

Telephone: _____

For other product information please contact one of the offices listed on the next page.

Ordering Supplies and Service Parts

Order supplies (leadwires, electrode paste, thermal paper, etc.) or service parts (manuals, circuit boards, cables, software, etc.) from:

Supplies

GE Marquette Supplies
2607 North Grandview Blvd.
Mail Code: SN-471
Waukesha, WI 53188
Telephone: 800-558-5102 (U.S. only)
414-521-6856 (outside U.S.)
Fax: 800-232-2599 (U.S. only)
414-521-6855 (outside U.S.)

Service parts

GE Marquette Service Parts
P.O. Box 9100, 100 Marquette Drive
Jupiter, FL 33468-9100
Telephone: 800-321-3251 (U.S. only)
561-575-5000 (outside U.S.)
Fax: 800-421-6841 (U.S. only)
561-575-5050 (outside U.S.)

Have the following information handy before calling:

- part number of the defective part, or
- model and serial number of the equipment,
- part number/name of the assembly where the item is used,
- item name, and
- where applicable, reference designation (eg, R13, S12).

Ordering Manuals When ordering additional operator manuals, be sure to include the software version of the product.

Other Questions or problems

For additional information contact one of the offices listed below.

Headquarters

GE Marquette Medical Systems, Inc.
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Marquette Medical Systems (HK)
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8 Causeway Road
Causeway Bay, Hong Kong
Telephone: (852) 2804-2320
Fax: (852) 2804-1776

Southeast Asia

Marquette Electronics (SEA) Pte.
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04-04A Thye Hong Centre
Singapore 0315
Telephone: (65) 471-2133
Fax: (65) 471-1540

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1 INTRODUCTION

Contents

Manual Information

Scope of the Manual

The content of this field service manual is aimed primarily at biomedical equipment technicians and field service personnel. The user of this field service manual is expected to have a solid background in electronics, including strong backgrounds in analog and digital electronics, as well as microcomputer technology familiarity.

Revision History

Each page of this manual has a revision letter located at the bottom of the page. It identifies the revision level of the entire manual. This may be important if you have different manuals and you don't know which is the most current.

For the initial release, all pages have the revision letter A. For the second update, all pages receive the revision letter B. The latest letter of the alphabet added to the table below corresponds to the most current revision.

Revision History		
Revision	**Date**	**Comment**
A	1 July 1999	Initial release of this manual.

Manual Purpose

This field service manual has been prepared by the technical publications staff at Marquette Hellige Electronics, Inc. It is intended for use by biomedical electronic technicians or other qualified service personnel responsible for installation, maintenance or repair of the DASH 2000 Patient Monitor (hereafter referred to as the monitor).

Chapter Content

The field service manual is organized into sections, as follows:

Introduction

Chapter one, "Introduction", describes the field service manual, manual page layout, related documentation, manufacturer responsibility, notes/cautions/warnings, and abbreviations.

Equipment Overview

Chapter two, "Equipment Overview", describes the product, the Marquette Unity Network, technical specifications, preparation for use, product part numbers and theory of operation.

Maintenance

Chapter three, "Maintenance", describes the maintenance schedule, visual inspection, cleaning the monitor, checkout procedures, leakage current tests.

Troubleshooting

Chapter four, "Troubleshooting", describes electro-static discharge, special components, battery failure, power source tests, data acquisition tests, service tips, a network related troubleshooting flow chart and the service mode menu.

Calibration

Chapter five, “Calibration”, describes adjustments/jumpers/switches and NBP calibration.

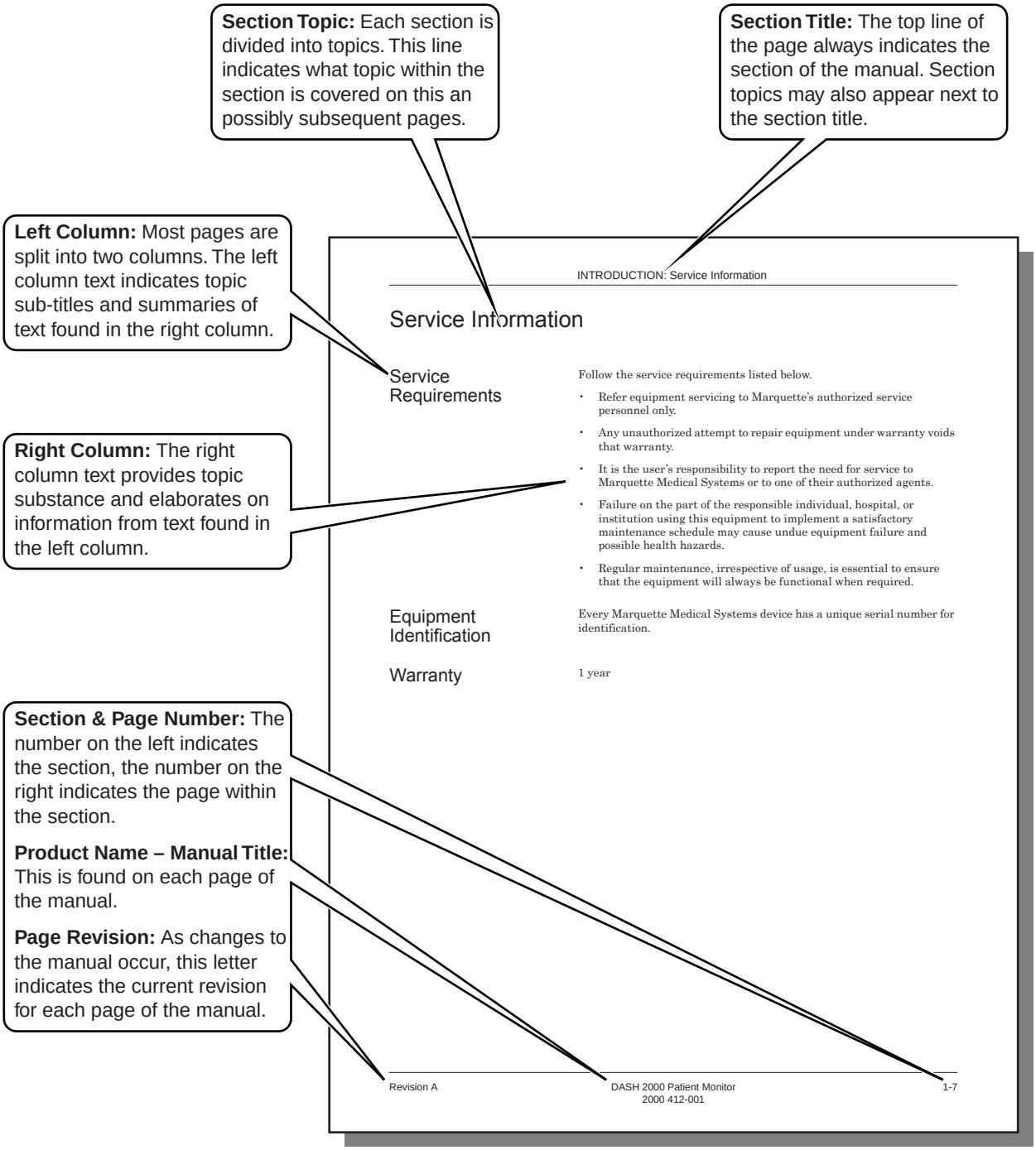
Configuration

Chapter six, “Configuration”, describes monitor configurations, installing software, loading software using floppy diskettes and setup or configuration for use.

Assembly Drawings

Chapter seven, “Assembly Drawings”, provides mechanical diagrams, reference diagrams, schematic diagrams and parts lists.

Page Layout


Section Topic: Each section is divided into topics. This line indicates what topic within the section is covered on this an possibly subsequent pages.
Section Title: The top line of the page always indicates the section of the manual. Section topics may also appear next to the section title.
Left Column: Most pages are split into two columns. The left column text indicates topic sub-titles and summaries of text found in the right column.
Right Column: The right column text provides topic substance and elaborates on information from text found in the left column.
Section & Page Number: The number on the left indicates the section, the number on the right indicates the page within the section.
Product Name – Manual Title: This is found on each page of the manual.
Page Revision: As changes to the manual occur, this letter indicates the current revision for each page of the manual.
INTRODUCTION: Service Information
Service Information
Service Requirements
Follow the service requirements listed below.
• Refer equipment servicing to Marquette's authorized service personnel only.
• Any unauthorized attempt to repair equipment under warranty voids that warranty.
• It is the user's responsibility to report the need for service to Marquette Medical Systems or to one of their authorized agents.
• Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
• Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.
Equipment Identification
Every Marquette Medical Systems device has a unique serial number for identification.
Warranty
1 year
Revision A
DASH 2000 Patient Monitor
2000 412-001
1-7

Safety Information

Responsibility of the Manufacturer

Marquette Medical Systems is responsible for the effects of safety, reliability, and performance only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by Marquette.
- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.

Intended Use

This device is intended for use under the direct supervision of a licensed health care practitioner.

To ensure patient safety, use only parts and accessories manufactured or recommended by Marquette Medical Systems.

Contact Marquette Medical Systems for information before connecting any devices to this equipment that are not recommended in this manual.

Equipment Symbols

The following symbols appear on the equipment.

NOTE

Some symbols may not appear on all equipment.

ATTENTION: Consult accompanying documents before using the equipment.

In Europe, this symbol means dangerous or high voltage. In the United States, this symbol represents the caution notice below:

CAUTION

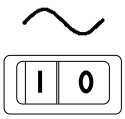
To reduce the risk of electric shock, **do not** remove the cover (or back). Refer servicing to qualified personnel.

Defibrillator-proof type CF equipment; type CF equipment is specifically designed for applications where a conductive connection directly to the heart is established. The paddles indicate the equipment is defibrillator proof.

Defibrillator-proof type BF equipment; type BF equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application. Type BF equipment is type B equipment with an F-type isolated (floating) part. The paddles indicate the equipment is defibrillator proof.

Type B equipment; type B equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application.

Equipotentiality



Alternating current (AC)

Power; **I** = ON; **O** = OFF

Fuse

Indicates where to press to open the door on the Series 7160 Direct Digital Writer.

Notes, Cautions, and Warnings

The safety statements presented in this section apply to the components of the DASH 2000 Patient Monitor. Look for additional safety information throughout the rest of this manual.

The order in which safety statements are presented in no way implies order of importance.

The terms **WARNING**, **CAUTION**, and **NOTE** are used throughout this manual to point out hazards and to designate a degree or level or seriousness. Familiarize yourself with their definitions and significance.

Hazard is defined as a source of potential injury to a person.

WARNING

indicates a potential hazard or unsafe practice which, if not avoided, could result in death or serious injury.

CAUTION

indicates a potential hazard or unsafe practice which, if not avoided, could result in minor personal injury or product/property damage.

NOTE

provides application tips or other useful information to assure that you get the most from your equipment.

Service Information

Service Requirements

Follow the service requirements listed below.

- Refer equipment servicing to Marquette's authorized service personnel only.
- Any unauthorized attempt to repair equipment under warranty voids that warranty.
- It is the user's responsibility to report the need for service to Marquette Medical Systems or to one of their authorized agents.
- Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
- Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.

Equipment Identification

Every Marquette Medical Systems device has a unique serial number for identification.

Warranty

1 year

Abbreviations

A

AAMI Association for the Advancement of Medical Instrumentation

ac alternating current

ADC analog-to-digital converter

Adj adjustable

Al aluminum

Ampl amplifier

ANSI American National Standards Institute, Inc.

ASIC application specific integrated circuit

ASYNC COMM asynchronous communication

AUI attachment unit interface

Ave Avenue

AWG American Wire Gage

B

B/M beats per minute

BDGH binding head

BP blood pressure

bpm beats per minute

BT blood temperature

C

Cap capacitor

cc cubic centimeter

Cer ceramic

CMOS complimentary metal-oxide semiconductor

CO cardiac output

CSA Canadian Standards Association

D

DAC digital-to-analog converter

dB decibel

dc direct current

DDW Direct Digital Writer

DEFIB SYNC defibrillator synchronization

DMM digital multimeter

E

ECG electrocardiogram, electrocardiograph

EEPROM electronically erasable programmable read only memory

ESD electro static discharge

F

FCC Federal Communication Commission

FDA Food and Drug Administration

FET field-effect transistor

FL Florida

G

GND ground

H

hi-pot high potential

Hz Hertz

I

ID inside diameter

IEC International Electrotechnical Commission

IEEE Institute of Electrical and Electronic Engineers

in inch

IT injectate temperature

J

JFET junction field effect transistor

K

kg kilogram

kHz kilohertz

kV kilovolt

L

LAN local area network

lb pound

LCA logic cell array

M

M mega, megohm

mA milliampere

MHz megahertz

mm millimeter

mmHg millimeter of mercury

MOSFET metal-oxide semiconductor field-effect transistor

MPP metallized polypropylene

MRT Monitoring Review Terminal

mV millivolt

N

NBP non-invasive blood pressure

No number

nS nanosecond

Ntwk network

P

PC printed circuit, personal computer

PCB printed circuit board

PCMCIA Personal Computer Memory Card International Association

pF picoFarad

PLCC plastic leaded chip carrier

PLL phase locked loop

pn part number

PNH pan head

Pos position

PPR peripheral pulse rate

PVC premature ventricular contraction

R

RAM random access memory

Res resistor

RESP respiration

Rgltr regulator

S

SM surface mount

SPDT single-pole, double-throw

SpO_2 pulse oximetry (arterial oxygen saturation)

SPST single-pole, single-throw

SST stainless steel

T

Tant tantalum

TEMP temperature

TPU time processing unit

Tram Transport Remote Acquisition Module

TTl transistor-transistor logic

U

UART universal asynchronous receiver/transmitter

UL Underwriters Laboratories, Inc.

V

V volt, voltage

Var variable

VDE Verband Deutscher Electrotechniker

Volt voltage

W

W watt, West

w/ with

WI Wisconsin

WW wire wound

Y

YSI Yellow Springs Instrument

Other

(Cont) continued

°C degrees Celsius

°F degrees Fahrenheit

Δz impedance variation

µ micro

µA microampere

µF microfarad

µV microvolt

Ω ohm

***y*T** temperature difference

% percent

2 EQUIPMENT OVERVIEW

Contents

Product Description

About the Monitor

The monitor is a compact, self-contained patient monitor incorporating many advanced features previously found only in complete modular systems.

Compact Design

Measuring a compact 27 cm (10.5 inches) wide, 22 cm (8.5 inches) tall, and 20 cm (8 inches) deep, and weighing just 5.1 kg (13 pounds), the monitor is thin and unobtrusive enough for locations previously considered impractical. The display size is 5.8 inches.

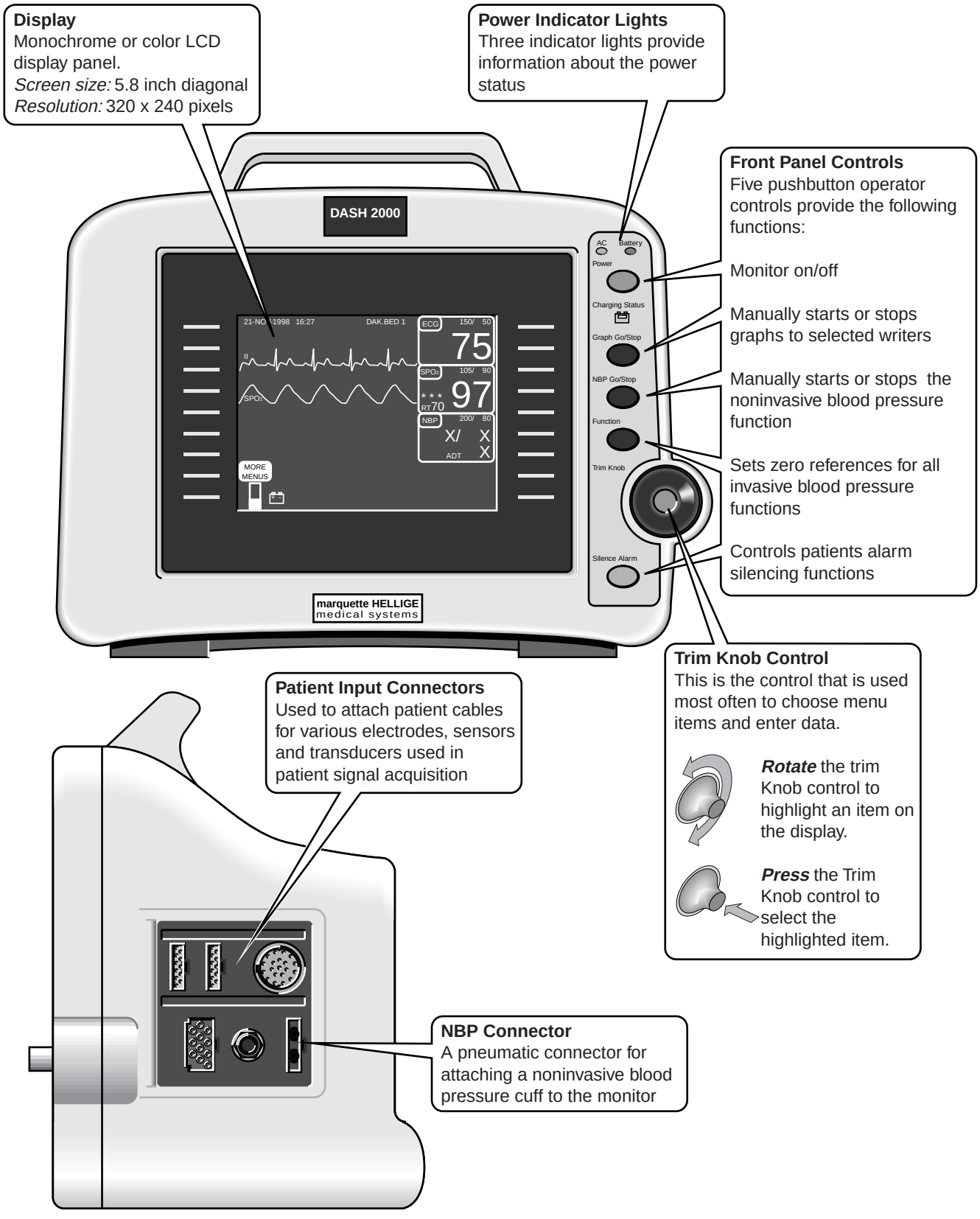
Network Compatible

The monitor can be part of a patient monitoring network, an open architecture, systems integration platform designed to improve the efficiency and effectiveness of healthcare delivery.

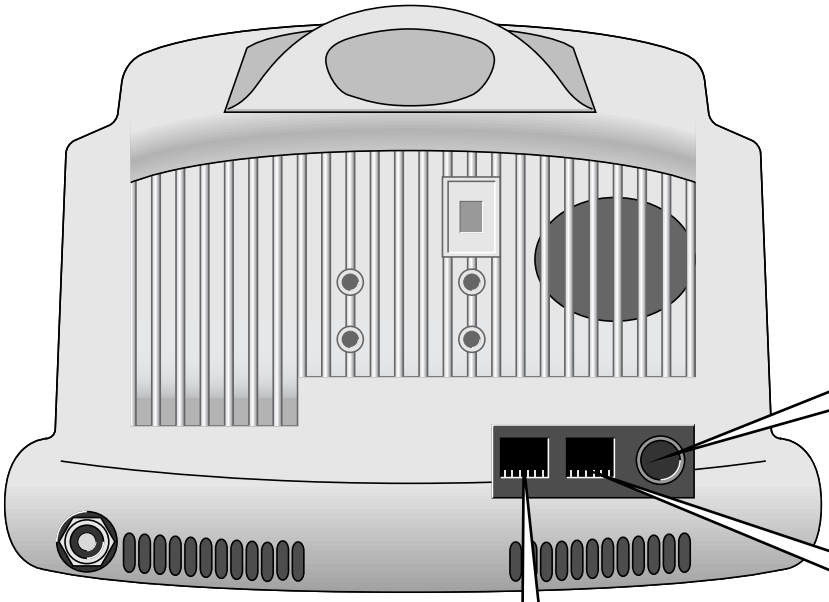
Easy to use

From software designed for specific care areas to the monitor's unique Trim Knob® control, the monitor was designed to be as easy to use as it is comprehensive.

Front Panel Description



Rear Panel Description



DEFIB SYNC
This connector provides a direct interface between the monitor and a defibrillator for synchronization of the two devices during emergency defibrillation for the synchronized cardioversion. The signals available through this connector are:
Outputs
- Defib sync pulse
- Analog ECG signal

Input
- Defibrillator triggered marker pulse

Aux Port
(for future use)
This port can be used for interconnection to other devices

Network Connector
An IEEE 802.3 twisted pair cat 5 cable can be connected to this port for monitors used in patient monitoring network configurations

Serial Number Label
(not shown)
Describes the type of equipment, date and sequence of product manufacturer for each monitor

Marquette Unity Network

Monitor Application

The Marquette Unity Network (hereafter referred to as the network) provides a method for standardized communication with various Marquette medical systems devices. This versatile monitor can operate both as a fully functional stand-alone device and as a component on the network, depending upon the application.

Patient Monitoring System Application

When connected to the network, the monitor provides access to other devices for many purposes. Marquette patient monitoring equipment such as Centralscope central station monitor; Series 7100/7160 direct digital writer; CDT-LAN patient telemetry system; ADU/Pager-LAN; and, Solar or other Eagle patient monitors are examples of devices that can be used in conjunction with the monitor when connected to the network.

Hospital-wide Network Application

There are various types of information management and data base systems devices which may also be integrated with the monitor via connection to the network. Marquette medical systems equipment such as MUSE cardiology management system; MARS UNITY workstation; review station; MAC-Lab cardiac catheterization system; QMI patient data management system; and, MUSE HIS interface are examples of systems and data bases which can be integrated with the monitor on the network.

Performance Specifications

Performance Specifications

The Dash 2000 Patient Monitor consists of a self-contained monitor. The Dash 2000 can also operate on battery (DC) power for use as a transport monitor.

Display

Size:	5.8-inch diagonal
Type:	
Monochrome:	Hi-Bright Liquid Crystal Display (LCD)
Color:	Liquid Crystal Display (LCD)
Resolution:	320 by 240 pixels
Number of traces:	3
Number of seconds/trace:	3.8 at 25 mm/sec
Sweep speed:	
All waveforms:	25 mm/sec -20% (with erase bar)
Waveform display:	Individual
Information window:	Display of non-real-time information without obstructing the display of real-time information
Display organization:	Prioritized by parameter

Controls

Standard:	Trim Knob control plus 5 hard keys: Silence Alarm, NBP Go/Stop, Graph Go/Stop, Function, and Power

Processing

Main processor:	MPC 821 32-bit integrated microcontroller (24 MHz)
Data acquisition processor:	MC68332 32-bit integrated microcontroller (15.72 MHz)
Program storage:	4-MB flash memory
Data storage:	512 kB (battery backed-up), 4-MB DRAM

Alarms

Classification:	4 levels – Crisis, Warning, Advisory, and Message
Notification:	Audible and visual
Setting:	Default and individual
Silencing:	1 minute, current alarm only
Volume:	Default 70%, 70 dB measured at 1 m
Location	Bedside and central station, if applicable
Visual color/modulation	Red, flashing

ECG

Standard leads available:	I, II, III, V, aVR, aVL, and aVF
Leads analyzed simultaneously:	I, II, III, and V (multi-lead mode)
Lead fail:	Identifies failed lead
Alarms:	User selectable upper and lower heart rate limits
Input specifications:	
Voltage range:	±0.5 mV to ±5 mV with size 2x or 4x below 1 mV and with QRS width Adult ICU 70 to 120 ms Neonatal ICU 40 to 80 ms
Signal width:	40 ms to 120 ms (Q to S)
Heart rate range:	30 to 300 BPM, accuracy ±1 BPM
Response time to change in heart rate:	12 s ±2 s (HR averaging)
Heart rate update:	2 s
Input impedance:	
Common mode:	>10 MOhms at 50/60 Hz
Differential	>2.5 MOhms from dc to 60 Hz
Tall T-wave rejection amplitude:	1.2 mV max.
Output specifications:	
Frequency response:	
Display:	
Diagnostic:	0.05 to 120 Hz
Monitoring:	0.05 to 40 Hz
Moderate:	0.05 to 25 Hz
Maximum:	5 to 25 Hz
DDW (Direct Digital Writer)	
Diagnostic:	0.05 to 120 Hz
Monitoring:	0.05 to 40 Hz
Moderate:	0.05 to 25 Hz
Maximum:	5 to 25 Hz
Common mode rejection:	90 dB minimum at 50 Hz or 60 Hz
Linearity deviation:	±3%
Noise:	<30 µV RTI (referred to input)
Leads off sensing:	For each electrode 1.25 V/62 MOhms referred to RL
Pacemaker detection/rejection:	
Input voltage range:	±2 mV to ±700 mV
Input pulse width:	0.1 to to 2 ms
Rise time:	10 ms to 100 µs
Over/under shoot:	2 mV (max.) with Diagnostic or Monitor filter setting and size 1x or 0.5x
Baseline drift:	<0.5 mV/hour with a ±700-mV, 2-ms pacemaker pulse applied
Time to alarm:	
for tachycardia:	12 s ±2 s
for cardiac standstill:	7 s ± 1 s (acoustic alarm)
Response to irregular rhythm	EK PRO used for optimized results, with learning function

Respiration

Measurement technique:	Impedance variation detection
Range:	±14 Vpk /(330 pF + 20 kOhm) per electrode excitation voltage/impedance
Respiration rate:	1 – 200 breaths per minute
Base impedance:	100 to 1000 Ohms at 52.5 kHz excitation frequency
Detection sensitivity:	0.4 to 10 Ohms variation
Waveform display bandwidth:	0.1 to 1.8 Hz (-3 dB)
Alarms:	User-selectable upper and lower respiration rate limits, and user-selectable apnea limit

Temperature (TEMP)

Number of channels:	1
Input specifications:	
Probe type:	YSI Series 400
Temperature range:	0 °C to 45 °C (32 °F to 113 °F)
Resolution:	±0.1 °C
Output specifications:	
Parameter displayed:	TP
Linearity:	<1 % from 30 °C to 42 °C
Error:	(independent of source) ±0.1 °C for YSI series 400 probes
Alarms:	User-selectable upper and lower limits for TP

Invasive Blood Pressure (BP)

Number of channels:	1
Transducer sites:	Arterial (ART), femoral artery (FEM), pulmonary artery (PA), central venous (CVP), right atrial (RA), left atrial (LA), intracranial (ICP), and special (SP)
Transducer requirements:	
Excitation voltage:	±2.5 Vdc ±0.1 %
Transducer output:	50 µV/V/cmHg
Input specifications:	
Range:	-25 mmHg to 300 mmHg
Offset:	±150 mmHg
Input impedance:	
Common mode:	>100 k at 50/50 Hz
Differential:	>100 k from dc to 60 Hz
Output specifications:	
Gain:	976 ±1 %
Frequency response:	dc to 50 Hz (+0/-3 dB)
Gain stability:	<±0.1%/°C, and <±0.1% over any 24 hour period
Zero balance range:	±150 mmHg
Zero balance accuracy:	±1 mmHg
Zero balance drift:	±1 mmHg over 24 hours
Common mode rejection:	>60 dB at 60 Hz
Noise:	<5 mVp-p from dc to 30 Hz
Accuracy:	±2% or ±1 mmHg, whichever is greater (exclusive of transducer)

Alarms:	User-selectable upper and lower limits for systolic, diastolic, and mean pressures

Pulse Oximetry (SpO2)

Parameters monitored:	Arterial oxygen saturation (SpO2) and peripheral pulse rate (PPR)
SpO2 range:	
calibrated:	50 – 100%
total:	0 – 100%
PPR range:	25 – 250 beats per minute (±3 beats per minute)
Accuracy:	Actual accuracy depends on probe. Please reference manufacturer's specifications.
SpO2:	±2% (70 – 100% SpO2) ±1 standard deviation ±3% (50 – 69% SpO2) ±1 standard deviation
PPR	±3 beats per minute
Alarms:	User-selectable upper and lower limits for SpO2 and PPR

Non-invasive Blood Pressure (NBP)

Measurement technique:	Oscillometric
Displayed parameters:	Systolic, diastolic, and mean pressures, pulse rate, time of last measurement
Measurement modes:	Manual, auto, and stat
Heart rate detection:	30 to 300 beats per minute
Total cycle time:	20 to 40 seconds typical (dependent on heart rate and motion artifact)
Automatic cycle times:	0 to 24 hours
Auto zero:	Zero pressure reference prior to each cuff inflation
Tubing length:	
Adult:	12 feet (3.6 m)
Neonatal:	8 feet (2.4 m)
Automatic cuff deflation:	Cycle time exceeding 3 minutes (90 seconds neonatal), power off, or cuff pressure exceeds 300 mmHg (+10%) adult, 150 mmHg (+10%) neonatal
Cuff sizes:	
Disposable:	Large adult, adult, small adult, pediatric, small pediatric, and infant
Reusable:	Thigh, large adult, adult, child, and infant
Alarms:	User-selectable upper and lower limits for systolic, diastolic, and mean pressures

Analog Output

ECG:

Gain:	1 V/mV ±10%
DC offset:	±100 mV (max)
Noise:	<5 mVp-p (0-300 Hz)
Frequency response:	0.05 Hz to 100 Hz +7/-0 Hz

Defibrillator Synchronization Pulse

Marker out:

Time delay:	35 ms (max), R-wave peak to leading edge of pulse.
Amplitude selectable in Service Menu	
+5 V selection:	3.5 V (min) at 1 mA sourcing; 0.5 V (max) at 5 mA sinking.
+12 V selection:	11.0 V (max) at 1 mA sourcing; 0.75 V (max) at 5 mA sinking.
Pulse width:	10 ms ±10% or 100 ms ±10% in Service Menu
Output impedance:	50 Ohms nominal
Current limit:	15 mA nominal, both sourcing and sinking.

Marker in:

Input threshold:	VIH = +2.5 V (min); VIL = +1.5 V (max)
Input hysteresis:	650 mV typical
Maximum input voltage:	±30 V (with respect to ground on pin 2)
Input impedance:	10 k (min) for –25 V < Vin < 25 V
Pulse width:	1.0 ms (min), Vin < 2.5 V

Environmental Specifications

Power requirements:	
AC voltage:	100 – 240 VAC ±10%
Power consumption:	16 W normal use, 45 W fast charge
Cooling:	Convection
Heat dissipation:	240 BTU/hr
Battery:	nickel-cadmium (NiCd), 12 V, 2.0 ampere hours
Fuses:	100 – 240 VAC: T2.0A, 250 VAC, 5 x 20 mm
Design (general):	Continuous, not protected against ingress of liquids
Battery operation time:	
General:	Battery age will affect operating time. SpO2 and NBP monitoring, as well as battery age, reduce operating time.
Monochrome LCD display:	Typical operation time while monitoring ECG is 3.5 hours from a new, fully-charged battery.
Color LCD display:	Typical operation time while monitoring ECG is 3 hours from a new, fully-charged battery.
Min. battery operating time:	1.5 hours
Battery charge time to 90%:	1 hour to 3 hours

Operating conditions:	
Ambient temperature:	10 to 40 °C (50 to 104 °F)
Relative humidty:	30 – 70%
Atmospheric pressure:	700 to 1060 hPa
Storage conditions:	
Maximum:	50 °C (122 °F) at 50% relative humidity, or 70 °C (158 °F) at 15% relative humidity
Minimum:	-25 °C (-13 °F)
Atmospheric pressure:	500 to 1060 hPa

Physical Specifications

Height:	21.5 mm (8.5 inches)
Width:	26.0 cm (10.2 inches)
Depth:	20.0 cm (7.9 inches)
Weight (with battery pack and recorder):	
with color/monochrome display:	11.5 lb (5.2 kg)

Certification

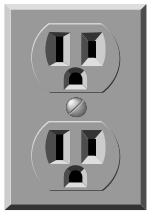
IEC:	IEC 60601-1 certified CE Marking for the 93/42/EEC Medical Device Directive

Warranty

Standard:	One year
Optional:	Other options are available. Contact the manufacturer sales representative for more information.

Preparation for Use

Power Requirements

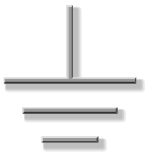


At least one grounded duplex wall receptacle should be provided for each monitor. The wall receptacle should be hospital grade and installed in a suitable junction box. Power should be provided by a power line dedicated solely to equipment requiring emergency power.

WARNING

Depending on battery charge, loss of power to the monitor results in the loss of all monitoring functions.

Equipment Ground Requirements



The ground pin of the wall receptacles and all exposed metal parts (beds, radiators, water pipes, etc.) in the patient area should be connected together and tied to the nearest equipotential ground point through a bonded grounding system, or with a 10-AWG stranded copper grounding cable. This equipotential ground point should be as close to earth ground as possible. Use only three-prong, polarized, hospital-grade wall receptacles to accept the three-wire, polarized plug on the power cord of the monitor.

If a bonded grounding unit is not available, interconnect the ground pins of all wall receptacles in the patient and monitor areas with 10-AWG (or larger) stranded copper cables. This copper cable must connect to the central grounding point. Do not jumper from ground pin to ground pin, then to the central grounding point. The ground cabling must not carry current, such as a grounded neutral, since the current flow will produce differences in potential along the ground. These potential differences are the main source for shock hazards to the users and patients.

Do not rely on conduit as a ground conductor. Plastic (PVC) pipes or fittings used as conduit break up the ground path, which can present potential shock hazards. The electrical ground system must be connected to actual earth ground. If this is not possible, then a good reference ground such as a metal cold water pipe or an electrically conductive building component should be used. It is more important that all grounded objects in the patient area are at the same potential than at true earth potential.

Monitor Ventilation Requirements

The monitor is capable of producing as much as 170 BTu per hour of heat load. This is equivalent to approximately 50 watts of energy.

WARNING

Failure to properly ventilate the monitor may cause equipment failure or improper monitoring conditions which may endanger the patient being monitored.

CAUTION

Do not locate the monitor in an enclosed area that may restrict the heat dissipated by it. Any restriction in air flow causes a rise in internal temperature which may result in equipment failure.

CAUTION

The monitor must be located no closer than 4 inches (10 cm) from any partition or wall. The monitor should be approximately 12 inches (30 cm) from any overhead partition or the ceiling.

Mounting Recommendations

Marquette Monitoring System Mounting Reference Guide:

- Manufacturer recommended methods of mounting the monitor to various locations.

Software Setup

Section 6: Configuration

- Information regarding connection of the monitor to peripherals

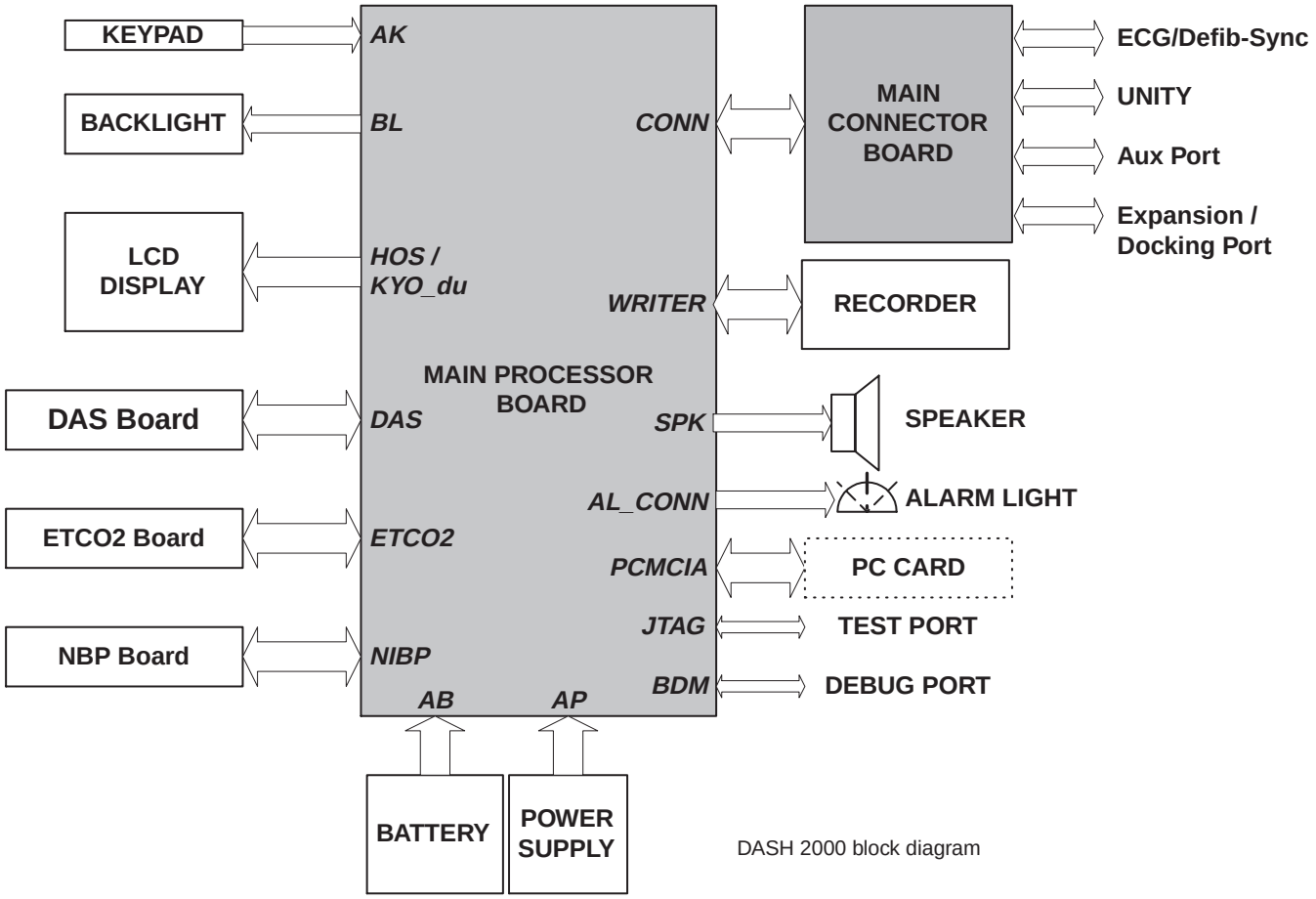
Theory of Operation

General Monitor Block Theory

The theory of operation for the monitor, as covered in this part of the section, is intended to provide an overall block level overview of the monitor for service technicians. A general understanding of the theory of operation is required to effectively install, maintain or repair the monitor.

More detailed theory of operation can be obtained by attending manufacturer formal technical training classes. Regularly scheduled technical training classes are held throughout the year at the manufacturer training facility located in Jupiter, Florida, or in Freiburg for Europe. If warranted, technical training classes may be scheduled at customer sites or other locations in the field as well.

Overall Monitor Block Diagram



DASH 2000 block diagram

Components

Power Supply PCB

The power supply PCB mounts internally to the monitor rear casting assembly. It's a 40 Watts controllable single output, universal input switching power supply, which has been designed to meet the safety ground leakage current requirements laid down by IEC 60601 and UL 544.

Acquisition PCB

The acquisition PCB, or data acquisition system (DAS), located in the monitor, is responsible for the acquisition of all vital-sign patient data. Analog sensor/electrode input signals are amplified and conditioned by hybrid assemblies, then converted to digital data. The digital patient data is transferred across an isolation barrier via high-speed opto-couplers to the main processor PCB for analysis and display.

The DAS consists of two isolated and one non-isolated sections which are separated by a barrier that is capable of withstanding up to 6000 VDC with respect to earth ground. Isolation is accomplished by using a coupled inductor power supply and opto-isolation for signals crossing the barrier.

Main Processor PCB

The main processor PCB provides signal processing, system control, user interface, and communications functions for the monitor, both color LCD and monochrome LCD display versions. It receives and processes digitized patient data from the isolated DAS assembly (acquisition PCB), text and waveform information for the video display, interfaces with the operator via the front panel switches and Trim Knob, and communicates with other products on the network using a built-in Ethernet interface.

Main Connector PCB

The main connector PCB is connected to the main processor board and is responsible for the dispersion of signals between the processor PCB and the monitor rear panel connectors. Ethernet, AutoPort communication, ECG/Defib syn and the docking station are the primary functions of the board.

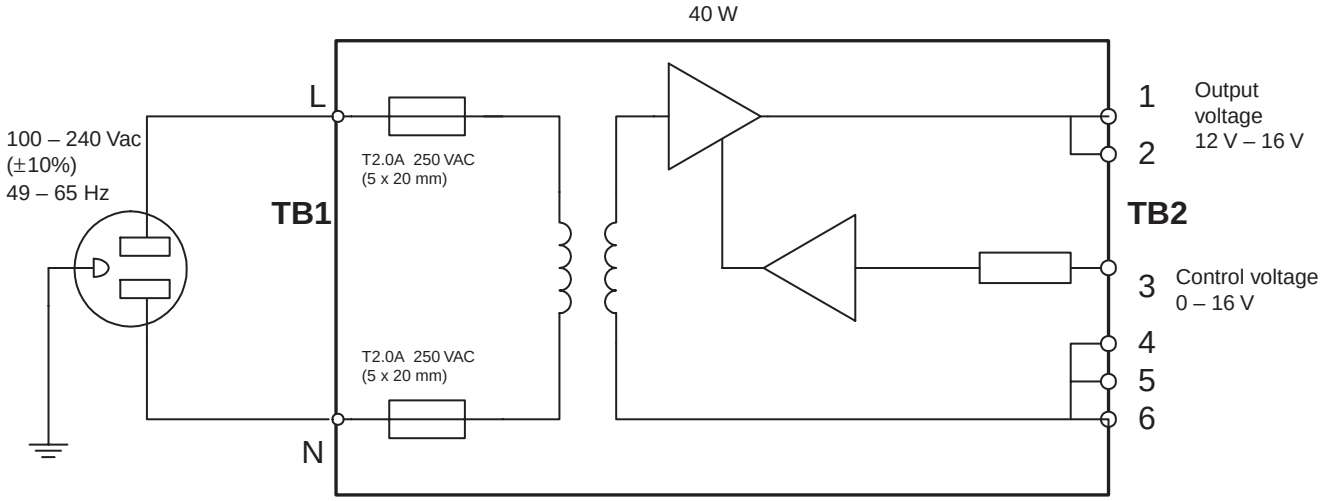
Power Supply PCB Theory

The power supply PCB mounts internally to the monitor rear casting assembly. The input voltage is between 85–264 V AC / 49–64 Hz. The power supply PCB provides a controllable output voltage between 12–16 V.

PCB Functions

The power supply PCB is a 40 W controllable single output, universal input switching converter. The output voltage is controlled via control voltage input (TB2, Pin 3).
The output voltage range is between 12–16 V, the control voltage range is 0–16 V.
The output voltage with open control input is 15.5 V ± 100 mV.

PCB Block Diagram

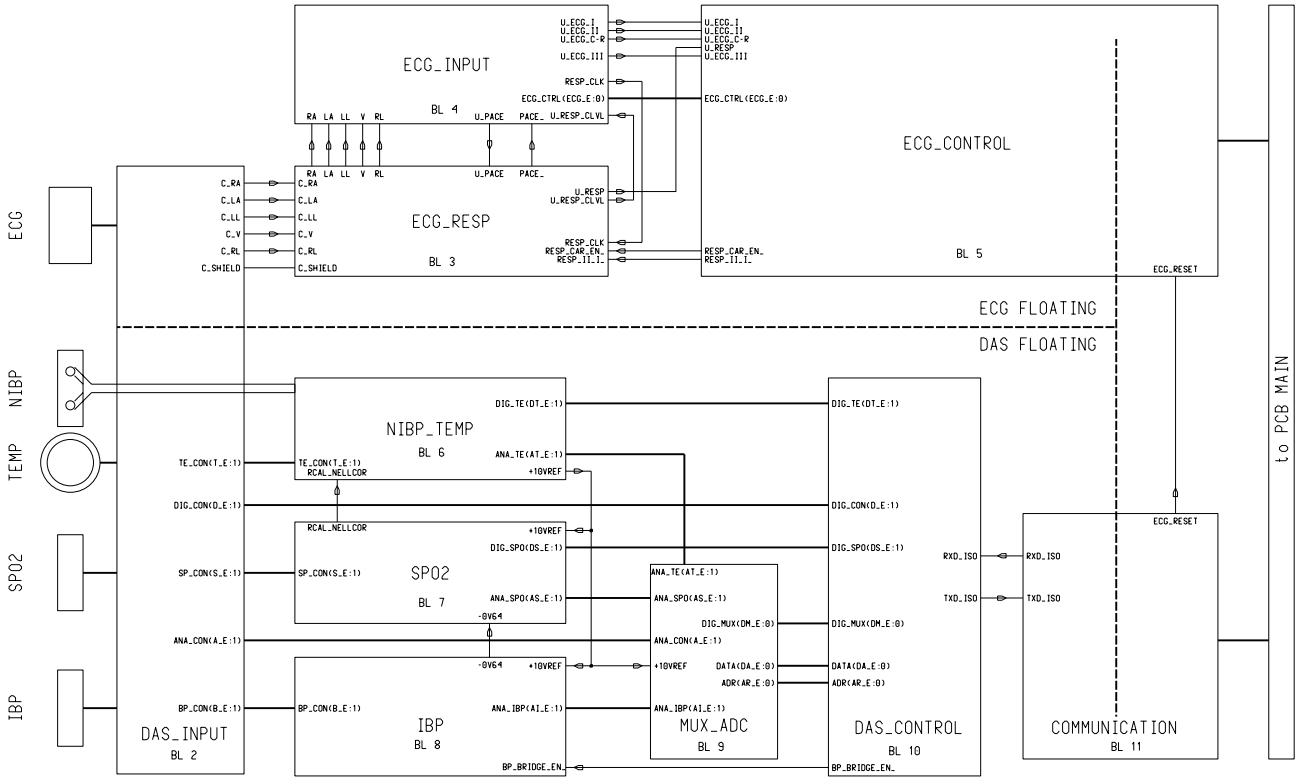


Acquisition PCB Theory

The acquisition PCB, or data acquisition system (DAS), located in the monitor, is responsible for the acquisition of all vital-sign patient data. Analog sensor/electrode input signals are amplified and conditioned by hybrid assemblies, then converted to digital data. The digital patient data is transferred across an isolation barrier via high-speed opto-couplers to the processor PCB for analysis and display.

The DAS consists of two isolated (ECG/RESP and NBP, SPO2, TEMP, IBP) and one non-isolated sections which are separated by a barrier that is capable of withstanding up to 6000 VDC with respect to earth ground. Isolation is accomplished by using a coupled inductor power supply and opto-isolation for signals crossing the barrier.

PCB Block Diagram



Functional Circuits

Functional circuits on the acquisition PCB include:

- Isolated power supplies generation,
- Patient cable input connector interface,
- ECG defibrillator protection,
- Patient signal generation (hybrids interface),
- Analog-to-digital conversion (patient signals),
- Data acquisition system (DAS) processing, and
- DAS communication interface and isolation barrier.

PCB Functions

The acquisition PCB is a microprocessor based data acquisition system with patient isolated power supply included. The DAS can be divided into four main sections:

1. Input sensor/electrode signal conditioning,
2. Analog to digital conversion,
3. Microprocessor/digital interface, and
4. Isolated power supply.

The input sensor/electrode conditioning for NBP, SPO2, TEMP and IBP is accomplished by the Analog input hybrids and the ECG/RESP section is accomplished by the HECTOR chip set with its own SPI interface to the main processor board. Input signals are received from the DAS input connector board. The NBP pressure hose is connected to a pressure transducer which develops the pressure equivalent electrical signal. The signals are then routed to the appropriate hybrid for amplification and filtering. All input signals are clamped for static protection either on the hybrids or on the circuit board.

Analog to Digital Conversion (NBP, SPO2, TEMP, IBP)

Output signals from the hybrids are coupled to a series of analog multiplexers. Outputs from the multiplexers are then applied via a summing multiplexer to an analog to digital (A/D) buffer. The high slew rate A/D buffer drives the 20-volt input of the analog to digital converter (ADC). Under microprocessor control, the channels are individually selected and sampled at a rate determined by the frequency content of the signal.

The ADC is a complete 12-bit successive-approximation device with tri-state output buffers for direct interface to the microprocessor bus. The data is read in two steps, first the 8 most significant bits then the 4 least significant bits.

Microprocessor/Digital Interface

The MC68332 is a 32-bit microcontroller which is upward compatible with the M68000 family. It provides 24 address lines and has a 16-bit data bus. It controls data acquisition, digital control and serial communication across the isolation barrier.

The system clock is generated by an on-chip PLL circuit and voltage controlled oscillator (VCO) which uses a low frequency external crystal (31.2 kHz) and an internal frequency synthesizer to step up the frequency to 15.7248 MHz (504 *x* 31.2 kHz). The frequency was selected for timing synchronization, to be an exact multiple of 60 Hz (60 Hz *x* 266,240).

The MC 68332 contains intelligent peripheral modules such as the TPU, the Queued Serial Module (QSM), the Test Submodule, the System Protection as well as 2 kilobytes of fast static RAM and twelve independent programmable chip selects.

The TPU provides 16 microcoded channels for performing time related activities. It is used to control the timing critical portion of the Pulse Oximetry function. The rest of the TPU is used for input/output (I/O) control signals.

The Queued Serial Peripheral Interface (QSPI) synchronous serial link is used to communicate with the MC68332 on the processor PCB via

opto-isolators and associated circuitry. The programmable queue allows the QSPI to perform up to sixteen (bytes) serial transfers without CPU intervention.

The MC68332 QSPI is designed to be used in a multiprocessor environment where one processor is the master and the other processors are slaves. A signal generated from the master processor selects the QSPI slave mode for the DAS processor which enables communications.

During normal operation, the DAS processor is a slave to the MPC821 host processor on the main processor PCB. Upon power up or reset, the DAS processor is designed to come up in the Background Debug Mode (BDM) since no boot code resides on the DAS. Direct communication with BDM allows the master to execute a number of commands including loading boot code into the memory if the DAS has never been programmed. Logic then disconnects the BDM communication link so the SPI link is connected directly between the host processor and the DAS processor. The host processor can then download the executable program into the FLASH memory.

The memory configuration is two 128K *x* 8 FLASH chips and direct addressing of two 128K *x* 8 static RAM chips. The RAM is expandable by moving zero-ohm jumpers if using higher density RAM chips.

The CMOS FLASH memory uses a high-integration block architecture. Programming of one block does not affect data stored in another block, allowing maximum flexibility.

The DAS control ASIC is a multifunction digital interface which provides logic interface support for the MC68332 processor. The ASIC provides the following functions:

- A latched buffer for analog to digital conversion,
- Provides logic to enable processor BDM upon power up or reset; connects serial communications to the processor debug module,
- The communication interface and control to the pulse oximetry function, and
- Identification for the ASIC and circuit board.

Isolated Power Supply

The voltage monitor for both isolated sections is an under-voltage sensing circuit which generates a reset to the processor if the 5-volt isolated supply voltage drops below 4.6 VDC.

The isolated power supply for both isolated sections is a current mode control flyback converter providing a main +5-volt regulated output (digital supply), a ±5 volts, as well as a ±12 volt winding cross regulated output (analog supplies). To achieve UL 544 patient connected hi-pot and leakage requirements, a specially designed potted coupled inductor and optical isolation are used. The supply uses feedback loss time-out for overload protection.

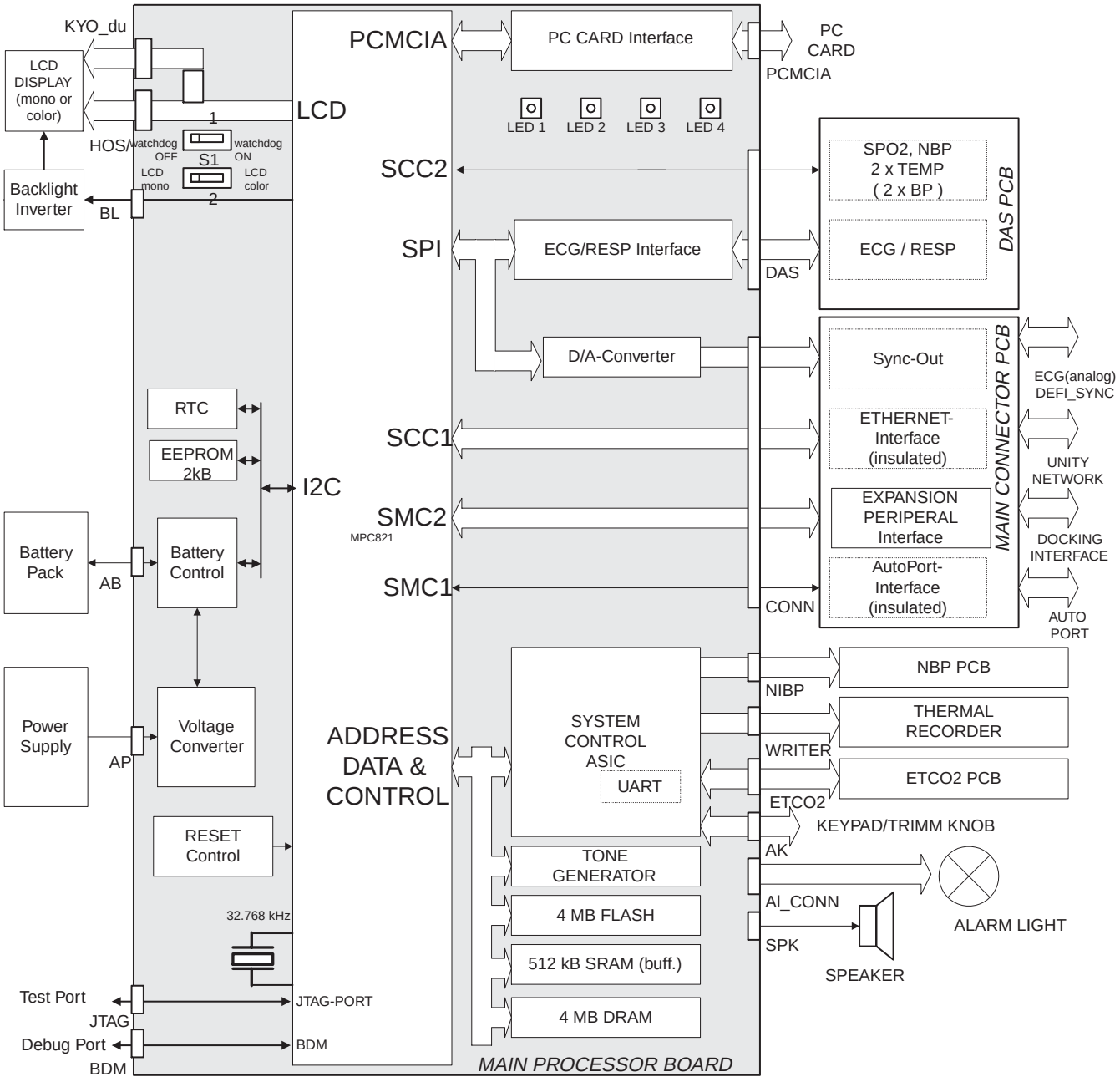
Calibration

The calibration procedure for the this assembly is found in Chapter 5, “Calibration”.

Main Processor PCB Theory

The main processor PCB provides signal processing, system control, user interface, and communications functions for the monitor, both color LCD and monochrome LCD display versions. It receives and processes digitized patient data from the isolated DAS assembly (acquisition PCB), text and waveform information for the video display, interfaces with the operator via the front panel switches and Trim Knob, and communicates with other products on the network using a built-in Ethernet interface.

PCB Block Diagram



Functional Circuits

As a result of the complexity of this board, there are many functional circuits. The functional circuits on the processor PCB include:

- Host processing circuit (monitor main processing unit):
  - Motorola MPC821 32-bit integrated microcontroller (25 MHz),
  - Clock – 32.7 kHz crystal oscillator,
  - Microprocessor support circuit (Reset Control),
  - Flash Memory (4 megabytes),
  - DRAM (4 megabytes)
  - Static RAM (512 Kbytes, buffered),
  - System Control ASIC.
- Real-time clock/calendar (RTC),
- Asynchronous serial communications interface UART (SCC/SMC ports),
- Ethernet SCC 1 (ETHERNET port),
- Noninvasive blood pressure interface,
- Alarm Light interface
- Analog output 10-bit DAC (ECG),
- Stereo sound generator, audio amplifier and speaker interface,
- Key pad (TRIM KNOB and push-buttons) interface,
- Integrated video processing circuit which develops waveform and text data for display,
- High frequency isolation region, DAS interface and power supply interface.

PCB Functions

The main processor PCB is essentially a self-contained, single-board computer. It includes a Motorola MPC821 microcontroller functioning as the host processor. The MPC821 has an integrated graphics system controller handling the video interface. The system application code is stored in electrically erasable FLASH memory for easy software updates. Data memory is implemented with static RAM (SRAM), all of which is backed with a gold capacitor.

Because of the large number of memory and peripheral devices which are interfaced to the MPC821, a multiple bus structure is employed. This approach limits the number of devices sharing a given bus and results in increased reliability and lower system noise. It allows most devices to operate at (or near) full speed because the capacitance each device I/O sees is typically no more than 100 pF.

To keep the overall size of the board to a minimum, the design utilizes a high-density Field Programmable Gate Array device (FPGAs). One of the outstanding features of this board is the almost total lack of Small Scale Integration (SSI) logic devices (gates, counters, etc.). Functions which required SSI devices in the past are now implemented in the FPGAs. These devices, which we referr to as ASICs (Application Specific Integrated Circuits) in this theory of operation, handle such functions as main system control, bus interface, NBP interface and the writer, and keypad interface. The ASIC is implemented using Altera Flex 6000 devices which must be loaded with a logic program each time the system powers up.

MPC821 High Integration Microcontroller

The Motorola MPC821 microcontroller was chosen as the main (host) processor for the monitor. This chip allows it to run existing Tram and Solar software, along with numerous on-chip peripherals such as a Universal Asynchronous Receiver Transmitter (SCC/SMC) and Serial Peripheral Interface (SPI). It also incorporates a very sophisticated Time Processing Unit (TPU) which is only utilized to a very small extent on the processor PCB. A special feature is the integrated graphic system controller which handles the complete video interface. An additional support feature of the MPC821 is the Background Debug Mode (BDM) which allows testing of the board (a special connector is incorporated on the edge of the board to access this mode).

The monitor actually utilizes a 821 on the main board and a 68332 on the acquisition PCB (DAS). The two processors communicate over the isolation barrier using the on-chip SPI. This interface operates at up to 4 megabits per second, transfers packets of up to 256 bits without CPU intervention, and requires very little external interface hardware. The Main (host) Processor functions as the SPI master in this design.

Basic Initialization Requirements

Because of the numerous on-chip peripheral registers, the 821 requires many configuration steps before it becomes fully operational in the system. In addition, certain basic steps are required by the hardware design and must be performed immediately upon power-up.

Main Memory Configuration

The main memory consists of 4 megabytes of electrically erasable FLASH memory and 512 Kbyte backed static RAM. All main memory runs at full speed with one wait-states being inserted. The FLASH memory is sector erasable so no separate boot memories are provided (i.e., the main code sectors may be erased without erasing the boot sectors).

Program Memory (FLASH)

The electrically erasable FLASH memory allows the monitor to receive software updates either from a AutoPort or from the network. The FLASH devices used on this board are state-of-the-art components which store 16 megabit per device. Considerable board area is saved by using these devices since only two are required. Physically, the devices reside directly on the local bus of the 821.

Data Memory (SRAM)

Data memory consists of 512 Kbyte of static RAM (SRAM) operating with three wait states. All SRAM is backed up using a gold capacitor. Check of the buffered voltage is performed upon power-up.

LEDs

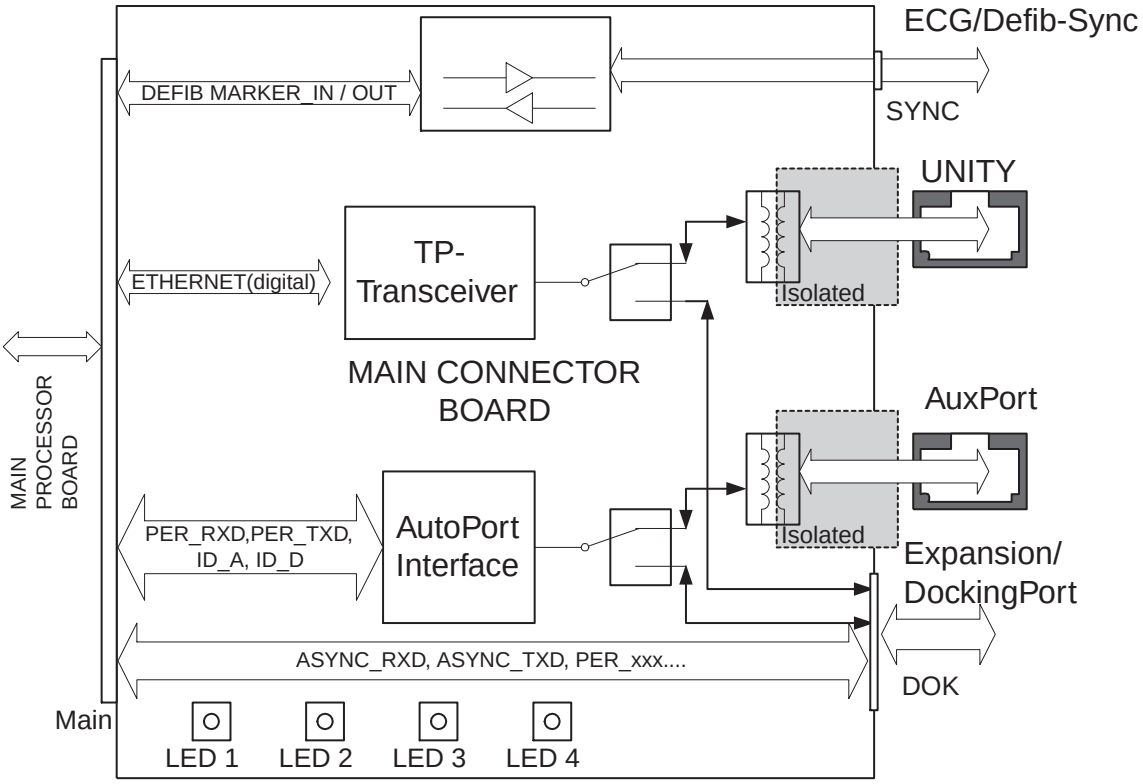
The LED 1 to 3 are used as operating status indicator. LED 4 is only used as reference element.

Main Connector PCB Theory

The main connector PCB is connected to the Main Processor Board and is responsible for the dispersion of signals between the processor PCB and the monitor rear panel connectors. Ethernet, AutoPort communication, and the docking station are the primary functions of the board.

If the monitor is connected to the docking station, the UNITY and also the AutoPort signals are automatically switched from the rear connectors to the docking station connector.

The four LEDs indicate the following UNITY functions:
LED 1: Collision indicator
LED 2: Link test (on if test is running)
LED 3: Receive indicator
LED 4: Transmit indicator



3 MAINTENANCE

Contents

Maintenance Schedule

Manufacturer recommendation

To make sure the monitor remains in proper operational and functional order, a good maintenance schedule must be adhered to. The manufacturer's recommendations in this regard are as follows:

- **Inspection**: Operators should perform this prior to admitting each patient to the monitor. Service personnel should perform this prior to servicing the monitor.
- **General Cleaning**: Operators should perform this prior to admitting each patient to the monitor. Service personnel should perform this after servicing the monitor.
- **Checkout Procedures**: These should be performed by qualified service personnel upon receipt of the equipment, every 12 months thereafter, and each time the monitor is serviced.
- **Leakage Current Tests**: These should be performed by qualified service personnel upon receipt of the equipment, every 12 months thereafter, and each time the monitor is serviced.
- **Hi-Pot Tests**: High-potential tests should be performed by qualified service personnel whenever any component of the isolated data acquisition system (DAS) is removed, repaired or replaced in the monitor.

NOTE

The Hi-Pot Tests provide a means of checking the patient isolation circuitry such that a patient receiving defibrillation, while attached or admitted to the monitor, will receive the full energy of each shock and that the monitor will not absorb the energy, when delivered.

- **Non-invasive Blood Pressure (NBP) Calibration**: NBP calibration should be performed by qualified service personnel upon receipt of the equipment and once each year, thereafter. Refer to Section 5: Calibration, for this information.

Manufacturer responsibility

Failure on the part of all responsible individuals, hospitals or institutions, employing the use of this monitor, to implement the recommended maintenance schedule may cause equipment failure and potential operator and patient health hazards. The manufacturer does not in any manner, unless an Equipment Maintenance Agreement exists, assume the responsibility for performing the recommended maintenance schedule. The sole responsibility rests with all individuals, hospitals, or institutions utilizing the monitor.

PM Form

For the latest PM forms regarding this product, contact GE Marquette Service. Make a copy of the DASH 2000 Patient Monitor PM form and use this copy to help guide you as you go through this chapter of the manual. The PM form may then be archieved for reference after completion of all the steps required to test the equipment.

If, for any reason, any of the procedures or tests are not met to standards indicated, contact GE Marquette Medical System Technical Support. Refer to “How to Reach Us” in chapter 1: Introduction of this manual.

Repair Log

For your convenience, a repair log is provided at the end of this chapter for you to record the repair history of this product.

Visual Inspection

Inspecting the monitor

The monitor should be carefully inspected prior to each patient being admitted to the monitoring system. Follow these guidelines when inspecting the equipment:

- Carefully inspect the monitor for obvious physical damage to the outer case, display screen and controls. Do not use the monitor if physical damage is determined. Refer damaged equipment to qualified service personnel for repair before using it again on a patient.
- Inspect all external connectors, front and rear, for degraded pins, prongs and connector housings. Refer damaged equipment to qualified service personnel for repair before using it again on a patient.
- Inspect all cable insulation, cable strain-reliefs and cable connectors for damage, cracks or degradation. Refer damaged equipment to qualified service personnel for repair before using it again on a patient.
- Safety labels and inscriptions on the device are clearly legible.

General Cleaning

A Word About Displays

The Dash monitors have a special filter for the display. Specifically, it's a circular-polarized filter with an anti-reflective coating. This type of filter increases the display's contrast while it reduces glare from nearby lights.

If you look closely at the display while it's turned off, you might notice milky-white streaks. The streaks don't mean that you need to clean the display. They're caused by the circular polarization effect of the filter, and they're perfectly normal with this type of filter.

Clean the Display

To clean the display of the monitor, use a soft, clean, lint-free cloth dampened with a glass cleaner.

WARNING

Do not spray glass cleaner or general cleaning solutions directly onto the display. Do not use hospital disinfectants, like Cidex or Betadine on the display.

Clean External Surfaces

Clean the external surfaces of the monitor before each time a patient is admitted to the system. The exterior surfaces may be cleaned with a lint-free cloth dampened with one of these approved solutions:

- ammonia (diluted),
- Cidex,
- mild soap (dissolved), or
- sodium hypochlorite bleach (diluted).

Recommendations

The manufacturer recommends the following guidelines to avoid damaging the monitor:

- Dilute all cleaning solutions according to respective manufacturer recommendations.
- Use a clean, dry, lint-free cloth to wipe off excess cleaning solution after each application.
- Do not pour water or cleaning solutions directly onto the monitor. Do not allow fluids to run into crevices, connectors or cooling vents on the monitor.
- Never use these cleaning agents:
  - abrasive cleaners or solvents of any kind,
  - alcohol-based cleaning agents,
  - wax containing a cleaning substance,
  - acetone, or
  - betadine.

CAUTION

Follow these cleaning instructions exactly. Failure to follow the instructions may melt, distort, or dull the finish of the case, blur lettering on the labels, or cause equipment failures.

Checkout Procedures

The following pages contain the checkout procedures for the monitor. The purpose of the checkout procedures is to provide service personnel with a method which can be used to verify operational and functional performance of the monitor. Failure to attain any of the listed results indicates a potential malfunction of the monitor.

Perform the checkout procedures upon receipt of the monitor, every twelve months thereafter, and each time a circuit board is removed or replaced.

The checkout procedures are based on the assumption that the monitor being tested is used with known good cables and test equipment. It also requires that the user be somewhat familiar with the operation of all test equipment required for the checkout procedures. For more information concerning the operation of these components, refer to the respective operator manual.

Manufacturer Recommended Test Equipment

The following table lists the manufacturer's recommended test equipment, adaptors, and cables necessary to successfully complete the checkout procedures. The checkout procedures were written for the test equipment in the following table. If test equipment other than the manufacturer's recommendation is used, it may be necessary to slightly modify some test steps.

Description	Part Number	Qty
Multifunction Micro-simulator	MARQ1	1
Patient cable, 5-leadwire, AHA or	412931-001	1
Patient cable, 5-leadwire, IEC	412931-002	1
Leadwireset, 5-leadwire, AHA or	414556-001	1
Leadwireset, 5-leadwire, IEC	414556-003	1
BP to Simulator cable	700095-001	1
Temp to Simulator cable	6770031	1
NIBP tubing and fittings according drawing		
Digital Manometer	Sensym PDM2OOM	1
SpO_2 Simulator	408610-001	1
SpO_2 Simulator cable, Nellcor	700232-004	1

Monitor Power and Battery Tests

1. Connect a power cord between a properly wired wall receptacle and the monitor power connector.
2. If the unit is not turned off; press the power button to switch it off.
3. Verify that the AC power indicator stays illuminated.
   Verify that the CHARGING STATUS indicator stays illuminated according the following list:

   yellow battery is being charged but not full

   green battery is fully charged

NOTE

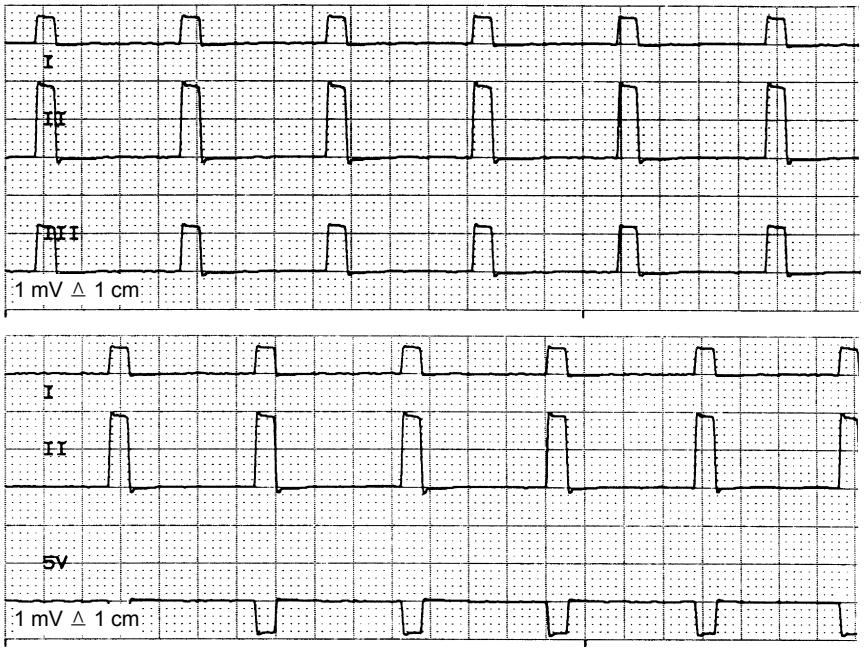
If indicator blinks yellow, then there is a malfunction in the power management system. The unit needs to be repaired.

4. Switch the unit on and disconnect the the power cord. Verify that the BATTERY indicator stays illuminated, AC power indicator and CHARGING STATUS indicator go off.
5. Connect the power cord back to the unit. Before continuing the test procedures the battery condition has to be checked.
   Starting from the screen showing the softbutton MORE MENUS, select the following menus in sequence:
   MORE MENUS, MONITOR SETUP, SERVICE MODE (actual date as password), BATTERY SERVICE.
   If the entry for last conditioning is older then 3 months, start a condition cycle (takes hours). If the entry is within 3 months, check if the FULL/NEW entry is below 40%, if it is below, exchange the battery.
6. Run the unit under battery power and perform the ECG Test step 1. to 4. as described later.
7. Connect the unit back to AC and perform the following tests.

ECG Tests

1. Set up the patient simulator as follows:
   - Heart rate – 80 bpm,
   - Heart rate amplitude – 1.0 mV,
   - 5-lead ECG patient cable properly attached.
2. Attach the ECG patient cable and ECG leadwire set to the ECG/RESP connector on the monitor and the leadwire connectors on the top of the patient simulator.
3. Admit the patient simulator to the monitor.
4. Observe the following:
   - ECG lead II is displayed and is noise-free,
   - Heart rate of 80 ±2 bpm is displayed,
   - With QRS tones enabled, an audible tone sounds with each R-Wave (QRS complex).
5. Verify all seven ECG leads are available for viewing and are noise-free.
6. Select ANALYSIS SETTING, DETECT PACE and set to PACE2.
7. Set ECG amplitude on simulator to 2 mV. Select the VP2 pacemaker pulse on the simulator.

8. Observe the following while viewing ECG leads II, III, aVR, aVF, and V:
   - a P appears above the PVC count indicating pacemaker pulse detection is enabled, a star is blinking at each Pacemaker Pulse
   - if necessary press “Silence alarms”.
9. Disable pacemaker pulse detection on the monitor and return the simulator to these conditions:
   - Heart rate – 80 bpm,
   - Heart rate amplitude – 1.0 mV,
   - 5-lead ECG patient cable properly attached.
10. Select ECG lead II for viewing in the top trace position on the monitor display.
11. Disconnect the RA leadwire from the patient simulator.
12. Observe following:
    - a RA FAIL message appears on the display, and
    - lead III automatically displays in place of lead II in the top trace position.
13. Reconnect the RA leadwire to the patient simulator.
14. Setup the graph curve selection according to the figure below. Inject a 1-millivolt calibration signal using the patient simulator and start a manual graph.
15. Observe that the calibration pulse is properly displayed and graphed. If others than the recommended simulators are used, the calibration pulses may be different (see figure below).
16. This completes the ECG tests. Continue to the next steps of these checkout procedures.



Respiration Tests

1. With the ECG patient cable still connected to the ECG/RESP connector of the monitor, set up the patient simulator as follows:
   - Respiration (RESP) baseline impedance – 750 Ω,
   - RESP ΔR – 0.5 Ω,
   - RESP lead select – I & II,
   - RESP rate (respirations per minute) – 30.
2. Set up the monitor as follows:
   - RESP parameter – on
   - RESP waveform – on,
   - RESP waveform lead select – lead II (RESP waveform derived from ECG lead II).
3. Observe the following:
   - RESP parameter window appears on the monitor with a reading of 30 ±2 (respirations per minute),
   - RESP waveform appears distortion-free on the monitor.
4. Change the RESP waveform lead select of the monitor to lead I (RESP waveform derived from ECG lead I).
5. Observe the following:
   - RESP parameter window appears on the monitor with a reading of 30 ±2 (respirations per minute),
   - RESP waveform appears distortion-free on the monitor.
6. Disconnect the ECG patient cable from the ECG/RESP connector of the monitor. Proceed to the next steps in these checkout procedures.

Temperature Tests

1. Set up the patient simulator for a temperature output of 37 °C.
2. Attach the temperature simulator from the series 400 TEMPERATURE OUTPUT connector of the patient simulator to the TEMP input of the monitor.
3. Verify a TEMP parameter window appears on the monitor display with a temperature reading of 37.0 °C ±0.4 °C.
4. Remove the temperature adaptor and temperature simulator cable from the monitor and patient simulator.

Invasive Blood Pressure Tests

The invasive blood pressure (BP) tests provide a method of verification for the BP connector of a monitor equipped with this optional function. Follow these steps:

1. Set up the patient simulator as follows:
   - Blood pressure (BP) polarity – POS,
   - BP output – 0 mmHg.

2. Connect the BP simulator cable from the BLOOD PRESSURE 1 - 120/80 connector of the patient simulator to the BP connector of the monitor.
3. Select ART as pressure site. Verify the ART parameter window, waveform label, corresponding graticules, and waveform appear on the monitor display, along with a BP waveform requiring zero reference. If waveform does not appear select waveform display ART.
4. Press the FUNCTION push-button on the front panel of the monitor to zero-reference the ART BP waveform.
5. Change the patient simulator BP output to 200 mmHg.
6. Observe a reading of 200/200 (200) ± 6 mmHg in the ART parameter window on the monitor display.
7. Change the patient simulator BP output to WAVE (simulated BP waveform).
8. Set the ART BP waveform gain on the monitor to auto.
9. Observe a distortion-free ART BP waveform and a reading of approximately 120/80 (93) in the ART parameter window on the monitor display.
10. Disconnect the BP simulator cable from the BP connector of the monitor. This completes the BP test.

Pulse Oximetry Tests

1. Set the pulse oximetry (SpO_2) simulator power switch to the off position.
2. Connect the Nellcor-style SpO_2 simulator cable between the SpO_2 connector of the monitor and the SpO_2 simulator.
3. Set up the SpO_2 simulator as follows:
   - SPO2 – 95.5% (using the white NELLCOR values),
   - PULSE RATE – 100 B/M (beats per minute),
   - MODE – NELLCOR,
   - Power switch – on.
4. Verify a SPO_2 parameter window, waveform label and corresponding graticules appear on the monitor display.
5. Verify the following appear on the monitor display:
   - Sinusoidal SpO_2 waveform,
   - SPO_2% parameter reading of 92 – 99(%),
   - PPR parameter reading of 96 – 104 (beats per minute).

6. Verify accuracy of the SPO_2% values (these are the white NELLCOR values shown on the SpO_2 simulator) on the monitor display using the SpO_2 simulator settings from the following table:

SpO_2 Simulator Setting	Displayed SPO_2% Value
95.5%	92 – 99
85.5%	82 – 89
68.4%	65 – 72

7. Verify accuracy of the PPR values on the monitor display using the SpO_2 simulator pulse rates from the following table.

Simulator PULSE RATE	Displayed PPR Value
70 B/M	66 – 74
100 B/M	96 – 104
160 B/M	155 – 165

8. Press the INTERFERENCE TEST button on the SpO_2 simulator for 30 seconds.
9. Verify the displayed SPO_2% value remains 92 – 99%, or an interference detection message is displayed and XX is displayed in the SpO_2 parameter window in place of an SPO_2% value.
10. Set the SpO_2 simulator power switch to the off position.
11. Disconnect the Nellcor-style SpO_2 simulator cable from the monitor SpO_2 connector. This completes the SpO_2 tests.

Noninvasive Blood Pressure Test

The overall accuracy of noninvasive blood pressure (NBP) readings by the monitor depend on the following:

- the zero pressure reading, and
- the voltage span of the NBP sensor in the monitor.

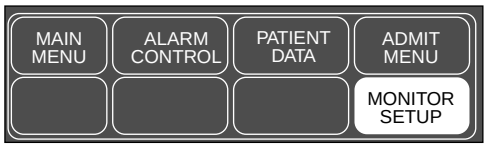
This procedure provides a method of verifying these items are accurate and also checks the NBP pneumatic circuit plumbing for leaks.

WARNING

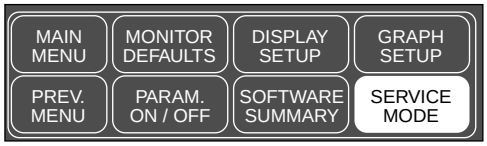
When the NBP cuff is used in this procedure, it must be tightly wrapped around a rigid cylinder or pipe. **Do not** put the NBP cuff around a human arm during the calibration procedures due to the potential for injury.

1. Remove all cables except for the power cord from the monitor.

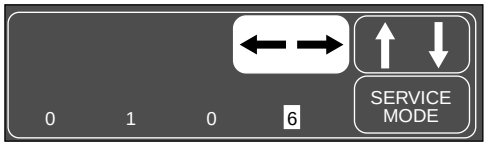
2. Apply power to the monitor.
   - Plug the power cord into a working ac power wall receptacle and turn the monitor on.
3. Use the Trim Knob control to scroll to MONITOR SETUP in the monitor main menu and press the Trim Knob control to select it.



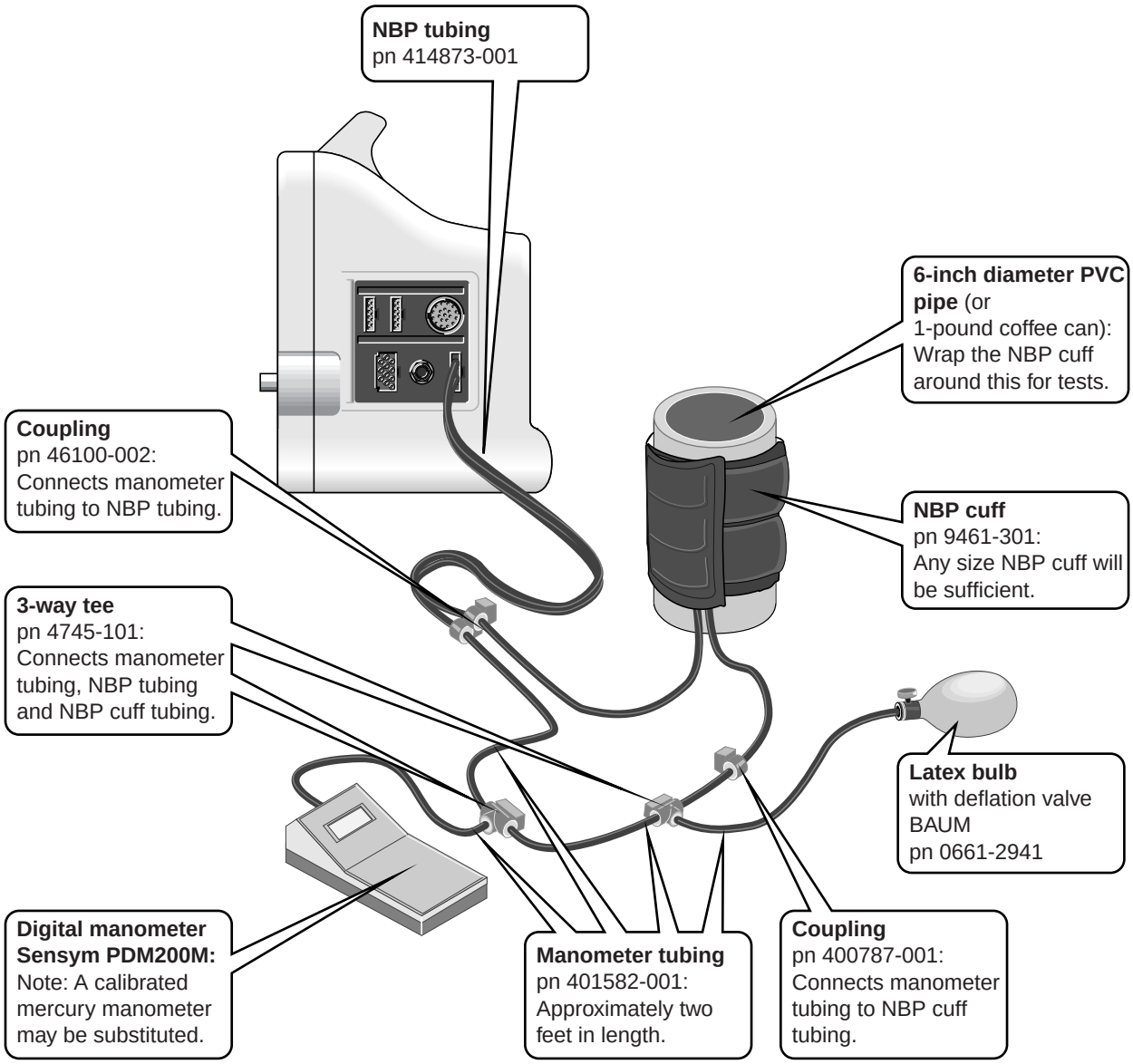
4. Use the Trim Knob control to scroll to SERVICE MODE in the monitor setup menu and press the Trim Knob control to select it.



5. A service menu password window appears on the monitor display, as shown in the figure at the left. A password is required to prevent non-service personnel from accessing the service menus. The password is four numbers that represent the date that currently resides in a memory circuit within the monitor (please note that this may or may not be the correct date). In the password, the first two numbers, starting from the left, represent the day and the second two numbers represent the month of whatever date that currently resides in the memory circuits of the monitor. For example, the seventh day of the third month (March 7th) would be represented in the password as 0703 (*ddmm*). Note the date that is currently on the monitor display and follow these steps to enter the password:
   - Rotate the Trim Knob control to highlight the password number that you would like to change.
   - To change the highlighted number, press the Trim Knob control.
   - Rotate the Trim Knob control until the correct number is displayed in the selected field.
   - To enter the number, press the Trim Knob control.
   - Repeat these steps until all password numbers are correctly displayed.
   - Once you have entered the correct password numbers, rotate the Trim Knob control to highlight SERVICE MODE in the enter password window.
   - Press the Trim Knob control one more time to enter the password and access the service menus of the monitor.

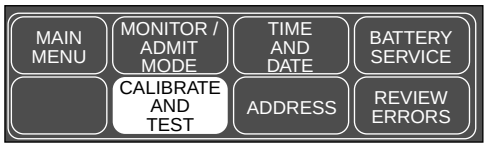


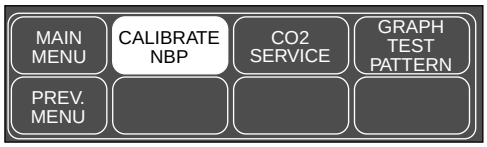
6. Connect a cuff and manometer to the monitor as shown below.



7. The service menus should appear on the monitor display. These next steps guide you through the service menus associated with checking NBP calibration and checking for leaks. If desired test results are not obtained, NBP calibration is necessary.

8. Rotate the Trim Knob control to highlight CALIBRATE AND TEST and press the Trim Knob control to select it. Next, rotate the Trim Knob control to highlight CALIBRATE NBP and press the Trim Knob control to select it.





9. Rotate the Trim Knob control to highlight CHECK CAL OFF, and then press the Trim Knob control to select it.

10. Rotate the Trim Knob control to highlight START, and then press the Trim Knob control to select it.

11. Leakage Test
    The Dash pumps up to 250 mmHg and then holds the pressure. Wait about 30 s until the pressure has stabilized to approximately 240 mmHg. From now on the dropdown-rate of the pressure must be less then 4 mmHg/min.

12. Measurement Accuracy
    By means of the latex bulb adjust the following pressures and check that the tolerance limits are not exceeded.

250 mmHg	±5 mmHg
200 mmHg	±4 mmHg
150 mmHg	±3 mmHg
100 mmHg	±3 mmHg
50 mmHg	±3 mmHg

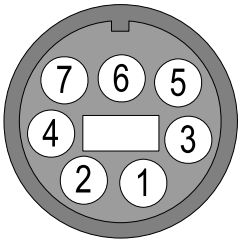
13. Deflation Pressure Threshold Test
    Increase the pressure, the cuff must be deflated automatically between 300 mmHg and 330 mmHg.

    Leave the service mode by pressing MAIN MENU:
    In NIBP menu, select neonate cuff size. Now start NIBP measurement. The system pumps up to appr. 120 mmHg. Now increase the pressure with the bulb, the cuff must be deflated automatically between 150 mmHg and 165 mmHg.

14. Active Test
    Apply a cuff and measure the blood pressure. Asses that the SYS, MAP and DIA parameter readings are plausible.

Defibrillator Synchronization Tests

1. Use the figure at the left as a reference for connecting the oscilloscope to the DEFIB SYNC connector, located on the back panel of the monitor, for performing these tests.
2. Test the ECG and Marker Out signals from the DEFIB SYNC connector. They should closely resemble the waveforms in the figures below. Note that there are two Marker Out traces shown below. The upper Marker Out figure references the frequency aspects of the signal. The lower Marker Out figure references the pulse width aspects of the signal.



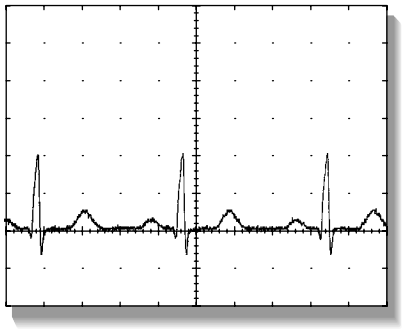
PIN	Signal Name	I/O	Signal Description
1	MARKER_OUT	O	Digital defibrillator output synchronization signal
2	MARKER_IN	I	Digital defibrillator input signal
3	ANALOG_GND	–	Analog return
4	DIGITAL_GND	–	Digital return
5	NC		
6	NC		
7	ECG_OUT	O	Analog ECG output signal

Patient Simulator Setup: HR – 80 bpm
HR amplitude – 1,0 mV

Display Setup: Channel I – Lead II

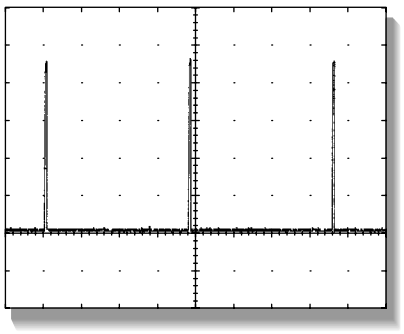
DEFIB SYNC connector: ECG

Signal Pin: 7
Ground Pin: 3
Time/Division: 0.2 s
Volts/Division: 0.5 V



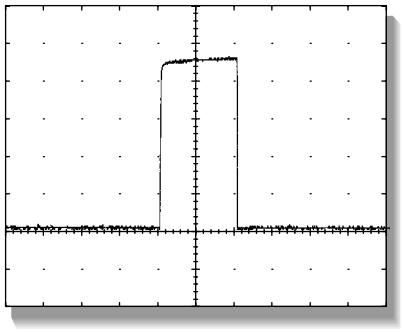
DEFIB SYNC connector: Marker Out (frequency)

Signal Pin: 1
Ground Pin: 4
Time/Division: 0.2 s
Volts/Division: 1 V, when Defi Sync output configured for 5 V



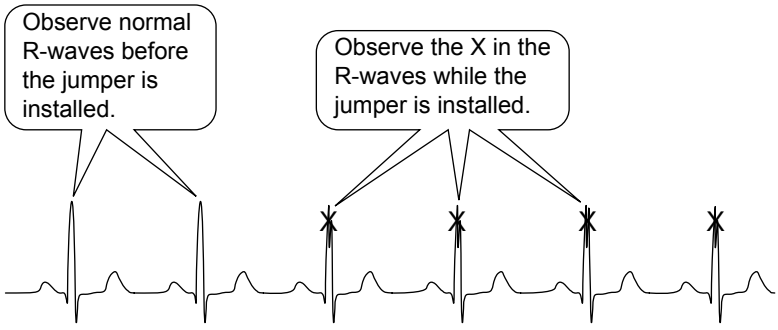
DEFIB SYNC connector: Marker Out (pulse width)

Signal Pin: 1
Ground Pin: 4
Time/Division: 5 ms
Volts/Division: 1 V, when Defi Sync output configured for 5 V and 10 ms



Verify defib sync markers

3. Attach a jumper wire between pin-1 (Marker Out) and pin-2 (Marker In) of the DEFIB SYNC connector located on the front of the monitor. Verify an X is displayed in each of the QRS Complex (ECG waveform) R-Waves on the monitor display, similar to those shown in the illustration below.



Defibrillator synchronization tests completion

4. Remove the jumper wire installed in the previous step from the DEFIB SYNC connector. This completes the defibrillator synchronization tests.

Speaker Tests

1. Set HR limits so, that HR exceeds the limits and alarm tone occurs.
2. Change the alarm volume of the monitor to 100%.
3. Verify the speaker volume of the monitor changes accordingly.
4. Return the volume of the monitor to the level it was previously set to, before you changed it for this test.

LAN Network Check

Do the following to check the monitoring network:

Check if the ECG and parameter values are displayed correctly on a Centraloscope or CIC.

Completion

This completes all tests associated with the checkout procedures. Disconnect the monitor from all test equipment in the following manner:

1. Set all test equipment power switches to the off position.
2. Set the monitor front panel power switch to the off position.
3. Remove all test equipment from the monitor.

Electrical Safety Tests

General

Electrical safety tests provide a method of determining if potential electrical health hazards to the patient or operator of the device exist.

Recommendations

To help you establish a systematic maintenance routine, Marquette recommends that you perform all safety tests presented in this chapter

- upon receipt of the device,
- every twelve months thereafter,
- each time the main enclosure is disassembled or a circuit board is removed, tested, repaired, or replaced, and
- record the date and results on the “Maintenance/Repair Log” included at the end of this chapter.

CAUTION

Failure to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards. Unless you have an Equipment Maintenance Contract, Marquette Medical Systems does not in any manner assume the responsibility for performing the recommended maintenance procedures. The sole responsibility rests with the individual or institution using the equipment. Marquette service personnel may, at their discretion, follow the procedures provided in this manual as a guide during visits to the equipment site.

Test Conditions

Electrical safety tests may be performed under normal ambient conditions of temperature, humidity, and pressure.

Test Equipment

The manufacturer recommended test equipment required to perform electrical safety tests is **listed** below. Equivalent equipment may be substituted as necessary.

Required Tools/Special Equipment	
Item	**Part Number**
Leakage Current Tester 120 V (or equivalent) 240 V (or equivalent)	 MT-1216-01 MT-1216-02
Multimeter	Fluke 8060 A
ECG test body SpO_2 test body	MT 3387 MT4366

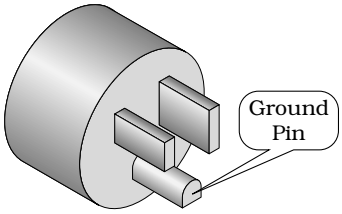
Wall Receptacle Test

Before starting the tests, the wall receptacle from which the monitoring device will get electrical power must be checked. This test checks the condition of the wall receptacle to ensure correct results from leakage tests.

For international wall receptacles, refer to the internal standards agencies of that particular country. Use a digital multimeter to ensure the wall receptacle is wired properly.

If other than normal polarity and ground is indicated, corrective action must be taken before proceeding. The results of the following tests will be meaningless unless a properly wired wall receptacle is used.

Ground (Earth) Integrity



Listed below are two methods for checking the ground (earth) integrity, “Ground Continuity Test” and “Impedance of Protective Earth Connection.” These tests determine whether the device's exposed metal and power inlet's earth (ground) connection has a power ground fault condition.

Perform the test method below that is required by your Country/Local governing safety organization.

Ground Continuity Test

Completion of this test is checked by the following steps:

1. Disconnect the DUT (device under test) from the wall receptacle.
2. Connect the negative(-) lead of the ohm meter to the protective earth terminal (ground pin in power in-let connector) or the protective earth pin in the MAINS PLUG (ground pin in power cord). Refer to the US 120Vac power cord figure on the left.
3. Set the Ohm meter to the milliohm (mΩ) range.
4. Connect the positive (+) lead of the Ohm meter to all exposed metal surfaces on the DUT. If the metal surfaces are anodized or painted scrape off a small area in a inconspicuous area for the probe to make contact with the metal.
5. Resistance should read to pass:
   - 0.1 ohm or less without power cord
   - 0.2 ohms or less with power cord

Impedance of Protective Earth Connection

This test unlike a ground continuity test will also stress the ground system by using special ground bond testers i.e. Kikusui (model 872 or TOS 6100) or Associated Research model HYAMP® Jr. Model 3030D.

This test normally is only required as a manufacturing production test to receive safety agency compliance (i.e. IEC601-1).

Some country agency's do require this test after field equipment repairs (i.e. Germany's DIN VDE 0751 standards).

Consult your country/local safety agency if in question.

Compliance is checked by the following steps:

1. A current not less than 10A and not exceeding 25 A from a current source with a frequency of 50 or 60 Hz with a no-load voltage not exceeding 6 V is passed for at least 5 s through the PROTECTIVE EARTH TERMINAL or the protective earth pin in the MAINS PLUG and each ACCESSIBLE METAL PART which could become LIVE in case of failure in BASIC INSULATION.
2. The voltage drop between the parts described is measured and the impedance determined from the current and voltage drop. It shall not exceed the values indicated.

For EQUIPMENT without a POWER SUPPLY CORD the impedance between the PROTECTIVE EARTH TERMINAL and any ACCESSIBLE METAL PART which is PROTECTIVELY EARTHED shall not exceed 0.1 ohms

For EQUIPMENT with a POWER SUPPLY CORD the impedance between the protective earth pin in the MAINS PLUG and any ACCESSIBLE METAL PART which is PROTECTIVELY EARTHED shall not exceed 0.2 ohms.

When taking this measurement move the customer's power cord around, no fluctuations in resistance should be observed.

Ground (Earth) Wire Leakage Current Tests

Perform this test to measure current leakage through the ground (earth) wire of the equipment during normal operation.

1. Set the leakage tester switches as follows:
   - Selector knob – 1,
   - GND switch – OPEN,
   - Polarity switch – NORM,
   - Power switch – OFF.
2. Connect the DMM to the METER jacks on the leakage tester. Set the DMM to measure AC millivolts.
3. Connect the power cord of the device under test to the power receptacle on the rear of the leakage tester.

   NOTE

   The device under test is to be tested at its normal operating voltage.

4. Set the leakage tester power switch to ON.
5. Set the power switch of the device under test to ON.
6. Read the current leakage indicated on DMM. If the reading is greater than the appropriate specification below, the device under test fails and should be repaired and tested again.
   - 300 microamperes (0.3 volts on the DMM), and the device under test is powered from 100 – 120 V / 50 – 60 Hz
   - 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200 – 240 V / 50 – 60 Hz, single-phase circuit
   - 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200 – 240 V / 50 – 60 Hz, single-phase circuit

   NOTE

   Center-tapped and non-center-tapped circuits produce different leakage currents and the UL and IEC limits are different.

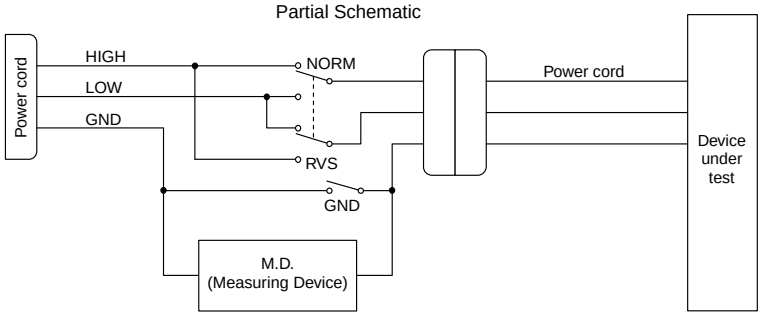
7. Set the polarity switch on the leakage tester to RVS (reverse).
8. Read the current leakage indicated on DMM. If the reading is greater than the appropriate specification below, the device under test fails and should be repaired and tested again.
   - 300 microamperes (0.3 volts on the DMM), and the device under test is powered from 100 – 120 V / 50 – 60 Hz
   - 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200 – 240 V / 50 – 60 Hz, single-phase circuit
   - 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200 – 240 V / 50 – 60 Hz, single-phase circuit

NOTE

Center-tapped and non-center-tapped circuits produce different leakage currents and the UL and IEC limits are different.

9. Set the leakage tester power switch to OFF.

Leakage Tester
Partial Schematic



NOTES

The MD (measuring device) is the circuitry defined by the appropriate standard for measuring leakage current.

The measuring devices, defined by various standard organizations (IEC, UL, etc.), produce almost identical test measurement results.

Enclosure Leakage Current Test

Perform this test to measure current leakage through exposed conductive surfaces on the device under test during normal operation.

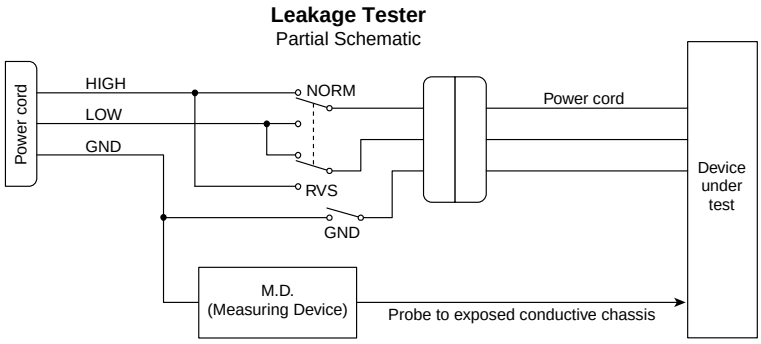
1. Set the leakage tester switches as follows:
   - Selector knob – 2,
   - GND switch – OPEN,
   - Polarity switch – NORM.
2. Connect a meter lead between the CHAS connector on the rear of the leakage tester and an unpainted, non-anodized chassis ground on the unit under test.
3. Set the leakage tester power switch to ON.
4. Read the current leakage indicated on DMM. If the reading is greater than the appropriate specification below, the device under test fails and should be repaired and tested again.
   - 300 microamperes (0.3 volts on the DMM), and the device under test is powered from 100 – 120 V / 50 – 60 Hz
   - 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200 – 240 V / 50 – 60 Hz, single phase circuit
   - 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200 – 240 V / 50 – 60 Hz, single-phase circuit

   NOTE

   Center-tapped and non-center-tapped circuits produce different leakage currents and the UL and IEC limits are different.

5. Set the polarity switch to RVS and observe the same meter readings as in the previous step.
6. Set the GND switch on the leakage tester to CLOSED.
7. Read the current leakage indicated on DMM. If the reading is greater than the appropriate specification below, and the device under test is powered from 100-240 V/50-60 Hz, the device under test fails and should be repaired and tested again.
   - 100 microamperes (0.1 volts on the DMM), and the device under test is powered from 100-240 V/50-60 Hz
8. Set the polarity switch to RVS and observe the same meter readings as in the previous step.

9. Set the leakage tester power switch to OFF and remove the meter lead connected in step 2.



Test Completion

Disconnect all test equipment from the device. Disconnect the device power cord plug from the leakage tester power receptable. Disconnect the leakage tester from the wall receptable.

Patient (Source) Leakage Current Test

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from the ECG/RESP connector of the device to ground.

1. Set leakage tester switches as follows:
   - Selector knob – 3,
   - GND switch – GND OPEN,
   - Polarity switch – NORM,
   - Power switch – OFF.
2. Connect a patient cable or ECG test body to the ECG/RESP connector of the DUT.
3. Connect a short length of cable between the ECG test body installed in the last step and the jacks on the top of the leakage tester.
4. Set the leakage tester power switch to ON.
5. Read the leakage current indicated on the DMM.

   If the reading is greater than 50 µA (0.05 volts on the DMM), the device under test fails this test and should be repaired and tested again.

   NOTE

   The AAMI and IEC single fault condition (ground open) is 50 µA, whereas the normal condition (ground closed) is less.

6. Change the leakage tester polarity switch to the RVS position.
7. Read the leakage current indicated on the DMM.

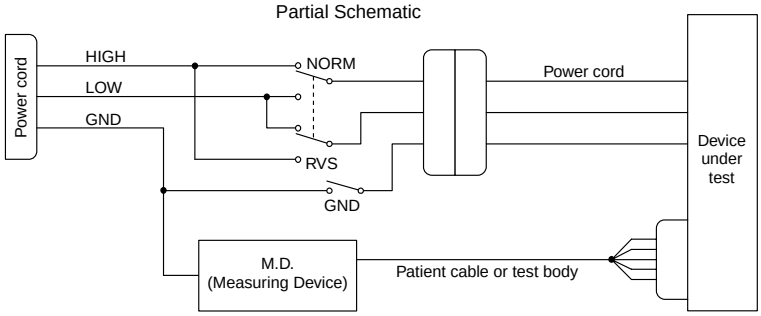
   If the reading is greater than 50 µA (0.05 volts on the DMM), the device under test fails this test and should be repaired and tested again.

   NOTE

   The AAMI and IEC single fault condition (ground open) is 50 µA, whereas the normal condition (ground closed) is less.

8. Change the GND switch to the CLOSED position.

Leakage Tester
Partial Schematic



9. Read the leakage current indicated on the DMM.

   If the reading is greater than 10 µA (0.01 volts on the DMM), the device under test fails this test and should be repaired and tested again.

10. Change the leakage current switch to the RVS position.

11. Read the leakage current indicated on the DMM.

    If the reading is greater than 10 µA (0.01 volts on the DMM), the device under test fails this test and should be repaired and tested again.

12. Set the power switch of the leakage tester to OFF.

Patient (Source) Leakage Current Test

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from the SpO_2 connector of the device to ground.

1. Set leakage tester switches as follows:
   - Selector knob – 3,
   - GND switch – GND OPEN,
   - Polarity switch – NORM,
   - Power switch – OFF.
2. Connect a SpO_2 test body to the SpO_2 connector of the DUT.
3. Connect a short length of cable between the SpO_2 test body installed in the last step and the jacks on the top of the leakage tester.
4. Set the leakage tester power switch to ON.
5. Read the leakage current indicated on the DMM.

   If the reading is greater than 50 µA (0.05 volts on the DMM), the device under test fails this test and should be repaired and tested again.

   NOTE

   The AAMI and IEC single fault condition (ground open) is 50 µA, whereas the normal condition (ground closed) is less.

6. Change the leakage tester polarity switch to the RVS position.
7. Read the leakage current indicated on the DMM.

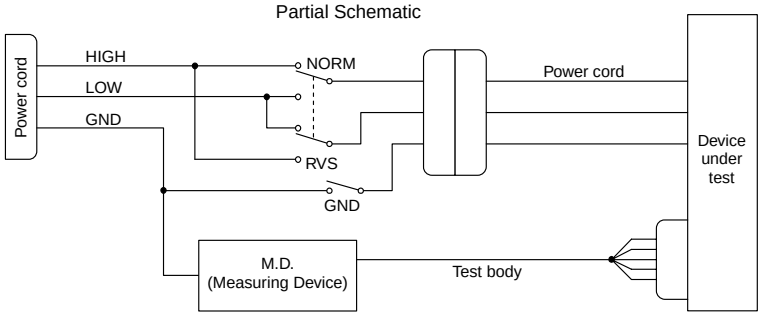
   If the reading is greater than 50 µA (0.05 volts on the DMM), the device under test fails this test and should be repaired and tested again.

   NOTE

   The AAMI and IEC single fault condition (ground open) is 50 µA, whereas the normal condition (ground closed) is less.

8. Change the GND switch to the CLOSED position.

Leakage Tester
Partial Schematic



9. Read the leakage current indicated on the DMM.

   If the reading is greater than 10 µA (0.01 volts on the DMM), the device under test fails this test and should be repaired and tested again.

10. Change the leakage current switch to the RVS position.

11. Read the leakage current indicated on the DMM.

    If the reading is greater than 10 µA (0.01 volts on the DMM), the device under test fails this test and should be repaired and tested again.

12. Set the power switch of the leakage tester to OFF.

Patient (Sink) Leakage Current Test (Mains Voltage on the Applied Part)

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from a mains voltage source into the ECG/RESP connector.

1. Set the leakage tester switches as follows:
   - Selector knob – 5,
   - GND switch – CLOSED,
   - Polarity switch – NORM.
2. Disconnect the test cable from the leakage tester PATIENT JACKS (TOP) and reconnect it to the PATN JACK connector on the front panel of the leakage tester.

   WARNING

   The following step will cause high voltage (120 VAC to 240 VAC) to appear at the PATN JACK on the leakage tester. Do not touch the PATN JACK posts or ECG lead clips during this test as an electrical shock will occur.

3. Set power switch on the leakage tester to ON.
4. Read leakage current indicated on DMM.

   If the reading is greater than the appropriate specification below, the device under test fails this test and should be repaired and tested again.

   - 10 µA, (0.01 volts on the DMM) at 120 VAC without the patient cable.
   - 20 µA (0.02 volts on the DMM) at 240 VAC without the patient cable.

     NOTE

     The 10 and 20 µA limit are based on internal design standards.

   - 50 µA (0.05 volts on the DMM) at 120 – 240 VAC with the patient cable.

     NOTE

     The 50 µA limit is common to all standards. AAMI ES-1 standard requires using the patient cable.

5. Change the leakage tester polarity switch to the RVS position.

6. Read the leakage current indicated on the DMM.

   If the reading is greater than the appropriate specification below, the device under test fails this test and should be repaired and tested again.

   - 10 µA (0.01 volts on the DMM) at 120 VAC without the patient cable.
   - 20 µA (0.02 volts on the DMM) at 240 VAC without the patient cable.

   NOTE

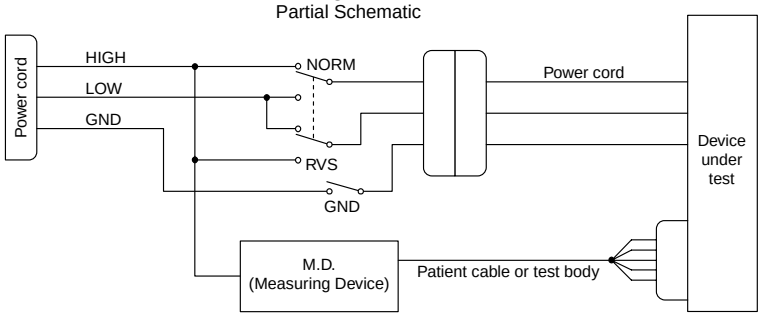
   The 10 and 20 µA limits are based on internal design standards.

   - 50 µA (0.05 volts on the DMM) at 120 – 240 VAC with the patient cable.

   NOTE

   The 50 µA limit is common to all standards. AAMI ES-1 standard requires using the patient cable.

Leakage Tester
Partial Schematic



7. Set the power switch on the leakage tester to OFF.

Patient (Sink) Leakage Current Test (Mains Voltage on the Applied Part)

This procedure only applies to Class I (grounded/earthed) equipment, and measures the leakage current from a mains voltage source into the SpO_2 connector.

1. Set the leakage tester switches as follows:
   - Selector knob – 5,
   - GND switch – CLOSED,
   - Polarity switch – NORM.
2. Disconnect the test cable from the leakage tester PATIENT JACKS (TOP) and reconnect it to the PATN JACK connector on the front panel of the leakage tester.

   WARNING

   The following step will cause high voltage (120 VAC to 240 VAC) to appear at the PATN JACK on the leakage tester. Do not touch the PATN JACK posts or ECG lead clips during this test as an electrical shock will occur.

3. Set power switch on the leakage tester to ON.
4. Read leakage current indicated on DMM.

   If the reading is greater than the appropriate specification below, the device under test fails this test and should be repaired and tested again.

   - 10 µA, (0.01 volts on the DMM) at 120 VAC without the patient cable.
   - 20 µA (0.02 volts on the DMM) at 240 VAC without the patient cable.

     NOTE

     The 10 and 20 µA limit are based on internal design standards.

   - 50 µA (0.05 volts on the DMM) at 120 – 240 VAC.

     NOTE

     The 50 µA limit is common to all standards.

5. Change the leakage tester polarity switch to the RVS position.

6. Read the leakage current indicated on the DMM.

   If the reading is greater than the appropriate specification below, the device under test fails this test and should be repaired and tested again.

   - 10 µA (0.01 volts on the DMM) at 120 VAC without the patient cable.
   - 20 µA (0.02 volts on the DMM) at 240 VAC without the patient cable.

   NOTE

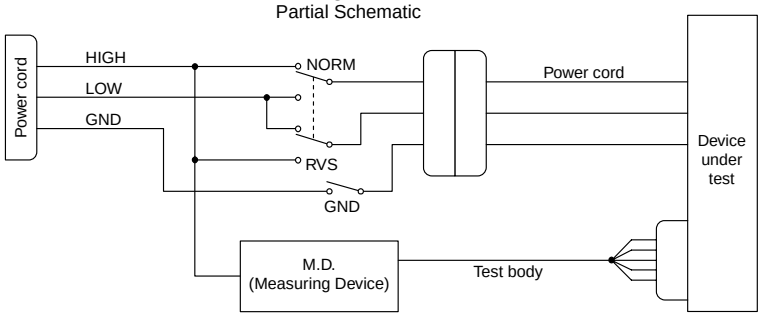
   The 10 and 20 µA limits are based on internal design standards.

   - 50 µA (0.05 volts on the DMM) at 120 – 240 VAC.

   NOTE

   The 50 µA limit is common to all standards.

Leakage Tester
Partial Schematic



7. Set the power switch on the leakage tester to OFF.

Test Completion

Disconnect all test equipment from the device. Disconnect the device power cord plug from the leakage tester power receptable. Disconnect the leakage tester from the wall receptable.

Hi-Pot (Dielectric Withstand) Test

The high potential (Hi-Pot) tests provide a method of checking patient isolation circuits and protect patients connected to the device under test from potential electrical health hazards. These tests are recommended for direct patient-connected medical devices to check the integrity of the patient isolation circuitry after any isolated component in the device has been repaired.

Recommendations

The manufacturer recommends that hi-pot tests be performed whenever a circuit board in the patient-isolated portion of the device under test is removed, repaired, or replaced. Examples of patient-isolated components include, but are not limited to, the front panel patient cable connectors, the isolated power supply, or any patient data acquisition assemblies.

WARNING

Failure to perform hi-pot tests may cause undue equipment failure and possible health hazards. The manufacturer does not in any manner, unless an Equipment Maintenance Agreement exists, assume the responsibility for performing these recommended hi-pot tests. The sole responsibility rests with the individuals, hospitals or institutions utilizing this equipment. Manufacturer service representatives may, at their discretion, use this procedure as a helpful guide during visits to the equipment site.

Test Conditions

These tests may be performed under normal ambient conditions of temperature, humidity, and pressure.

Test Equipment

Equipment required to perform these tests is listed below. Equivalent equipment may be substituted as necessary.

Name	Manufacturer	Part Number
AC/DC Hi-Pot Generator	Hipotronics	AD125
ECG Test Body	MEI	MT-3387

Preparation

Follow these steps in the same order in which they are listed.

1. Set up the AC/DC Hi-Pot Generator in the following manner:
   - Power switch – ON,
   - VOLTAGE RANGE selector – MEDIUM (10 kVA),
   - RAISE VOLTAGE selector – 0 volts,
   - OUTPUT & CURRENT selector – 2 mA range, and
   - Allow the tester to warm up for 15 minutes before continuing with this test.
2. Connect the ground pin on the power cord connector of the device under test to the ground of the AC/DC Hi-Pot Generator.

AC Hi-Pot Test

Perform the AC hi-pot tests only on the ECG/RESP front panel connector of the device under test.

CAUTION

Never attempt to perform this test on any of the other front panel connectors of the device under test. Damage to the device under test may occur if this test is performed on any of the other front panel connectors.

1. Install the ECG test body in the ECG/RESP front panel connector of the device under test.
2. Connect one end of a high voltage lead to the exposed lead of the test body.
3. Connect the other end of the high voltage lead to the AC OUT connector of the AC/DC Hi-Pot Generator.

WARNING

The following step will cause high voltage (1500 V AC) to appear at the test body.

4. Set the HIGH VOLTAGE switch to ON. The high voltage indicator should illuminate with this action.

NOTE

During this test, watch the analog meter to ensure the current level never exceeds 2 mA. If it does, the unit has failed the test and must be repaired then tested again.

5. Slowly turn the RAISE VOLTAGE selector to 1500 volts.
6. Wait for 60 seconds. If the breakdown warning lamp illuminates or the buzzer activates before the time expires, then the unit has failed the test and should be repaired then tested again.
7. Slowly turn the RAISE VOLTAGE selector to 0 volts.
8. Set the HIGH VOLTAGE switch to OFF. The high voltage indicator should turn off.
9. If the device under test fails, repairs must be made and the unit must be tested again.
10. This completes the AC hi-pot test.

Repair Log

A repair log is included for your convenience to record the repair history of this product.

Unit Serial Number:

Institution Name:

Date	Maintenance / Repair	Technician

4 TROUBLESHOOTING

Contents

Electrostatic Discharge (ESD)

CMOS Components

The monitor makes extensive use of CMOS components because they are more immune to noise and consume less power than standard TTL or NMOS components. However, CMOS components are inherently more susceptible to electrostatic discharge (ESD) damage than other types of semiconductor materials. ESD damage, causing a weakening or complete breakdown of p-n junctions within multilayer semiconductor substrates, can range from slight degradation to catastrophic failure. Slight degradation usually results in intermittent failure of the affected component catastrophic failure results in rendering the affected component permanently unusable. Although CMOS components may be more sensitive to ESD, all semiconductor devices are susceptible to ESD damage.

All external connector inputs and outputs of the monitor are designed with protection from ESD damage. However, if the monitor requires service, exposed components and assemblies contained within are susceptible to ESD damage. This includes human hands, non-ESD protected work stations and/or improperly grounded test equipment.

The following guidelines help make a service workstation more resistant to the ESD damage:

- Discharge any static charge you may have built up before handling semiconductors or assemblies containing semiconductors.
- A grounded, antistatic wristband (3M part number 2046 or equivalent) or heel strap should be worn *at all times* while handling or repairing assemblies containing semiconductors.
- Use properly grounded soldering and test equipment.
- Use a static-free work surface (3M part number 8210 or equivalent) while handling or working on assemblies containing semiconductors.
- **Do not** remove semiconductors or assemblies containing semiconductors from antistatic containers (Velo-stat bags) until absolutely necessary.
- Make sure power to an assembly is turned off before removing or inserting a semiconductor.
- **Do not** slide semiconductors or electrical/electronic assemblies across any surface.
- **Do not** touch semiconductor leads unless absolutely necessary.
- Semiconductors and electrical/electronic assemblies should be stored only in antistatic bags or boxes.

These guidelines may not guaranty a 100% static-free workstation, but can greatly reduce the potential for failure of any electrical/electronic assemblies being serviced.

Special Components

Surface Mounted Devices

Surface mounted devices are used to aid in miniaturizing the electrical/ electronic assemblies within the monitor.

Surface mounted integrated circuits have legs that are soldered to rectangular pads on the surface of the printed circuit board (PCB), versus pin-through devices having legs that are made to be inserted into solder fillets protruding completely through a PCB. Surface mounted integrated circuits (ICs, SMD, PLCC) may have legs on either two or four sides of the IC. Another surface mounted technology are Ball Grid Array ICs (BGA) using soldering balls as electrical connections on the bottom of the components.

Surface mounted resistors, capacitors, and diodes have conductive parts acting as legs that are directly soldered to the PCB.

WARNING

Surface mounted components were **not** designed to be removed or replaced using standard soldering equipment. Removal of surface mounted components using a conventional soldering iron can potentially destroy the PCB. Only soldering workstations specifically designed for surface mount technology may be used to remove and replace these type of components.

Battery Failure

Defective Battery/ Battery System

The BATTERY DEFECTIVE message is displayed in the STATUS MESSAGE line when errors have occurred within the battery management system or the battery. The reason of the battery system error can be found in the error log-book (MONITOR SETUP –> SERVICE MENU –> REVIEW ERRORS –> VIEW OUTPUT ERRORS). Check for PROCESS NAME: power_battm in the log-book.

The following error entries could be produced by the battery system:

0x717	No communication between PIC and PPC (12C-Error)
0x718	PIC loses communication to benchmark chip
0x719	Battery defective or disconnected or battery fuse blown

Blinking Charging Status

When the BATTERY DEFECTIVE error 0x719 occurs then additionally the CHARGING STATUS LED is blinking yellow.

Battery Replacement

A replacement of the battery is absolutely necessary when the battery reaches 40% full rated capacity of the 100% design capacity of the battery pack. Then the system message REPLACE BATTERY is displayed in the STATUS MESSAGE line. The Battery Service Information Window in the Battery Service Menu shows the actual FULL/NEW ratio in percent. If the usage of the Dash 2000 requires a replacement because the FULL/NEW ratio of 40% is not acceptable then it is up to the user to replace the battery earlier.

Follow this procedure to replace a defective battery pack in the monitor.

Preparations to Open the Device

Before any service interventions, turn off the device and disconnect the device from the power line. Take ESD protection precautions as described in "Safety Information for Disassembly". Put the device on a clean, level surface (ESD pad) which is placed on a soft material to avoid scratches on the front panel.

Opening the Device and Battery Replacement

1. Disassemble the **DASH 2000 Assembly** as described in "Disassembly Procedure".
2. Disconnect battery connector and remove the 2 screws from the battery bracket.
3. Remove old battery and insert the new battery.
4. Assembly the device by reversing the above operating steps.

Due to replacement of the battery during which the battery management system was without current the fuel gauge no longer reflects the current battery status. The system indicates BATTERY LOW.

Everytime, after the battery was disconnected from the circuit board drain the battery by operating the device on battery power until it switches off. Then connect the device to the power line and start a conditioning cycle.

NOTE

Disposal Notice: Should this product (battery) become damaged beyond repair, or for some reason its useful life is considered to be at an end, please observe all local, state, and federal regulation that relate to the disposal of products that contain lead, batteries, plastics, etc.

Power Source Tests

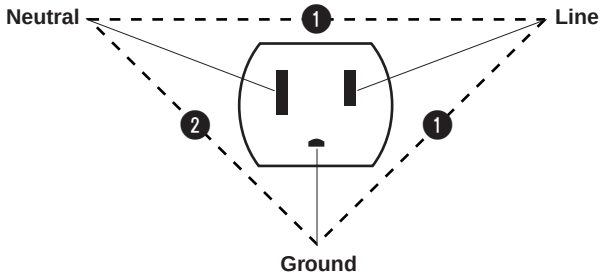
AC Line Voltage Test

This test verifies that the domestic wall outlet supplying power to the equipment is properly wired For international wiring tests, refer to the internal standards agencies of that particular country.

120 VAC, 50/60 Hz

Use a digital voltmeter to check the voltages of the 120-volt AC wall outlet (dedicated circuit recommended). If the measurements are significantly out of range, have a qualified electrician repair the outlet. The voltage measurements should be as follows:

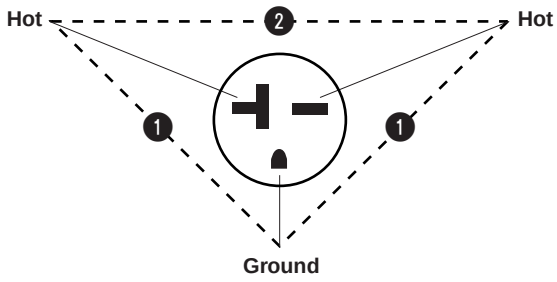
1. 120 VAC (±10 VAC) between the line contact and neutral and between the line contact and ground.
2. Less than 3 VAC between neutral and ground.



240 VAC, 50/60 Hz

Use a digital voltmeter, set to measure at least 300 VAC, to check the voltages of the NEMA 6-20R, AC wall outlet (dedicated circuit recommended). If the measurements are significantly out of range, have a qualified electrician repair the outlet. The voltage measurements should be as follows:

1. 120 VAC (±10 VAC) between either “hot” contact and ground.
2. 210 to 230 VAC between the two “hot” contacts.



Power Cord and Plug

Verify the power cord being used with the monitor is good. The following are a couple of things to check for in this regard:

- Failure of the power cord strain relief is very common. Often times users of the equipment pull on the power cord itself, rather than the power cord plug, to unplug the monitor from a wall receptacle. If in doubt, test for continuity through each conductor of the power cord connector and plug.
- Verify line, neutral, and ground conductors are properly connected to the power cord plug and are not short-circuited. Rewire and tighten these, or replace the power cord, as necessary.

Ground Continuity and Impedance of Protective Earth Connection

- Verify correct Ground Continuity and Impedance of Protective Earth Connection as described under “Preventive Maintenance”.

Data Acquisition Tests

ECG Functions

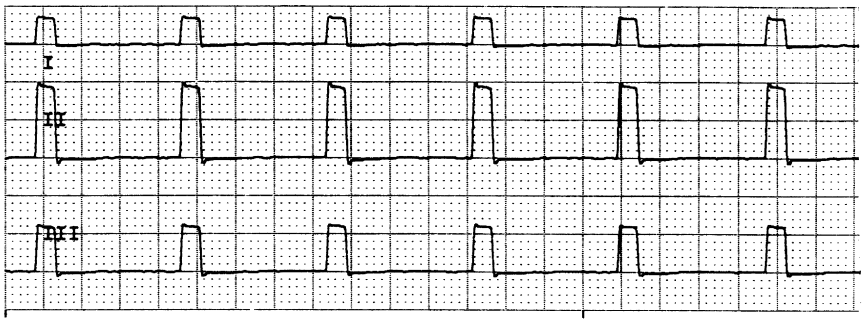
1. Connect the MEI Multifunction Microsimulator, pn MARQ1, and appropriate patient cables, to the ECG connector of the monitor. Turn the monitor and the patient simulator on.
2. Set the monitor to display leads I, II, and III and a second time to I, II and V:
   - Select WAVEFORMS ON/OFF from the menu.
   - Set the displayed waveforms for the following ECG leads:

	ECG 1	WAVEFORM 2	WAVEFORM 3
1.	LEAD I	LEAD II	LEAD III
2.	LEAD I	LEAD II	LEAD V

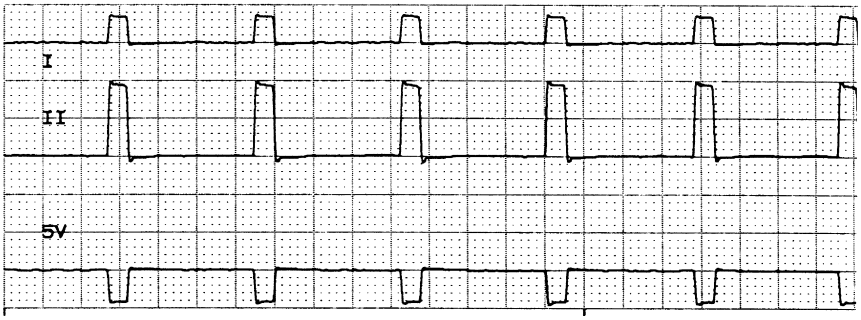
3. Set the patient simulator to output calibration (cal) pulses at 1.0 mV.
4. Check the cal pulse () amplitude. These should be according to the printed graph below.
5. It may be necessary to run a graph to accurately measure the cal pulses. Perform these steps to graph all four waveforms.
   - From the main menu, select GRAPH & ALARMS.
   - Select GRAPH CONTROL from the menu.
   - Set the graphed waveforms for the following ECG leads:

	ECG 1	WAVEFORM 2	WAVEFORM 3
1.	LEAD I	LEAD II	LEAD III
2.	LEAD I	LEAD II	LEAD V

   - Press the GRAPH GO/STOP front panel control on the monitor to start and stop a manual graph.
   - Compare the printed graph with the sample shown below.

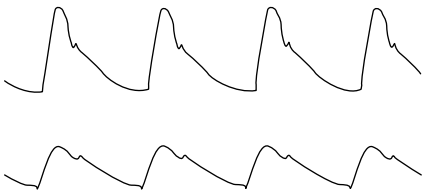


1 mV ≙ 1 cm



1 mV ≙ 1 cm

ECG Waveforms Display Incorrectly



1. If the calibration pulses were not correct, test the patient simulator using a working monitor. If the patient simulator is functioning as designed, you may need to replace the acquisition PCB.
2. If displayed ECG waveforms contain a significant amount of noise (see figure at left), check the ECG patient cables.
3. Test the patient simulator and ECG patient cables on a working monitor to verify the ECG signal.
4. If the ECG signal, patient simulator and ECG patient cables are good, the acquisition PCB is suspect and may need to be replaced.

ECG Waveforms Do Not Display At All

1. Test the ECG patient cables on a working monitor.
2. Test the patient simulator on a working monitor.
3. Swap the acquisition PCB into a working monitor. If the symptoms follow the PCB into the working monitor, replace the acquisition PCB.
4. If none of these first three steps provide any results, swap the processor PCB and/or power supply PCB into a working monitor.

Lead Fail Functions

1. With the monitor displaying leads I, II, and V from the patient simulator, remove the RA leadwire from the patient simulator.
2. The monitor should display a RA FAIL message. Lead fail detection is functioning properly if this is the case. Lead fail detection is not functioning, if this is not the case. The acquisition PCB is suspect. Swap the PCB with a working monitor to verify the malfunction.
3. Reattach the RA leadwire to the patient simulator.

Pace Detect Functions

1. With the patient simulator set to HR 80, amplitude 2 mV and with the monitor displaying leads II, I, and V set the patient simulator to output a VP2 waveform.
2. Enable the pacemaker detection function of the monitor:
   - select ECG from the display main menu,
   - select DETECT PACE and set to PACE 2.
3. Verify the heart rate remains at approximately 80 bpm.
4. Disable the pacemaker detection function of the monitor.

Pace Detect Functions Do Not Work Properly

If the pacemaker detection test results are not correct, as described above:

- Verify the patient simulator is functioning correctly by testing it on a working monitor,
- The acquisition PCB is suspect. Swap a working acquisition PCB into the monitor and perform these test to verify correct operation.

Invasive Blood Pressure Functions

The invasive blood pressure (BP) test procedure requires the use of the following patient simulator: MEI Multifunction Microsimulator, pn. MARQ1. If use of a different patient simulator is necessary, adjust the procedure steps/readings accordingly.

Setup BP

Connect the BLOOD PRESSURE output of the patient simulator to the patient connector on the monitor.

Zero-Reference

Properly zero-reference the BP input:

- Set the patient simulator BP output to 0 mmHg
- Press the ZERO ART softkey in the BP menu.

Generate Dynamic BP Waveforms

Set the patient simulator BP output to WAVE.

Setup the BP scale on the monitor for auto gain:

- Select ART from the main menu of the monitor
- Select ART SCALE from the ART menu
- Select AUTO gain from the ART SCALE menu

Verify Dynamic BP Results

Once the BP waveforms are setup as described above verify the following:

- The ART BP waveform is noise-free.
- BP displayed parameter is within tolerance as indicated in the following list:

BP Parameter:	ART
Systolic (mmHg):	116 – 124
Diastolic (mmHg):	78 – 82

NOTE

These tests are designed for use with a MEI Multifunction Microsimulator, pn. MARQ1. Accuracy specifications of the patient simulator in combination with the monitor (±2% or 1 mmHg, whichever is greater) is how the parameter values listed above, were derived. Use of any other manufacturer patient simulator and associated specifications, can potentially change these test results.

Generate Static BP Waveform

Set the patient simulator BP output to 200 mmHg, static pressure.

- Verify the BP channel is working correctly if systolic, diastolic, and mean pressure values for ART are displayed between 194 and 206 mmHg.

BP Waveform Does Not Appear Correctly On The Display

1. If the BP waveform displayed on the monitor appear noisy or distorted, test the Patient simulator and simulator test cables and on a working monitor to determine the source of the problem.
2. If the static pressure test results were inaccurate, test the Patient simulator and simulator test cables and on a working monitor to determine the source of the problem.
3. If the patient simulator and associated test cables are determined to be functioning correctly, the acquisition PCB is suspect. Swap the acquisition PCB into a working monitor to determine if replacement is necessary.

BP Waveform Does Not Appear On The Display At All

1. If the ART parameter label, reading and associated waveform do not display on the monitor, verify the patient simulator and associated test cables on a working monitor.
2. Inspect the BP front panel connector on the monitor for bent or broken pins.
3. Perform continuity tests between the front panel connector of the monitor, front panel circuit assembly located behind the front panel connector and connection to the acquisition PCB.
4. If the patient simulator and associated test cables are determined to be functioning correctly and the continuity tests yield no malfunction, the acquisition PCB is suspect. Swap the acquisition PCB into a working monitor to determine if replacement is necessary.

Respiration Functions

1. Connect the MEI Multifunction Microsimulator, pn. MARQ1, and appropriate patient cables to the ECG/RESP front panel connector on the monitor.
2. Adjust the patient simulator to output a respiration waveform using the following settings:
   - Rate BPM – 30
   - Baseline Impedance Ohms – 750,
   - ΔR Ohms – 2.0.
3. Enable the respiration function of the monitor:
   - Select MONITOR SETUP from the main menu display on the monitor,
   - Select PARAMETERS ON/OFF from the monitor setup menu.

   Next, turn and push the Trim Knob to:
   - scroll to and select RR in the parameters on/off pop-up window.
   - toggle and select ON in the RR line of the parameters on/off pop-up window.

Verify the following:

- Respiration rate is displayed and accurate.
- Respiration waveform is displayed and noise-free.
- Markers appear in the displayed respiration waveform (refer to figure at left). These indicate the points at which the monitor senses inspiration and expiration for determination of the respiration rate.

No Respiration Waveform or Rate Appear on the Display

If the respiration waveform or rate does not appear on the monitor display, perform the following steps to isolate the problem:

- Vary the baseline impedance on the patient simulator
- Vary the ΔR on the patient simulator.
- Test the patient simulator and appropriate patient cables on a working monitor to determine the source of the problem.
- If none of the previous recommendations corrects the problem, the acquisition PCB is suspect. Swap the PCB into a working monitor to determine the source of the problem and replace as necessary.

Markers do not Appear on the Respiration Waveform; Respiration Rate is Inaccurate

If the markers on the respiration waveform do not appear on the display or the respiration rate count is inaccurate, try changing the respiration sensitivity level on the monitor. To do this, use the Trim Knob on the monitor to:

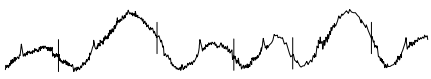
- Scroll to and select RR (respiration parameter) from the monitor main menu,
- Scroll to and select SENSITIVITY from the respiration parameter menu, and
- Scroll to and select a different sensitivity percentage (%) from the sensitivity menu

NOTE

Usually, a lower respiration sensitivity % level rectifies this problem.

Respiration Functions Work Properly When Using A Patient Simulator but not on an Actual Patient

Refer to the *Operator's Manual* for detailed information regarding patient preparation relative to respiration monitoring functions. Achieving optimum results for respiration waveforms and accurate respiration rate detection by the monitor, requires proper preparation for ECG electrode placement on the patient. An example of a noisy respiration waveform, usually due to bad patient preparation, is shown at the left.



NOTE

With patients that exhibit excessively high baseline chest impedance, proper respiration monitoring can be extremely difficult, if not impossible.

Noninvasive Blood Pressure Functions

Perform the noninvasive blood pressure (NBP) Checkout Procedure found in Chapter 3, “Maintenance”. This procedure determines whether or not the NBP functions of the monitor are working as designed or whether the monitor requires NBP calibration.

If, after performing the prescribed checkout procedure, it is determined that there are potential problems that NBP calibration does not cure, try the following:

1. If calibration is unsuccessful and cannot be properly performed, there could be leaks in the pneumatic circuit plumbing. The following steps will assist you in determining this:
   - The NBP cuff and tubing is the easiest area to inspect for leaks and is also the most likely area for failure in this regard. Closely inspect these items for cracks or leaks. Test the NBP cuff and tubing on a working monitor to determine the source of the problem.
   - If the NBP cuff and tubing are determined to be good after testing them on a working monitor, the leaks are probably internal to the monitor. Disassemble the monitor and check inspect all internal tubing and connections in the pneumatic circuit plumbing.
2. If no leaks are found after performing the previous step, the NBP pump assembly is suspect. Swap the NBP pump assembly with one from a working monitor and/or replace as necessary.

NBP Alarms Occur Continuously

Cannot get NBP readings from a patient in under 3 minutes

NBP displayed readings are inaccurate

If the monitor is not configured properly, a variety of NBP problems may occur. To determine monitor configuration, rotate then push the Trim Knob to:

- Scroll to and select MONITOR SETUP from the main menu of the monitor,
- Scroll to and select SERVICE MODE from the monitor setup menu and enter the two-digit numeric day and month shown in the upper-left corner of the monitor display.
- Scroll to and select MONITOR/ADMIT TYPE from the service mode menu of the monitor.

Verify the configured monitor type matches the environment in which the monitor is being used. If it is set to a neonatal ICU when the monitor is used for the adult ICU application or vice versa, problems listed to the left may occur.

Service Mode Menu

The SERVICE MODE menu option items provide the user access to several general and technical built-in software functions of the monitor. Only persons responsible for configuring and maintaining the monitor should access the service mode menu option items.

WARNING

The Service Mode menu is intended for use only by qualified service technicians. Experimentation with service mode menu option items can be detrimental to the monitor. Lost patient data, damaged operating system software for the monitor, even network related problems are but a few examples of problems that can be induced as the result of tampering with service mode menu option items.

Service Mode Menu Option Items

Access to the service mode menu option items is necessary for the following service-related functions of the monitor:

MONITOR / ADMIT TYPE

ADMIT MENU — For setup or configuration of the monitor to admit a patient with one of the following network configuration features enabled:

- Standard,
- Rover,
- Combo, or
- Rover Combo.

MONITOR TYPE — For setup or configuration of one of three monitor operating modes. The three modes of operation for the monitor are:

- Adult ICU,
- Neonatal ICU, or
- Operating Room.

TIME AND DATE — For entering or changing the monitor time and date.

BATTERY SERVICE — For setup or configuration of the Conditioning Cycle and to get Battery Service Information.

CALIBRATE AND TEST — For checkout or calibration of the noninvasive blood pressure function of the monitor and for pattern test of the internal writer.

ADDRESS

SET UNIT NAME — For setup or configuration of the monitor care unit name,

SET BED NUMBER — For setup or configuration of the monitor bed number or bed name,

SET INTERNET ADDRESS — For setup or configuration of the monitor Internet address for the network,

REVIEW ERRORS — For troubleshooting difficult equipment problems, network problems or service information on a software engineering level.

Access to the Service Mode Menu

Begin setup by entering into the service mode menu of the monitor. Follow these steps:

1. Make sure all cables are properly connected to the monitor.
2. Apply AC power to the monitor.
   - Plug the power cord into a working AC power wall receptacle and turn the monitor main power switch to ON.

Select Monitor Setup From the Main Menu

Use the Trim Knob control to scroll to MONITOR SETUP in the monitor main menu and press the Trim Knob control to select it.

Select Service Mode From the Monitor Setup Menu

Use the Trim Knob control to scroll to SERVICE MODE in the monitor setup menu and press the Trim Knob control to select it.

Enter the Service Menu Password

A service menu password window appears on the monitor display. A password is required to prevent non-service personnel from accessing the service menus. The password is four numbers that represent the date that currently resides in a memory circuit within the monitor (please note that this may or may not be the correct date). In the password, the first two numbers, starting from the left, represent the day and the second two numbers represent the month of whatever date that currently resides in the memory circuits of the monitor. For example, the seventh day of the third month (March 7th) would be represented in the password as 0703 (*ddmm*). Note the date that is currently on the monitor display and follow these steps to enter the password;

- Rotate the Trim Knob control to highlight the password number that you would like to change.
- To change the highlighted number, press the Trim Knob control.
- Rotate the Trim Knob control until the correct number is displayed in the selected field.
- To enter the number, press the Trim Knob control.

- Repeat these steps until all password numbers are correctly displayed.
- Once you have entered the correct password numbers, rotate the Trim Knob control to highlight SERVICE MODE in the enter password window.
- Press the Trim Knob control one more time to enter the password and access the service menus of the monitor.

About Service Mode Menu Option Items

Service mode menu option items are used for many purposes in the monitor. The majority of the functions of these menu option items are for initial setup and configuration. Some of the functions are for troubleshooting as well. Caution should always be exercised when using any of these password-protected functions.

Service mode menu option items are used by service technicians to:

- relay software information to design engineers;
- calibrate and troubleshoot NBP functions of the monitor;
- set admit menu options, software feature levels and operating mode of the monitor;
- configure the monitor unit name, bed number and Internet address for use on the network; *and*
- enter or change the time and date on the monitor,
- setup the battery management system.

None of these options should be used unless specifically instructed to do so.

WARNING

Some of the service mode menu option items are to be used only by qualified service technicians and others are for general use. Because of this, unnecessary tampering with service mode menu option items for experimentation purposes is not recommended by the manufacturer and may cause a malfunction of the monitor.

Review Errors

The REVIEW ERRORS menu option item is mostly used as an advanced troubleshooting technique by manufacturer engineering personnel. Some of the information recorded in the monitor error log can be useful for field service troubleshooting.

About the Monitor Error Log

Details included in this part of the section provides an introduction to error log usage and meaning. Because the information contained in the error log is engineering-oriented, the intent of the manual is to simply provide a general understanding of this monitor function.

Downloading the Error Log

A method for downloading error log data over the network to a central station is included in this part of the section. Once downloaded to a central station, the error log data can be loaded onto floppy diskettes, or reviewed on the central station.

Accessing the Review Errors Menu Option Item

To access the error log and learn more about the REVIEW ERRORS menu option item, follow these steps:

1. Rotate and press the Trim Knob control to scroll to and select REVIEW ERRORS from the service mode menu option items.
2. The review errors menu option items include four possible selections; one each for viewing output or input errors along with one each for clearing output or input errors. Rotate and press the Trim Knob control to scroll to and select VIEW OUTPUT ERRORS from the review errors menu option items.
3. The RUN TIME ERROR LOG pop-up window appears on the left side of the monitor display. One time-dated output software error appears in the pop-up window at a time.

   The Trim Knob control can be used to scroll through each logged error, perusing all of the parameters associated with each output software error. Rotate the Trim Knob control to move the cursor (>) to a position for viewing the NEXT or PREVIOUS error as well as the position that allows the user to QUIT viewing output errors.

   Selecting QUIT closes the run time error log pop-up window and returns to the review errors menu option items.
4. The VIEW INPUT ERRORS menu option item, when selected using the Trim Knob, causes a RUN TIME ERROR LOG pop-up window to appear on the monitor display. The pop-up window now displays input software errors and provides basically the same information as the VIEW OUTPUT ERRORS pop-up window provided. The appearance of both pop-up windows are similar, the difference being errors that are logged as input versus output to/from the monitor.
5. To clear out the stored run time error logs, use the Trim Knob to scroll to and select the CLEAR OUTPUT ERRORS or CLEAR INPUT ERRORS menu option item, respectively.

   Immediately following the assertion of the Trim Knob to clear one of the error logs, a message appears directly above the menu option items, on the right side of the display. The message verifies the actuation of the Trim Knob for this function.

Error Log Information

This part of the section describes in greater detail what information the error log contains and what can be learned from error logs.

An error log in the monitor is constructed as a circular file (not referring to a wastepaper basket). This circular file can hold up to 50 events. As an event occurs, error information is stored in the log. Subsequent events are stored sequentially as they occur. When the 50-event limit is reached, the next error (the 51st error) is written over the first event that was logged, erasing that event and replacing it with the latest event. The 52nd event is written over the second event, and so on. If errors occur infrequently the error log could span a period of weeks and months, maybe even years. For example; if a problem with the network begins, repeating frequently, the error log might consist only of errors from the last few hours. In any case the error log contains the 50 most recent detected and recorded errors.

A sample of the monitor error log pop-up window appears as follows:

When using the error log to troubleshoot a problem with the monitor, the following parameters from the pop-up window that are of greatest interest are:

Process Name: — The task that was operating when the event or problem occurred,

Error Code: — A software code for the type of event or problem that occurred,

Severity: — Indicates the level of impact of the event or problem on the system,

Date: — The date the event or problem occurred,

Time: — The time the event or problem occurred, and

Error number: — A sequential number (0-50) used to identify each event or problem.

How Network Errors are Logged

If certain types of network errors or problems occur, two additional categories are added to the error log pop-up window.

Network Error: — Identifies a network error or problem occurred,

Channel Number: — Identifies the network channel exhibiting the error

Error Logs

Something to remember about the error log is that it contains more than just operating system errors. Many events that occur that might have an impact upon the system are entered into the log. The 700-series of error codes include many such events.

Error Code Descriptions

Some of the event/error codes you might find useful are described in the following table:

Error Code	Description
400-4FF	Network errors were detected.
703	Diagnostics test were completed.
70B	Internet address was changed. The network address for the monitor was changed. Any network address changes should only be done by qualified service personnel.
70E	Time was changed from this monitor. Helps determine how the system-wide time may have been altered.
70F	Date was changed from this monitor. Helps determine how the system-wide time may have been altered.

Severity of the Error

Severity is a measure of how the event/error affected the system. There are three levels of severity. The following is a list of these levels accompanied by a brief description of each:

Continue: — The event or error was logged, the task may or may not have completed, but the system was able to continue operating. Most error log entries have this severity level.

Fatal: — The event or error was logged, the task did not complete, and the system was unable to continue operating as recovery was not possible. This level of severity in an event or error is always followed by an automatic warm start.

Forced Restart: — The operating system restarted normally after a known condition, such as an Internet address change, patient discharge, etc.

Service Tips

Fault/Symptom Analysis

This information is provided for the benefit of service technicians responsible for the maintenance and repair of the monitor. The symptoms covered in this part of the Troubleshooting section represent only a select number of faults that you may encounter and by no means are intended to cover every possible failure that may occur.

A systematic approach to the diagnosis of problems as well as a general understanding of the architecture, both hardware and software, of the monitor are essential to ensure successful troubleshooting of this device. The manufacturer recommends formal service training before repairs are attempted on the monitor. The Service Tips listed below combined with formal training should provide the service technician with skills necessary to service and repair a monitor, in the event of a malfunction.

Fault	Reason	Solution
The string "SERVICE MONITOR" is displayed on the screen	• Communication problems between DAS Acquisition board and PCB Mainboard • Calibration problems on DAS Acquisition	• Check connection between DAS and PCB Mainboard. • Replace DAS Acquisition board.
The Charging Status LED is blinking yellow	The battery is defective, disconnected or the battery fuse SI1 is defective	• Check the possible reasons and try to solve them. Change battery or replace PCB Mainboard.
Network communication problems	• PCB Main Connector defective • Ethernet Connector problems	• Check the possible reasons and try to solve them.
The LED 4 on the PCB Mainboard is not flashing continuously after 20 seconds startup time	The monitor is stuck somewhere in its startup sequence due to a malfunction on the PCB Mainboard.	• Replace the PCB Mainboard
Video problem – the LCD display is always dark	The LCD display, the backlight converter, the PCB Mainboard or Connector to LCD display has a malfunction	• Check the possible reasons and try to solve them • Replace the devices

Acquisition PCB Symptoms

Symptoms relative to patient signal acquisition such as missing parameter text and waveform(s) may be associated with acquisition PCB failure.It is important that you are able to distinguish the difference between the general format of the display, which is generated by the processor PCB, versus the patient signals and data that is associated with these patient signals, a function of data acquisition, which is generated by the acquisition PCB.

Processor PCB Symptoms

Symptoms with network communications, asynchronous communications, NBP control, analog output, audio/sound generation, and remote video signals/communications as well as other display-related problems all may be associated with processor PCB failure. All of these are functions controlled by microcontroller or graphics processing circuitry located on the processor PCB.

Power Supply PCB Symptoms

The power supply provides power that is used throughout the DASH monitor. The supply voltages are generated for various applications on the PCB Mainboard out of the +9 to +18 regulated VDC voltage. Below is a list of the supply voltages and where and how these voltages are applied. Problems in any of the following areas may be associated with power supply failure.

+9 to +18 VDC Supply Applications

- Voltage Converters (+12 VDC, -12 VDC, +5 VDC, +3.3 VDC, +26 VDC, -23 VDC)
- Acquisition PCB
- Expansion Interface
- Writer Interface
- On/Off Interface

+12 VDC Supply Applications

- Memory card (PCMCIA) slot – programming power source
- Defib marker out – power source for defib sync jack
- Audio amplifier – power source (speaker)
- NBP compressor (pump assembly) and solenoid valves – power source

+3.3 VDC Supply Applications

- Main processor PCB – logic power source

+5 VDC Supply Applications

- Main processor PCB – logic power source
- Display assembly – logic power source and backlight power source
- Ethernet transceiver
- Expansion Interface – logic power source
- Memory card (PCMCIA) slot – logic power source
- Remote display – logic power source
- Main memory – flash memory programming power source

+26 VDC Supply Applications

- Color LCD voltage

-23 VDC Supply Applications

- Monochrome LCD voltage

Power Supply Fuses

The power supply has two 2-Ah fuses (slow-blow) on the primary side. If these fuses fail, the power supply must be replaced, not the fuses. For the secondary side, there is a 4-Ah fuse (slow-blow) on the PCB Mainboard. If this fuse blows, the entire PCB Mainboard has to be replaced, because the fuse is soldered onto the board.

5 CALIBRATION

Contents

Adjustments and Switches

Hardware Calibration

The following table summarizes the hardware adjustments and switches on the monitor. The hardware adjustments are only necessary if a circuit board is repaired or replaced.

Reference Designation	Description
Main Processor PCB:	
S1	2-station DIP switch, LCD Type and Watchdog
Main Connector PCB:	
None	None
Acquisition PCB:	
None	None
Power Supply PCB:	
None	None

Software Calibration

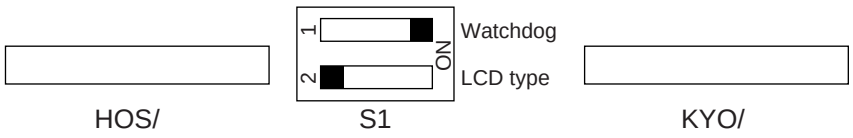
Noninvasive blood pressure (NBP) is the only function that requires software calibration. The manufacturer recommends performing the NBP software calibration upon receipt of the monitor initially, and once each year thereafter. The NBP software calibration should also be performed whenever the monitor is opened for service purposes. This ensures the pneumatic circuit plumbing has not developed any air leaks as a result of disassembly.

Main Processor PCB

The main processor PCB has a 2-station DIP switch. This switch is used to configure the LCD display type color or monochrome and the watchdog ON or OFF.

Switch S1 Settings

As you can see in the picture below the 2-station DIP switch S1 can be found on the PCB Mainboard between the LCD connector HOS for the monochrome LCD display and the KYO connector for the color display. The switches are switched to ON state on the right site of S1. The above switch is switch 1 and the below switch is switch 2. Switch 1 is the watchdog ON/OFF switch. Switch 2 is the LCD type switch for monochrome or color display. Switch 2 has to be in position ON for a color display, in OFF position the monochrome display is selected. The watchdog needs to be enabled for normal application. If a board is configured as shown in the picture below the watchdog is configured ON and the LCD type is configured as monochrome type.



PCB Mainboard

Noninvasive Blood Pressure

The overall accuracy of noninvasive blood pressure (NBP) readings by the monitor depend on the following:

- the zero pressure reading, and
- the voltage span of the NBP sensor in the monitor.

This procedure provides a method of verifying these items are accurate and also checks the NBP pneumatic circuit plumbing for leaks.

Manufacturer Recommendation

The manufacturer recommends performing the "noninvasive blood pressure test" upon initially receiving the monitor, before it is used on a patient, and once each year thereafter. Also, perform that procedure each time the monitor is opened for service or repair. If this test fails, the following has to be performed.

Test Equipment

The following items are required to successfully complete the NBP calibration procedure:

- Manometer (Sensym PDM200M or mercury manometer),
- NBP tube, pn 414873-001,
- NBP cuff, pn 9461-301 (any size will work),
- Something to wrap the NBP cuff around (PVC pipe or coffee can),

The table below lists items for connecting the NBP tube between the manometer and NBP cuff:

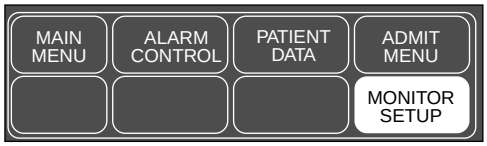
Description	Part Number	Qty
NBP cuff coupling	400787-001	1
NBP hose coupling	46100-002	1
NBP tee	4745-101	1
NBP tubing	401582-001	2

WARNING

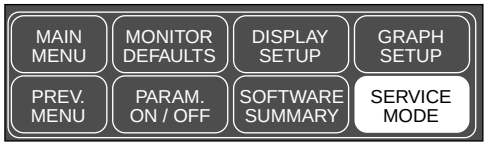
When the NBP cuff is used in this procedure, it must be tightly wrapped around a rigid cylinder or pipe. **Do not** put the NBP cuff around a human arm during the calibration procedures due to the potential for injury.

Calibration Procedure

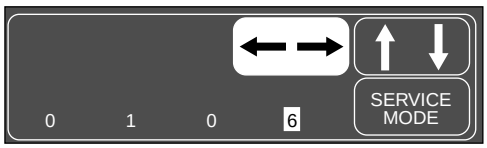
1. Remove all cables except for the power cord from the monitor.
2. Apply power to the monitor.
   - Plug the power cord into a working ac power wall receptacle and turn the monitor on.
3. Use the Trim Knob control to scroll to MONITOR SETUP in the monitor main menu and press the Trim Knob control to select it.



4. Use the Trim Knob control to scroll to SERVICE MODE in the monitor setup menu and press the Trim Knob control to select it.



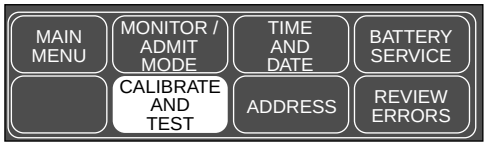
5. A service menu password window appears on the monitor display, as shown in the figure at the left. A password is required to prevent non-service personnel from accessing the service menus. The password is four numbers that represent the date that currently resides in a memory circuit within the monitor (please note that this may or may not be the correct date). In the password, the first two numbers, starting from the left, represent the day and the second two numbers represent the month of whatever date that currently resides in the memory circuits of the monitor. For example, the seventh day of the third month (March 7th) would be represented in the password as 0703 (*ddmm*). Note the date that is currently on the monitor display and follow these steps to enter the password:
   - Rotate the Trim Knob control to highlight the password number that you would like to change.
   - To change the highlighted number, press the Trim Knob control.
   - Rotate the Trim Knob control until the correct number is displayed in the selected field.
   - To enter the number, press the Trim Knob control.
   - Repeat these steps until all password numbers are correctly displayed.
   - Once you have entered the correct password numbers, rotate the Trim Knob control to highlight SERVICE MODE in the enter password window.
   - Press the Trim Knob control one more time to enter the password and access the service menus of the monitor.

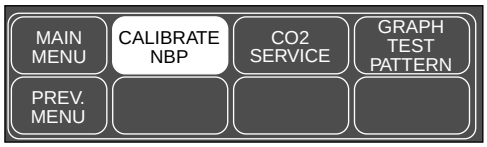


Service Menus

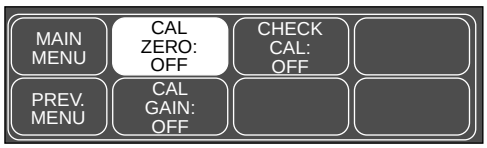
The service menus should appear on the monitor display. These next steps guide you through the service menus associated with checking NBP calibration. If desired test results are not obtained, NBP calibration is necessary.

1. Rotate the Trim Knob control to highlight CALIBRATE AND TEST and press the Trim Knob control to select it. Next, rotate the Trim Knob control to highlight CALIBRATE NBP and press the Trim Knob control to select it.

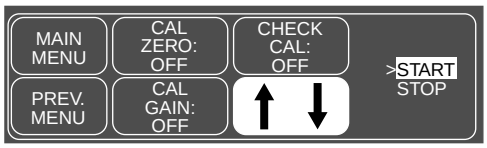


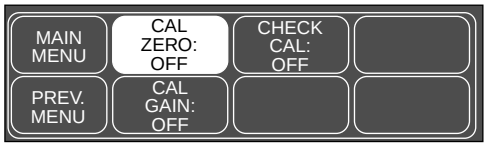


2. Rotate the Trim Knob control to highlight CAL ZERO OFF, and then press the Trim Knob control to select it.

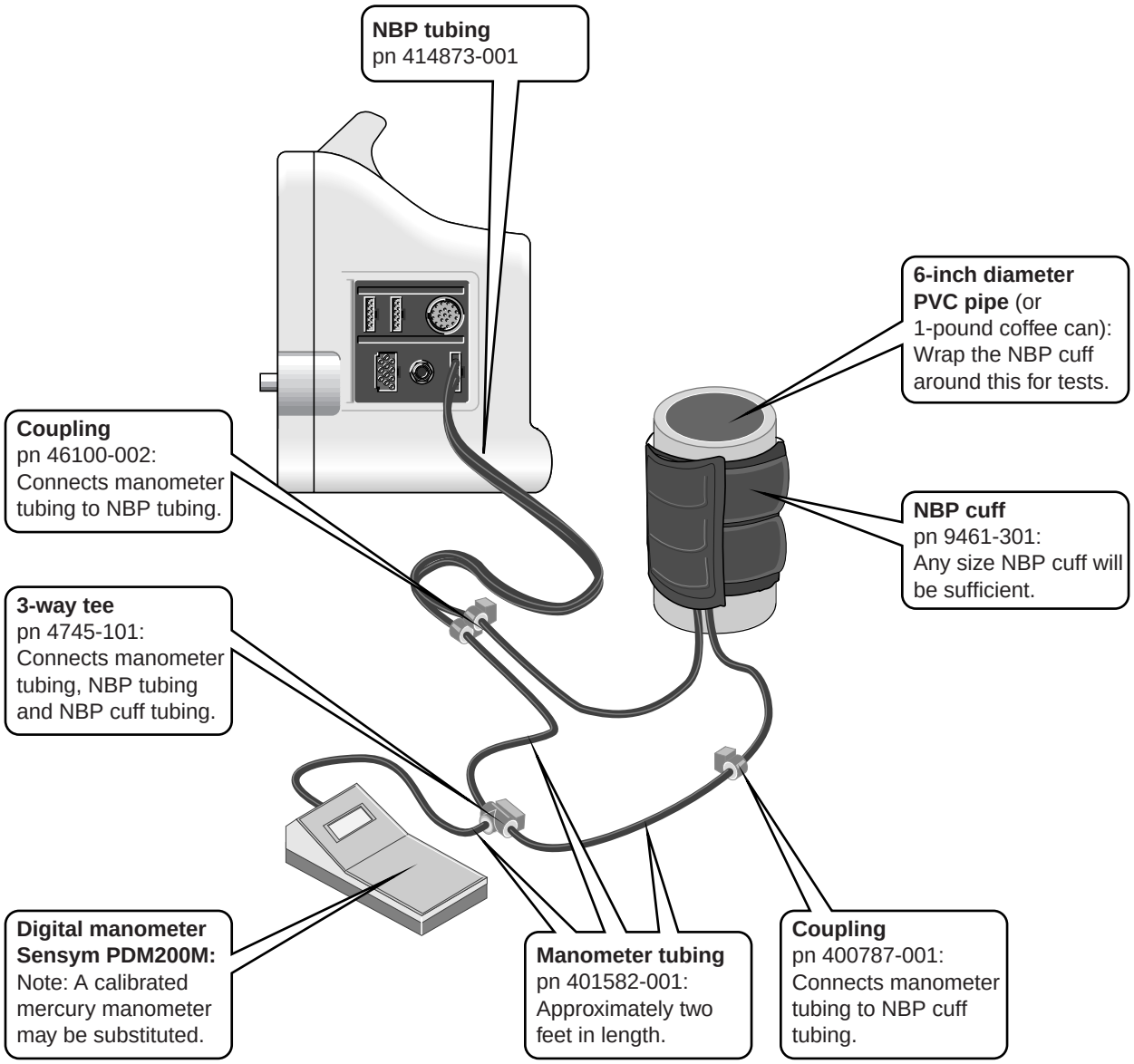


3. Rotate the Trim Knob control to highlight START, and then press the Trim Knob control to select it. The CAL ZERO menu item shows that it's IN PROGRESS, and when it's done it shows that it's OFF again.





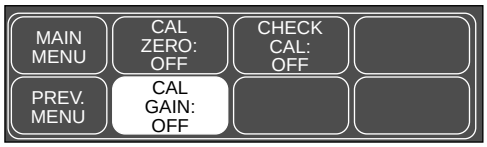
4. Connect a cuff and manometer to the monitor as shown below.



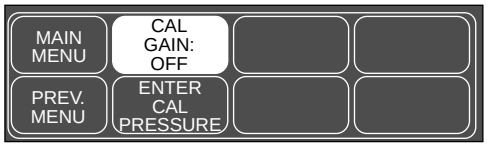
5. Turn the manometer on and adjust the range switch to the 1000 mmHg setting.

Start the Gain Calibration Test

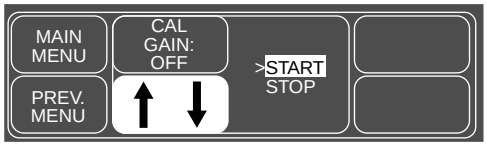
1. Rotate the Trim Knob control to highlight CAL GAIN OFF, and then press the Trim Knob control to select it.

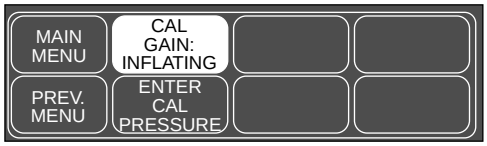


2. Rotate the Trim Knob control to highlight CAL GAIN OFF, and then press the Trim Knob control to select it.

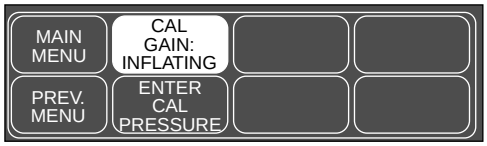


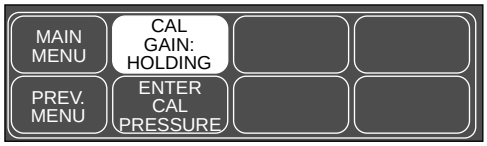
3. Rotate the Trim Knob control to highlight START, and then press the Trim Knob control to select it. The second line of text on the CAL GAIN menu item changes from OFF to INFLATING. Then, the monitor starts pumping up the pressure bulb or cuff – the audible whirring sound of the NBP pump motors occurs and an increase in displayed pressures on both the monitor and the manometer can be observed.



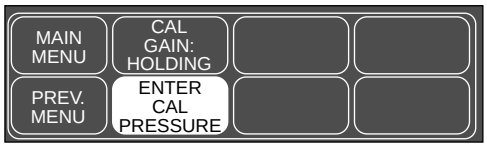


4. The pump shuts off at about 250 mmHg, and the pressure drops slowly to about 240 mmHg before stabilizing. The second line of text on the CAL GAIN menu item changes from INFLATING back to HOLDING. If the pressure continues to drop at a rate of 4 mmHg/min or more, there is a leak in the NBP plumbing. If there is a leak in the NBP plumbing, repair it and restart this calibration procedure.

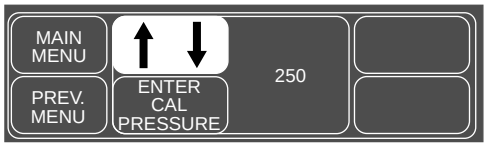




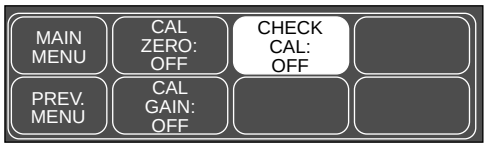
5. Rotate the Trim Knob control to highlight ENTER CAL PRESSURE and press the Trim Knob control to select it.



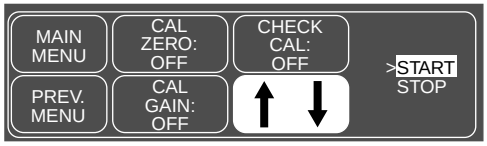
6. An ENTER CAL PRESSURE pop-up window will appear. Use the Trim Knob control to select a pressure value that is 1 mmHg lower than the current manometer reading.



7. When the manometer falls to exactly the value that you selected in the pop-up window, press the Trim Knob control to enter the value.
8. Rotate the Trim Knob control PREV. MENU to highlight CHECK CAL OFF, and then press the Trim Knob control to select it.

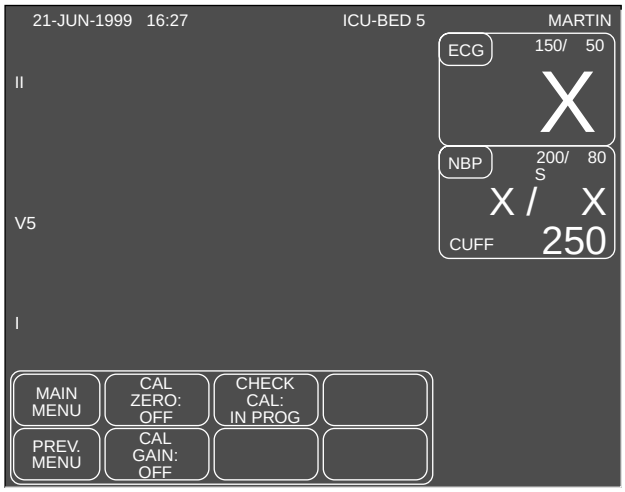


9. Rotate the Trim Knob control to highlight START and press the Trim Knob control to select it.



10. The text on the menu item changes from CHECK CAL OFF to CHECK CAL IN PROGRESS. Verify the pressure readings (shown

as CUFF in the NBP parameter box) on the monitor and manometer are equal (± 1 mmHg) for *at least* one full minute.



11. Rotate the Trim Knob control to highlight CHECK CAL IN PROGRESS and press the Trim Knob control to select it.

12. Rotate the Trim Knob control to highlight STOP and press the Trim Knob control to select it. The monitor automatically releases pneumatic pressure in the entire plumbing circuit.

13. Turn the monitor off, turn the manometer off and remove the test apparatus from the monitor.

6 CONFIGURATION

Contents

Monitor Configurations

Setup For Use

The last part of this section is devoted to setup or configuration of the monitor. Also refer to the *Marquette Unity Network User's Manual*, pn. 403799-023, for information relative to setup or configuration of other patient monitoring system components.

Stand-alone

The monitor is fully functional with respect to patient monitoring capabilities when operating without connection to a network or any other devices for that matter.

Refer to the *DASH 2000 Patient Monitor Operator's Manual* for more information regarding all patient monitoring functions of the monitor.

Network Interface

The monitor can be connected to many peripheral devices, other patient monitoring devices, diagnostic devices, as well as other hospital-wide network systems by connection to The Marquette Unity Network.

Loading Software

Intended Use

This part of the section is for the purpose of loading manufacturer software into the monitor initially, reloading software when the possibility of corrupted software exists, or updating software in the event of a release of a new software revision.

Software Loading/ Updating Methods

The process of loading or updating software in the monitor is described in this part of the section. Manufacturer software can be loaded into the monitor using these methods:

From Diskette

- The monitor is connected directly to a personal computer (PC) or PC laptop. The Update Program is run off of the update diskettes and the software is downloaded to the monitor via serial communication. Over the Network

Over the Network

- For the monitor connected to a patient monitoring network, the software is loaded from the update diskettes onto a Centralscope central station or a Clinical Information Center (CIC). The central station or CIC then acts as a network file server and software is downloaded to the monitor over the network.

NOTE

Each method of downloading software to the monitor is distinctly different. Completely read all of this part of the section prior to any attempt to load or update software. This is particularly important if this is a first attempt to load or update software in the monitor.

Software Compatibility

Write down or print out software code part numbers from the SOFTWARE SUMMARY window for each monitor in the system. To print the SOFTWARE SUMMARY table from each monitor, use the Trim Knob to select the following menu option items from the monitor main menu display:

MONITOR SETUP,
SOFTWARE SUMMARY, then
press the GRAPH GO/STOP key.

To print the software revision of the writer, use the Trim Knob to scroll to and select the following menu option items from the monitor main menu display:

MONITOR SETUP (1),
SERVICE MODE (2),
enter password (3)
(The password is the current date shown in the upper left corner of the display. The expected format is: DDMM.)
CALIBRATE AND TEST (4),
GRAPH TEST PATTERN (5), then
select START (6)

To stop test pattern, follow step (1) to (5), then select STOP.

If there is a previous revision of software residing in the monitor memory, update the monitor as necessary. Keep the monitor at current levels of manufacturer software to maintain the proper network communication and to provide the user with all of the latest operational features that the manufacturer offers.

The boot codes (MAIN BOOT, DAS BOOT, etc.), which reside in various monitor memory locations, play a minor role with regard to actual patient monitoring functions. These boot codes are designed to be updated very infrequently – if ever.

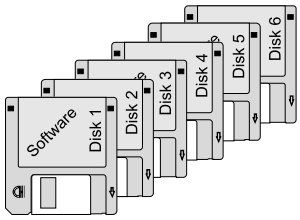
NOTE

Boot code components of the monitor software should be updated only when absolutely necessary.

CAUTION

If a failure occurs in the update process while loading one of the boot code components, full or partial patient monitoring capability is lost. The monitor is rendered useless and requires service by a manufacturer technical support engineer.

Monitor Software Files



All software files for the monitor are contained on six diskettes included with a manufacturer software update kit. The functional characteristic of files that can be updated is listed below (in the order by which these must be downloaded to the monitor) along with the respective representation from the monitor SOFTWARE SUMMARY table:

- Main processor operational code (MAIN),
- Acquisition processor operational code (DAS),
- Main processor boot code (MAIN BOOT), and
- Acquisition processor boot code (DAS BOOT)

To update the internal writer in the Dash 2000, you need to order the writer update kit. Contact your GE Marquette representative for further information.

Maintain Patient Monitoring

The monitor is not capable of downloading code while connected to a patient. Inform medical staff responsible for patients connected to the monitor that the equipment is going to be updated so they may take appropriate actions.

WARNING

There is a temporary loss of monitoring functions throughout various parts of the patient monitoring system until the update is complete on each monitor in the system. Medical staff should be prepared to cover patients in need during these periods of lost monitoring functions.

To transfer a patient from one bed to another, refer to the "How To..." chapter of the *Marquette Unity Network User's Manual*, pn 403799-023. If one is available, have the medical staff transfer the patient to a spare monitor while loading or updating software.

Problems While Loading Software

If problems result while loading software into the monitor:

- Restart the procedure from the beginning,
- For monitors connected to patient monitoring network, refer to the *Marquette Unity Network User's Manual*, pn 403799-023, or
- Contact manufacturer technical support at one of the following telephone numbers:

  1-800-558-7044 — within the United States, or

  1-407-575-5000 — outside of the United States.

Load Software From Diskette

About the Procedure

This procedure describes how to update software in the monitor from a PC or PC laptop floppy disk drive using update diskettes provided in the manufacturers software update kits.

This update procedure requires the following:

1. PC or PC laptop, to download software, with the following minimum requirements:
   - MS-DOS compatible,
   - 1.4M, 3.5-inch floppy disk drive, and
   - RS-232C serial port.
2. Download kit, pn 2000453-001, including:
   - Monitor cable assembly, pn 418335-002, and
   - PC cable assembly, pn 420915-013.
3. Manufacturer software update diskettes.

Connect the PC to the Monitor

Connect the PC to the monitor by following these steps:

1. Attach the monitor cable assembly to the 8-pin D-type connector labeled AUX (RS-232) on the monitor rear panel.
2. Connect the PC cable assembly from the RS-232C to the D-type connector labeled AUX at the rear of the PC.

Software Diskettes

The software media consists of six 3.5-inch high density (HD) floppy diskettes.

Diskettes 1, 2, and 3 contain programs and files for downloading software to the monitor over the network. Refer to “Load Software Over The Network” for that procedure.

Diskette 4, used for this procedure, contains the update program utility along with update files for:

- Main processor boot code, and
- DAS processor boot code.

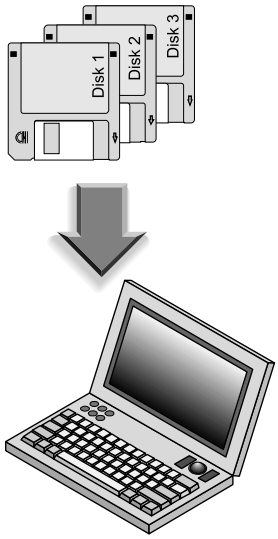
Diskette 5, also used for this procedure, contains the update program utility along with the update file for:

- Main processor operational code (part 1). This part of the update software includes monitor software in various languages.
- DAS operational code.

Diskette 6, also used for this procedure, contains the update program utility along with the update file for:

- Main processor operational code (part 2). This part of the update software includes monitor software in various languages.

Update Program Start-up



Start the update download program from an update diskette to begin loading software into the monitor by following these steps:

1. Apply power to the PC and wait for the **C:\>** prompt to appear on the PC display.

CAUTION

The manufacturer recommends operating the PC (or PC laptop) on AC power for the duration of the update process. This prevents inadvertent power interruptions to the PC or PC laptop. Interruptions of power cause the update process to fail. While downloading the boot code components, interruptions in the update process may result in monitor malfunction or being rendered completely useless. The monitor may require factory service as a result.

NOTE

If the PC used for this procedure automatically launches any version of Windows, perform the necessary steps to quit Windows and return to DOS.

2. Compare the SOFTWARE SUMMARY window with the file names from the tables on the next page. Only load the files that currently reflect earlier revisions, as compared with the SOFTWARE SUMMARY printout, into the monitor. Generally, the main processor operational code (MAIN) or acquisition processor operational code (DAS) need to be updated. Depending on the vintage of the monitor, boot code may need to be updated as well but this is generally not the case.
3. Following is the order in which the update files are to be downloaded:
   - Main processor op-code (MAIN), and
   - Acquisition processor op-code (DAS).

Then, only if necessary:

- Main processor boot code (MAIN BOOT), and
- Acquisition processor boot code (DAS BOOT).

Files on Diskette 4

Below is the list of update files typically found on Diskette 4.

Diskette 4 Files	
File Name	**Description**
45668900.*xxx*	MAIN BOOT
41510500.*xxx*	DAS BOOT

Files on Diskette 5

Below is the list of update files typically found on Diskette 5.

Diskette 5 Files	
File Name	**Description**
45669000.*xxx*	MAIN (1)
41495900.*xxx*	DAS

Files on Diskette 6

Below is a list with the update files typically found on Diskette 6.

Diskette 6 Files	
File Name	**Description**
45669000.*xxx*	MAIN (2)

4. Insert the diskette containing the specific software to be loaded or updated in the monitor into the PC floppy disk drive.
5. Type **a:** at the **c:**\> prompt and press ENTER on the PC keyboard to change directories to the floppy drive. Then type **update** at the **a:**\> prompt and press ENTER on the PC keyboard to launch the update program. The UPDATE UTILITIES menu appears on the PC display.
6. Press F2 on the PC keyboard to select UPDATE BEDSIDE from the update utilities menu. The UPDATE BEDSIDE utilities menu appears on the PC display.

NOTE

The update file included on diskettes 5 and 6 for other language update kits reflects a different file name than that shown in the list for each language of update kit ordered.

Setup Monitor to Accept Download Files

The PC and the monitor are serially linked, communication-wise. The following steps describe how to download a specific file into monitor memory. In order to proceed, the monitor must be enabled to receive update files. Follow these steps to enable the monitor for download, then select and load a specific file to the monitor.

1. At the monitor, activate the BOOT LOADER program by following these steps:
   - Hold down the NBP GO/STOP and FUNCTION keys,
   - Press and release the Trim Knob control,
   - Hold down the NBP GO/STOP and FUNCTION keys until the BOOT LOADER menu appears on the monitor display.
2. In this step, one of two situations is present:
   - For a monitor **not connected** to a patient monitoring network, the BOOT LOADER takes approximately 30 seconds to activate and the SERVICE MENU appears on the monitor display. If this is the case, proceed to the next step.
   - For a monitor **connected to** a patient monitoring network, use the Trim Knob to scroll to and select the number corresponding to SERVICE MENU from the FILE SERVER SELECTION menu list. The SERVICE MENU appears on the monitor display.
3. Decide which code to download to the monitor based on software revision comparisons made earlier in the procedure. Use the Trim Knob to select the number corresponding to the SERIAL DOWNLOAD routine for the file requiring update.

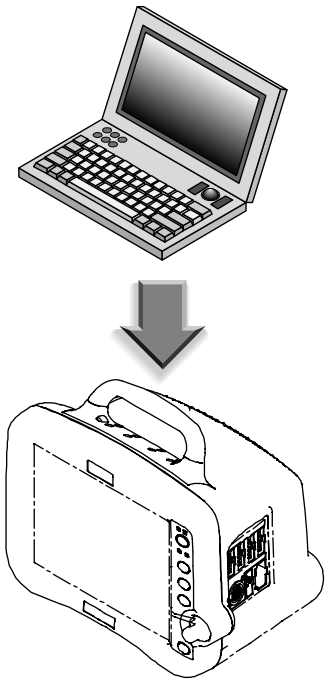
NOTE

A warning message and prompt appears on the monitor display. Use the Trim Knob to select YES to proceed with the download only if the selected code that currently resides in the monitor is an earlier version as compared to the software contained on the update diskettes.

CAUTION

Do not update any of the boot code components unless absolutely necessary.

Download Files to the Monitor



At this point, the monitor is ready to accept download files and the PC is setup to provide the files for download. Follow the next steps once the PC and monitor are setup for download.

1. Moving back to the PC, find and select (highlight) the file requiring download from the UPDATE BEDSIDE utility menu list of files. If the list does not include the necessary file, eject the diskette from the floppy drive and insert the correct diskette. Press HOME on the PC keyboard to refresh the UPDATE BEDSIDE utility menu list.

   Use the up/down arrow keys on the PC keyboard to scroll through the list of files contained on the update diskettes.

2. To begin the process of downloading the selected file, press ENTER on the PC keyboard.

CAUTION

In the process of loading update software into the monitor, the update download program first erases all of the memory locations associated with each file. Problems in the download process may render the monitor useless. **Do not** interrupt the download process once it has begun. If you encounter problems that render the monitor useless, contact the appropriate technical support group listed in the beginning of this document.

The monitor indicates a warning if the file name from the PC does not match the file name residing in the monitor memory.

NOTE

If you need to load MAIN code for a language other than already resides in the monitor ignore the warning and proceed to download software.

CAUTION

Do not reboot or power down the monitor while you download boot code files. This renders the monitor useless and requires factory service.

Verify PC-to-Monitor Communication

Messages appear on the monitor and PC displays indicating how the update is going. Verify the RECEIVED bytes advance. When the selected file has finished downloading, the monitor returns to the BOOT LOADER program and displays the SERVICE MENU, and the PC sounds an audible indication (a “beep”) and indicates a completed download process on the PC display. The monitor automatically restarts itself after any main processor code (MAIN or MAIN BOOT) is finished loading.

Errors During Download Process

For most errors, simply press RETURN on the PC or repeat the download procedure. If the byte numbers stop advancing for more than two minutes, refer to “Problems While Loading Software” found in the “Introduction” section of this procedure.

Repeat Steps For Each File Requiring Update

Perform steps in “Setup Monitor to Accept Download Files” and “Download Files to the Monitor” for each file that requires updating before proceeding to the next steps. When all code is loaded, turn monitor power off, then on.

Completion

To configure (setup) proper graph locations for a monitor that has a standalone writer attached to it, connect the monitor to the network then follow these steps:

Setup Graph Locations

Use the Trim Knob to scroll to and select the following menu options selection sequence. Beginning at the monitor main menu options, scroll to and select:

MONITOR SETUP
GRAPH SETUP
GRAPH LOCATION

Select a Writer

From the GRAPH LOCATION menu option items, use the Trim Knob to scroll to and select:

- the MANUAL GRAPH LOCATION option item (the monitor may take up to a minute to poll the network for available writers), then choose one of the manual graph locations from that list of writers; then
- the ALARM GRAPH LOCATION option item, then choose one of the alarm graph locations from that list of writers; and finally
- the PRINT WINDOW LOCATION option item, then choose one of the print window locations from that list of writers.

Test the Monitor

Connect a patient simulator to the monitor. Admit and generate patient waveforms at the monitor with the simulator powered up. Perform the following steps to test the communication paths between the monitor and each selected writer.

- Press the GRAPH GO/STOP key on the monitor front panel. Verify the graph output arrives at the selected manual graph location. Press the GRAPH GO/STOP key again to stop the manual graph.
- Switch the simulator power off to cause a fatal alarm by. Verify the graph output arrives at the selected alarm graph location.
- Bring up a non-real-time window on the monitor display. Print the window. Verify the print output arrives at the selected print window location.

Verify Software Update

Verify the software downloaded successfully. Execute the following menu option selection sequence, beginning at the monitor main menu:

MONITOR SETUP
SOFTWARE SUMMARY
Press the GRAPH GO/STOP key

Compare the displayed monitor software revisions with those previously printed or written down. Repeat the entire procedure if software revisions are not properly updated.

Update All Monitors

Load or update software for each monitor as required. Update software to current revisions in all monitors for best monitor performance and operation.

Load Software Over The Network

About the Procedure

This section of the procedure provides instructions to load the contents of update diskettes 1, 2, and 3 to a Centralscope central station or Clinical Information Center (CIC) system hard disk drive, initiate the central station as a file server from the monitor, and download software to the monitor over the patient monitoring network.

NOTE

This method can only be used to update monitors connected to a patient monitoring network. If the monitor requiring update is not connected to the network or is connected to a network without central stations, you cannot use this procedure to update the monitor. Refer to "Load Software From Diskette" for an alternate procedure.

Network Update Diskettes

Diskettes 1, 2, and 3, are used for this procedure and contain the update program utility along with update files for (listed in order by which these files must be downloaded to the monitor):

- Main processor operational code (MAIN.SCR) – this part of the update software includes monitor software in various languages, when available,
- Acquisition processor operational code (DASMAIN.SCR),
- Main processor boot code (BOOT.SCR), and
- Acquisition processor boot code (DASBOOT.SCR).

Copy Files

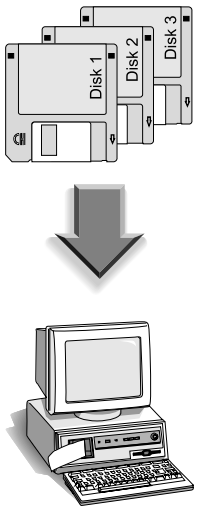
The following steps describe how to copy files from update diskettes 1, 2, and 3 onto the Centralscope central station or CIC system hard disk drive. The Centralscope central station or CIC system acts as a file server for downloading update files to the monitor over the patient monitoring network.

1. Write down the Centralscope central station or CIC CARE UNIT NAME and CENTRAL NUMBER of that particular central station for use later in this procedure.
2. Insert diskette 1 from the Update Kit into the Centralscope central station or CIC floppy disk drive.

Choose Procedure

Perform the procedure for your application ("Centralscope Central Station" or "Clinical Information Center (CIC)"). After you have copied the diskettes to your system, go to "Download Files to the Monitor."

Centralscope Central Station



1. At the Centralscope central station, execute the following menu sequence, starting from the MAIN menu:

   CENTRAL SETUP,
   SERVICE,
   PASSWORD (MEI CS 123),
   LOAD SOFTWARE (Wait 10 seconds), and
   FLOPPY.

2. Observe status messages in the upper left corner of the central station display. Verify the following messages:

   LOADING FROM...FLOPPY, (then)
   LOADING DISK D2<version> # 1 OF 3…

NOTE

The Centralscope central station may display status messages other than those described in these instructions. If, after 20 minutes, diskette 1 does not eject from the floppy drive, reboot the central station and start over.

---

3. When diskette 1 is completely loaded, the Centralscope central station automatically ejects the diskette and displays the message:

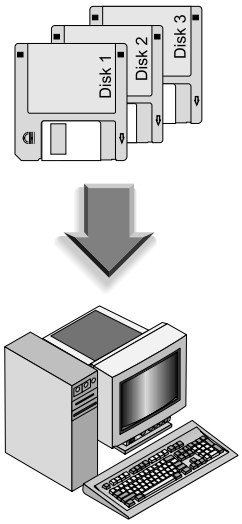
   INSERT DISK D2<version> #2 OF 3…

4. Follow the instructions on the screen to exchange diskettes in the hard drive as each one is loaded on the Centralscope central station hard drive.

5. When loading of diskette 3 is complete, the Centralscope central station automatically ejects the diskette and displays the message:

   LOAD FROM FLOPPY COMPLETE.

Clinical Information Center (CIC)



1. At the Clinical Information Center, execute the following menu sequence, starting from the MAIN menu:

   SETUP CIC,
   then, select the SERVICE PASSWORD tab,
   Type password: mms_com (lowercase with underscore)
   RETURN

2. At the **c:** prompt message, type:

   a: cinstall *xx*

   Where *xx* is the software version you are installing.

NOTE

If you insert the wrong diskette, or type in the wrong version number, the screen displays an “Incorrect Disk” error message. Press [CONTROL] [C] to restart the procedure.

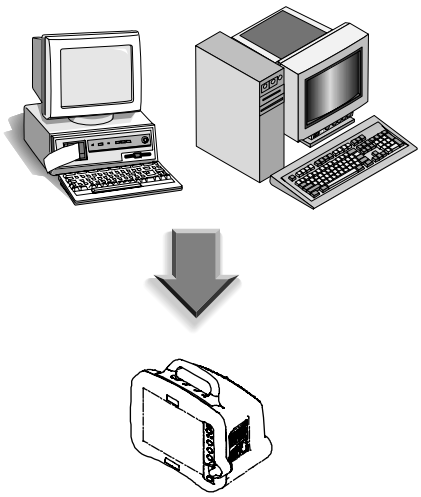
---

3. Follow the instructions on the screen to exchange diskettes in the hard drive as each one is loaded on the Clinical Information Center hard drive.
4. When loading of diskette 3 is complete, the Clinical Information Center displays the message:

   INSTALL COMPLETE.

5. Click on the "X" in the upper right hand corner of each screen to close out the download screen and the main screen.

Download Files to the Monitor



The following steps describe how to download files from the network to the monitor.

NOTE

Verify the monitor is on the network by selecting LIST NETWORK from the SERVICE MONITOR menu of the central station or CURRENT TELEMETRY LISTINGS from the SERVICE menu of the CIC system

1. At the monitor, start the BOOT LOADER program by following these steps:
   - Hold down the NBP GO/STOP and FUNCTION keys,
   - Press and release the Trim Knob control, and
   - Hold the NBP GO/STOP and FUNCTION keys until the BOOT LOADER menu appears on the monitor display.
2. Use the Trim Knob to select the following at the FILE SERVER SELECTION menu:
   - In the menu list, identify and scroll to the central station which has the update files stored on it (this should have been noted or written down earlier in the procedure). This central station acts as a file server to download files to the monitor over the network.
   - Select the number corresponding to the central station that contains the update files.
3. Use the Trim Knob to scroll to and select the number from the DIRECTORY SELECTION menu corresponding to:

   /update.net/dash2000/<version>

4. Compare the revision of the file to be updated with the software revision of the corresponding area of the monitor. Perform the following steps only if a file existing in the monitor is older than the update files just copied onto the central station hard drive.

5. From the SCRIPT NAME SELECTION menu list, use the Trim Knob to scroll to and select the number corresponding to the file (script) requiring update. Following is a list of files that appear in the SCRIPT NAME SELECTION menu (listed in sequential order for each script to be loaded):

   *MAIN.SCR,
   *BOOT.SCR,
   DASMAIN.SCR, and
   DASBOOT.SCR.
   *Monitor reboots when loading these scripts.

   Download only the files that require update based on comparison of file revisions made previously. Once a file has been selected, the monitor will begin the download process.

6. The monitor should display the part number, version, and date of the file to be downloaded.

NOTE

A warning message and prompt appears on the monitor display. Use the Trim Knob to scroll to and select YES if the file selected for download is correct.

CAUTION

Do not reboot or power down the monitor while downloading boot code components (BOOT.SCR, DASBOOT.SCR, etc.). This renders the monitor useless and manufacturer factory service is required.

7. The order in which the files are updated in the monitor is important (see “Network Download Procedure”). If an update of the main processor operational code (MAIN.SCR) or main processor boot code (BOOT.SCR) components is required, the monitor reboots automatically upon completion of each of those updates.
8. Messages appear on the display to indicate how the update is going.
9. For most errors, simply repeat the previous steps. If the byte numbers stop advancing for more than two minutes, start the procedure over or call technical support.
10. Perform the previous steps for each software file as required. This should be based on comparison of revisions made earlier in this procedure.
11. When the update is complete, use the Trim Knob to select START PATIENT MONITORING.

Activate Software

You may download all the monitors in the care unit, then activate the upgraded software.

After all of the files have been successfully loaded, press the monitor power switch to OFF then ON to operate the monitor with the newly loaded software.

Completion

Follow these steps to configure (setup) proper graph locations for an internal or network writer:

1. Use the Trim Knob to select the following menu options selection sequence. Beginning at the monitor main menu options, scroll to and select:

   MONITOR SETUP
   GRAPH SETUP
   GRAPH LOCATION

2. From the GRAPH LOCATION menu option items, use the Trim Knob to scroll to and select:
   a. The MANUAL GRAPH LOCATION option item (the monitor may take up to a minute to poll the network for available writers), then choose one of the manual graph locations from that list of writers; then
   b. The ALARM GRAPH LOCATION option item, then choose one of the alarm graph locations from that list of writers; and finally
   c. The PRINT WINDOW LOCATION option item, then choose one of the print window locations from that list of writers.

3. Connect a patient simulator to the monitor. Admit and generate patient waveforms at the monitor with the simulator powered up. Perform the following steps to test the communication paths between the monitor and each selected writer.
   a. Press the GRAPH GO/STOP key on the monitor front panel and verify the graph output arrives at the selected manual graph location. Press the GRAPH GO/STOP key again to stop the manual graph.
   b. Cause a fatal alarm by switching the simulator power off and verify the graph output arrives at the selected alarm graph location.
   c. Bring up a non-real-time window on the monitor display and print the window. Verify the print output arrives at the selected print window location.
   d. Verify software was downloaded successfully. Execute the following menu option selection sequence, beginning at the monitor main menu:

      MONITOR SETUP
      SOFTWARE SUMMARY
      Press the GRAPH GO/STOP KEY

   Compare displayed monitor software revisions with the those previously printed or written down. Repeat the entire procedure if software revisions are not properly updated.

4. Load or update software for each monitor as required. Update software to current revisions in all monitors for best monitor performance and operation.

Setup For Use

About Setup

This part of the section contains the procedure for initial setup or configuration of the monitor. The procedure addresses use in both types of patient monitoring system configurations:

- **Stand-alone patient monitor:** The monitor is not interconnected to other patient monitoring system devices, and
- **Networked patient monitor:** The monitor is interconnected to other patient monitoring system devices for the sake of sharing patient data.

Monitor Setup Parameters

Both configurations require some initial setup before the monitor can be used to full potential on patients. The following is a description of each area requiring setup or configuration:

UNIT NAME — This a general identification parameter (seven characters in length) for the monitor to establish communication links between other devices on the network. The unit name acts as a means of separating groups of patient monitoring devices on the network.

BED NUMBER — This is also an identification parameter (five characters in length) for the monitor to establish communication links between other devices on the network. The bed number acts as a means of separating each monitor within groups of patient monitoring devices on the network.

GRAPH LOCATION — This is a setup parameter for the monitor to establish communication links between graph devices directly connected to the monitor or those located on the network. The graph location must be setup or configured for each of the following types of graphs:

- MANUAL GRAPH LOCATION: Where the manual graph prints,
- ALARM GRAPH LOCATION: Where the alarm graph prints, and
- PRINT WINDOW LOCATION: Where windows (displayed by the operator for various purposes) print.

Although information in this part of the section relates to a specific version of software, the process generally remains similar from version to version of software.

Procedure Summary

Below is a summary of the procedure to setup the monitor for normal operation:

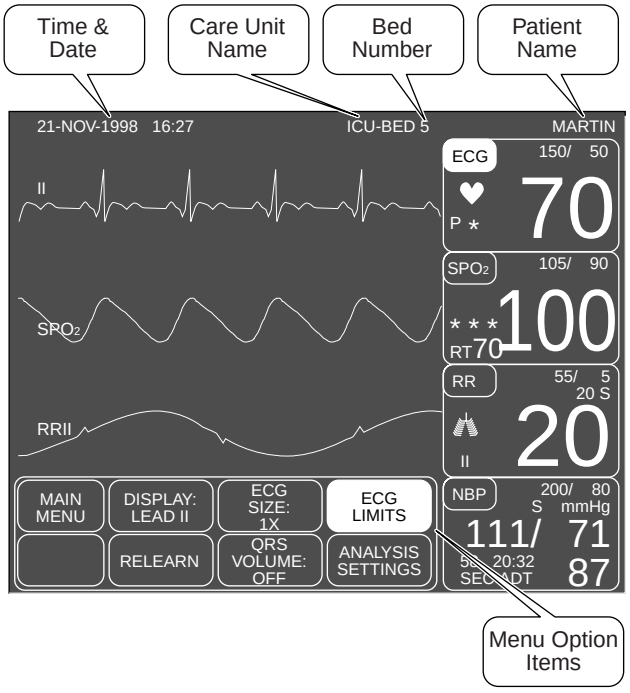
1. Determine the current monitor software revision level.
2. Setup the monitor care UNIT NAME.
3. Setup the monitor BED NUMBER.
4. Setup a MANUAL GRAPH LOCATION for the monitor.
5. Setup an ALARM GRAPH LOCATION for the monitor.
6. Setup a PRINT WINDOW LOCATION for the monitor.
7. Verify setup or configuration of the above items.

Display Features

The monitor display shows features that are mentioned in this part of the section. Use the figure below to locate these three features.

1. Along the top of the display are two text fields.
   - The first text field is the DATE AND TIME. These both must be setup correctly on the monitor before initial use.
   - The second text field consists of a care UNIT NAME followed by a BED NUMBER. These both must be setup or configured on the monitor before initial use.
   - The third text field is the PATIENT NAME. This may be entered by the user (optionally) each time a patient is admitted to the monitor.
2. The center part of the display shows each of the monitored patient parameters in both a graphic and text format.
3. Along the bottom of the display are menu option items.

Display Feature Locations



The Main Monitor Menu

The topmost level (master directory) of the monitor operating system software is the main menu; the menu that normally remains displayed when there is no operator intervention on the monitor. The main menu includes a normal patient monitoring display plus five menu option items.

Monitor Menu Options

In lower levels (sub-directories) of monitor operating system software are menu option items. These are used for further navigation through monitor operating system software for purposes that are specific to previous menu selections.

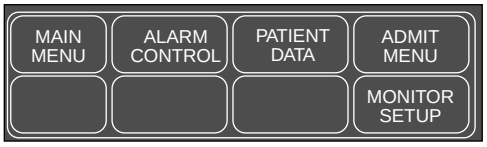
More about the Menus

When most groups of menu option items are displayed on the monitor, an option item labeled MAIN MENU allows the user to immediately step back to the main menu, or topmost menu, on the monitor display. The only Main Menu option item discussed in this part of this section is MONITOR SETUP.

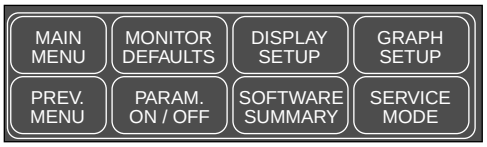
SOFTWARE SUMMARY Menu

To determine the software revision under which the monitor is currently operating, follow these steps:

1. Use the Trim Knob control to scroll to and select MONITOR SETUP from main menu on the monitor display.

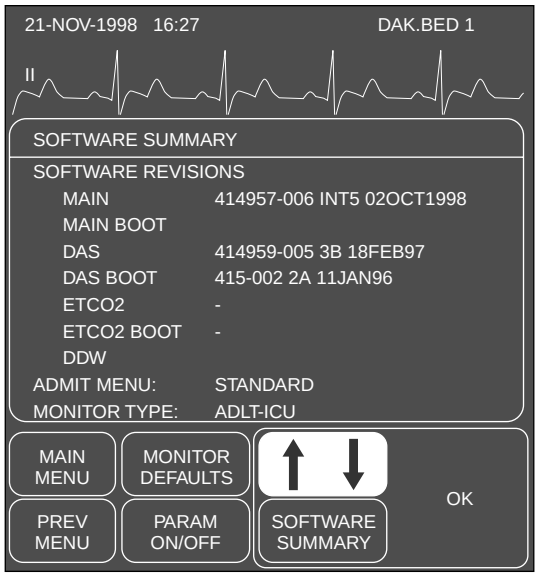


2. Scroll to and select SOFTWARE SUMMARY from the monitor setup menu.



Software Summary Pop-up Window

The software revisions of each processing circuit within the monitor are displayed in a pop-up window similar to the one shown below.

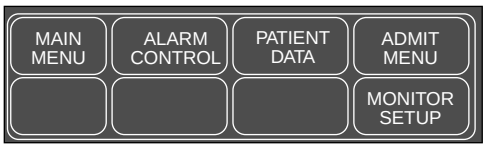


A part number for the software (414959-005), the version of the software (3B), and the software release date (25APR99) immediately follow each item in the list.

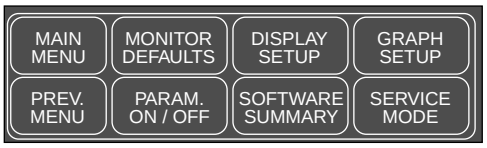
Enter the Service Mode Menu

Begin setup by entering into the service mode menu of the monitor. Follow these steps:

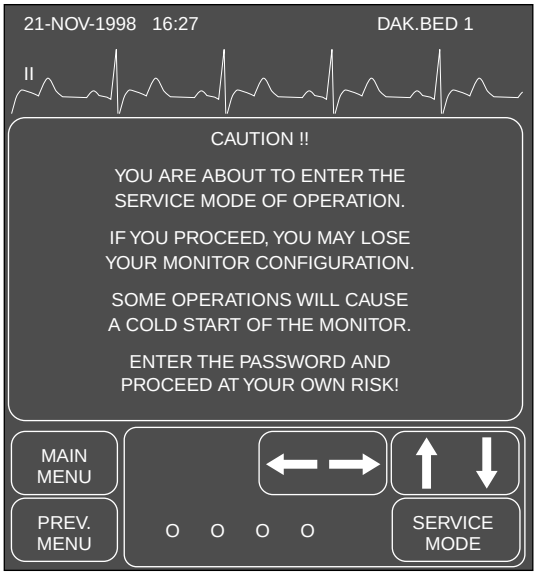
1. Make sure all cables are properly connected to the monitor.
2. Plug the power cord into a working AC power wall receptacle.
3. Use the Trim Knob control to scroll to MONITOR SETUP in the monitor main menu and press the Trim Knob control to select it.



4. Use the Trim Knob control to scroll to SERVICE MODE in the monitor setup menu and press the Trim Knob control to select it.



5. A service menu password window appears on the monitor display.



A password is required to prevent non-service personnel from accessing the service menus. The password is four numbers that represent the date that currently resides in a memory circuit within the monitor (please note that this may or may not be the correct date). In the password, the first two numbers, starting from the left, represent the day and the second two numbers represent the month of whatever date that currently resides in the memory circuits of the monitor. For example, the seventh day of the third month (March 7th) would be represented in the password as 0703 (*ddmm*). Note the date that is currently on the monitor display and follow these steps to enter the password:

a. Rotate the Trim Knob control to highlight the password number that you would like to change.

b. To change the highlighted number, press the Trim Knob control.

c. Rotate the Trim Knob control until the correct number displays in the selected field.

d. To enter the number, press the Trim Knob control.

e. Repeat these steps until all password numbers correctly display.

f. Once you have entered the correct password numbers, rotate the Trim Knob control to highlight SERVICE MODE in the enter password window.

g. Press the Trim Knob control one more time to enter the password and access the service menus of the monitor.

Unit Name

From the service mode menu option items which appear on the monitor display, follow the next steps of the procedure to setup or configure the UNIT NAME of the monitor.

About the Monitor Unit Name

The monitor UNIT NAME provides a means of differentiating groups of devices on the network. Groups of devices with similar care unit names auto-segment themselves from other groups of devices with different care unit names on the network. The care UNIT NAME is part of a software address integrated into electronic packets of information transmitted or received to or from the network. The UNIT NAME is programmable and therefore allows users to define groups of devices on the network.

WARNING

Do not use the word “none” as a care UNIT NAME. This name can be very confusing to users and make network troubleshooting extremely difficult.

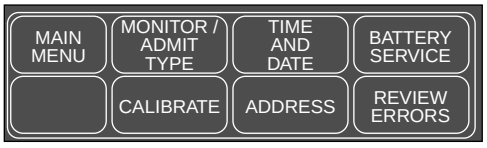
CAUTION

It is very difficult to visually detect spaces (“spaces” are characters) when programmed into the UNIT NAME. The manufacturer recommends avoiding the use of spaces in the UNIT NAME.

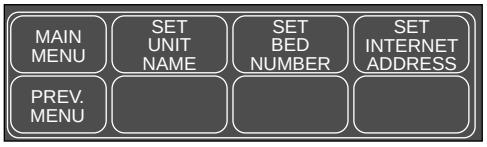
Setup the Unit Name of the Monitor

Setup or configure the UNIT NAME of the monitor by following these steps:

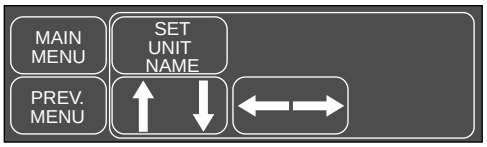
1. Use the Trim Knob control on the front panel of the monitor to select ADDRESS from the service mode menu option items.



2. Use the Trim Knob control to scroll to SET UNIT NAME in the address menu and press the Trim Knob control to select it.



3. The SET UNIT NAME pop-up window appears on the monitor display as shown below.



The SET UNIT NAME pop-up window displays either the current care UNIT NAME or is completely blank. The software supports up to seven alphanumeric characters to be used in the UNIT NAME field.

NOTE

It is important that you enter the correct UNIT NAME with regard to spelling, spaces and special characters programmed into the field. If a mistake is made in programming the UNIT NAME field, the monitor is not available on the network for display at central stations within the same care unit.

4. Two sets of arrow icons appear in the UNIT NAME pop-up window.
   - The horizontal (left/right) arrow icons, when highlighted, allow the user to select a specific character for change by rotating the Trim Knob control. Press and release of the Trim Knob while a specific character is highlighted enables that specified character for change.
   - The vertical (up/down) arrow icons, when highlighted, allow the user to scroll through all of the alpha numerics available for each character. Rotating the Trim Knob control at this point allows the user to select a specific alphanumeric to be entered into the specified character position within this field. To enter the chosen character into memory, press and release the Trim Knob control one more time.
5. Repeat step 4 for each character to be entered as part of the UNIT NAME. Up to seven characters may be setup or configured. The manufacturer recommends UNIT NAME fields that are less than seven characters to be left-justified, leaving unused character positions (immediately to the right of the user-entered unit name) blank.
6. When you finish making each character entry, use the Trim Knob control to select the SET UNIT NAME menu option item. Press the Trim Knob control. This programs the newly entered UNIT NAME into the monitor memory and closes the pop-up window.

Bed Number

From the service mode menu option items which appear on the monitor display, follow the next steps of the procedure to setup or configure the BED NUMBER of the monitor.

About the Monitor Bed Number

The monitor BED NUMBER is manually programmed into monitor. The monitor has flash memory which stores the user programmed BED NUMBER. This acts as a software identification code for the following applications:

- For networked monitors, the BED NUMBER provides unique network identification for each monitor from groups of devices sharing the same unit name on the network. The monitor BED NUMBER software is integrated into electronic packets of information which are either sent to or received from other devices on the network.
- General identification: The BED NUMBER also is used for annotation purposes on all graphs generated by the monitor.

WARNING

Do not use the word “none” as a BED NUMBER. This name can be very confusing to users and make network troubleshooting extremely difficult.

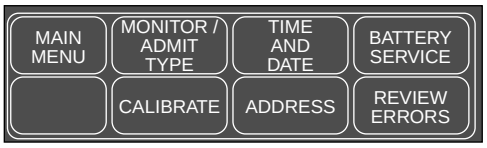
CAUTION

It is very difficult to visually detect spaces (“spaces” are characters) when programmed into the BED NUMBER. The manufacturer recommends avoiding the use of spaces in the BED NUMBER.

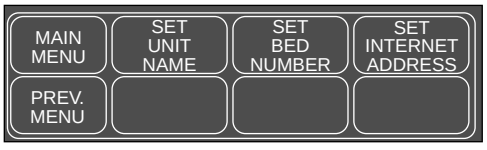
Setup the Bed Number of the Monitor

Follow these steps to setup or configure the BED NUMBER of the monitor:

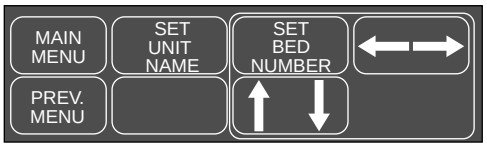
1. Use the Trim Knob control on the front panel of the monitor to select ADDRESS from the service mode menu option items.



2. Use the Trim Knob control to scroll to SET BED NUMBER in the address menu and press the Trim Knob control to select it.



3. The SET BED NUMBER pop-up window appears on the monitor display as shown below.



The SET BED NUMBER pop-up window displays either the current BED NUMBER or is completely blank. The software supports up to five alphanumeric characters to be used in the BED NUMBER field.

NOTES

It is important that the correct BED NUMBER be entered with regard to other monitors within the same care unit. If a mistake is made in programming the BED NUMBER field, the worse-case being a duplicate BED NUMBER on two different monitors within the same care unit, the monitor cannot communicate properly on the network and presents problems when the monitor is setup or configured for display at central stations.

4. Two sets of arrow icons appear in the BED NUMBER pop-up window. Rotate the Trim Knob to highlight one of the sets of arrows and press it to enable each function:

   - The horizontal (left/right) arrows, when highlighted and enabled, allow the user to select a specific character for change by rotating the Trim Knob control. A press and release of the Trim Knob while a specific character is highlighted, enables that specified character for change.
   - The vertical (up/down) arrows, when highlighted, allow the user to scroll through all of the alphanumerics available for each character in the BED NUMBER. Rotating the Trim Knob control at this point allows the user to select a specific alphanumeric to be entered into the specified character position within this field. To enter the chosen character into memory, press and release the Trim Knob control one more time.

5. Repeat step 4 for each character to be entered as part of the BED NUMBER. Up to five characters may be setup or configured. The manufacturer recommends that user-defined BED NUMBER consisting of less than five characters, be left-justified and leave unused character positions (those to the right of the user-defined bed number) blank.

6. When finished making each character entry, use the Trim Knob control to select the SET BED NUMBER menu option item. Press the Trim Knob control. This programs the newly entered BED NUMBER into the monitor memory and closes the pop-up window.

Graph Locations

One area of monitor setup or configuration that most often is overlooked, is the setup or configuration of each GRAPH LOCATION for the monitor. Three types of graphs can be generated by the monitor: manual, alarm and print windows.

The application of the monitor plays an important role in the selection of GRAPH LOCATIONS. The following describes each application:

- For a networked monitor, each type of graph is setup or configured individually and can be directed to various writer/printer locations on the network. Each type of graph can be sent to a networked printer or the internal (build-in) writer. Each type of graph can be setup or configured on the monitor to print at one of the following destinations:
  a. Dash 3000 patient monitor with optional internal writer,
  b. Dash 2000 patient monitor with optional internal writer,
  c. Centralscope Central Station with internal or external writer,
  d. Solar 7000/8000 Patient Monitor with external writer,
  e. Eagle 4000 Patient Monitor with external writer,
  f. Eagle 3100 Patient Monitor with external writer, and/or
  g. Network laser printer.
- For a stand-alone monitor, each type of graph is setup or configured individually and can only be directed to an optional internal writer.

Three separate graph locations can be setup or configured in the monitor. The following describes each GRAPH LOCATION:

MANUAL GRAPH LOCATION — The graph device that prints patient waveforms and annotation. The monitor generates manual whenever the GRAPH GO/STOP front panel control on the monitor is pressed.

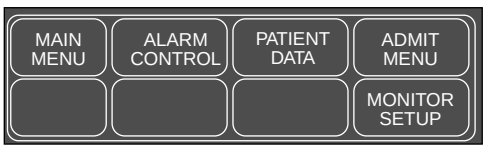
ALARM GRAPH LOCATION — The graph device that prints patient waveforms and annotation. The monitor automatically generates alarm graphs whenever it senses a Crisis Alarm or Warning Alarm.

PRINT WINDOW LOCATION — The monitor displays the graph device that prints patient information in various types of screens. The monitor generates print windows whenever an operator displays and selects a menu option item for each specific function.

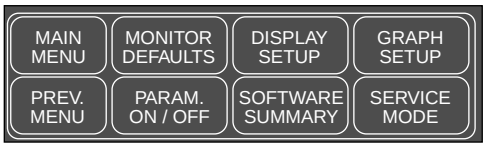
Setup the Graph Locations of the Monitor

Setup or configure the GRAPH LOCATIONS of the monitor by the following steps:

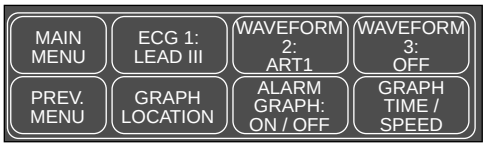
1. Use the Trim Knob control on the front panel of the monitor to select MONITOR SETUP from the main menu option items.



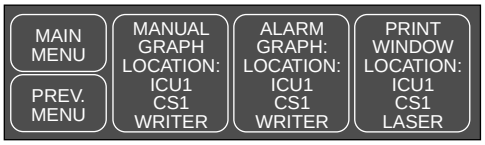
2. Use the Trim Knob control on the front panel of the monitor to select GRAPH SETUP from the monitor setup menu option items.



3. Use the Trim Knob control on the front panel of the monitor to select GRAPH LOCATION from the graph setup menu option items.



4. Use the Trim Knob control on the front panel of the monitor to select either MANUAL GRAPH LOCATION, ALARM GRAPH LOCATION, or PRINT WINDOW LOCATION from the graph location menu option items.



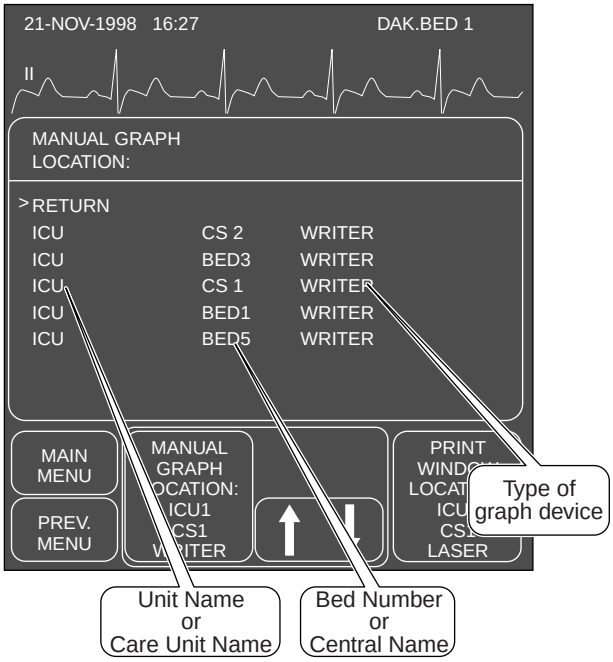
NOTE

The graph location menu has menu option items for programming the manual graph location, the alarm graph location and the print window location. All three must be setup and configured individually for full functional use of the monitor.

Select one of the graph location menu option items on the monitor to display a pop-up list of all available writers.

Select a Writer

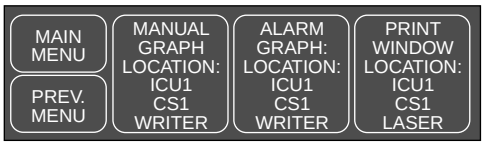
The graph location pop-up list appears in the left portion of the monitor display.



The pop-up list includes the unit name (or care unit name), the bed number (or central name), as well as the type of graph device for:

- The internal writer of the monitor, and/or
- Writers connected to devices that have an identical care UNIT NAME on the network.

1. Rotate the Trim Knob control to scroll (move the cursor) to a desired graph location and press the Trim Knob control to program the selected writer graph location into the monitor flash memory. The graph location menu option item changes to show the selected graph location and the pop-up list closes.



2. When you finish making each graph location selection, use the Trim Knob control to scroll to MAIN MENU from the graph location menu option items. Press the Trim Knob control to exit all of the menus and return to the main menu.

Time and Date Setup

The TIME AND DATE function of the monitor provides a means for the real time clock circuit to be setup correctly or changed by the user. The TIME AND DATE setup or configuration of the monitor is used mainly for the purpose of documentation of patient events and history files stored in the monitor each time a patient is admitted. Therefore, it is important that the correct time and date be entered into the monitor.

Leap Years and Daylight Savings Times

The internal real time clock circuit of the monitor automatically compensates for leap years, but does not automatically compensate for daylight savings time changes. The latter requires manual setup or configuration of the monitor TIME AND DATE field each spring and fall.

CAUTION

For networked monitors, changing the TIME AND DATE field on the monitor causes the new time and date to be broadcast over the network. All other devices on the network change the time and data to match the newly entered TIME AND DATE on the monitor. This may cause other monitors on the network to change time-dated patient data stored in each monitor.

Procedure

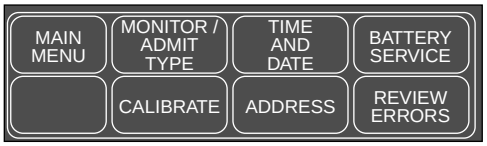
Follow these steps to setup or configure the TIME AND DATE of the monitor:

1. Use the Trim Knob control to scroll to and select the TIME AND DATE menu option from the SERVICE MODE menu.

WARNING

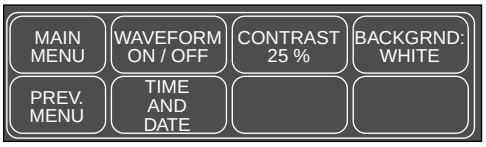
TIME AND DATE parameters are actively enabled for change each time the SET TIME or SET DATE menu option items are selected.

- For monitors connected to the network, select the menu option from the SERVICE MODE menu.



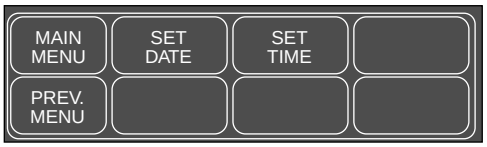
- For a stand-alone monitor (not connected to the network), select the menu option from the DISPLAY SETUP menu.

color version

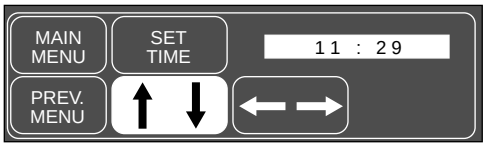


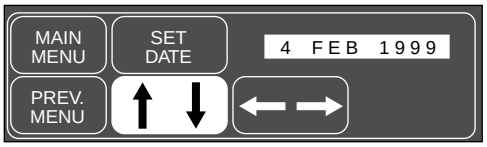
monochrome version

2. To enter or change time on the monitor, select SET TIME from the time and date menu option items. To enter or change the date on the monitor, select SET DATE from the time and date menu option items.



3. To enter or change a SET TIME or SET DATE parameter, rotate the Trim Knob control to select a parameter for change. Press the Trim Knob control to enable the selected parameter for change.





4. Rotate the Trim Knob control to enter or change the selected time or date parameter. Press the Trim Knob control to enter new time or date parameters into temporary memory in the monitor.

NOTE

Changes are written to flash memory in the monitor when SET TIME or SET DATE is selected and set.

When each desired time or date entry has been made, immediately rotate the Trim Knob control to select SET TIME or SET DATE in the time and date menu on the monitor. Press the Trim Knob control to program the new time or date into flash memory in the monitor.

7 UPPER LEVEL ASSEMBLY

Contents

Safety Information for Disassembly

Please observe the following safety information when disassembling the monitor.

ESD Protection

All PCBs contain semiconductor which must be protected from electrostatic discharge. When working on open montiors and when handling PCBs, it is important to observe ESD safety precautions. Please read also the paragraph "ESD Discharge" in this chapter. It is especially important that service technicians always establish contact between the PCB and ground before touching a component.

ESD Protection Guidlines

Use the following ESD protection guidlines when working on an open monitor or when handling PCBs.

- Use an ESD protective underlay connected to a non-fused earth conductor potential.
- Connect yourself to the ESD protective underlay via an armband.
- Use an ESD protective travel bag to transport PCBs.

Suggested Tools/ Equipment

The following tools may be required for disassembling the unit.

Goosenecked tweezers

Posidrive screwdriver

Type "Posidrive", sizes 0 , 1 and 2

Slotted head screw screwdriver 6mm for battery screws

Connector wrench 5.5 mm for hexagonal spacers

ESD packaging for PCBs

ESD underlay with ESD armband

Disassembly Procedure

Preparations before Opening the monitor

Before any service interventions, turn off the device and disconnect the device from power line.

Opening Unit

To open the unit, do the following.

1. Lay the monitor with the front panel face down on a clean, level surface (ESD pad) which is placed on a soft material to avoid scratches on the front panel.
2. Undo the 6 screws on the rear to remove the front panel frame and open the device.
3. Fold the front panel frame down and disconnect the keypad connector.

Display

To remove the display, do the following.

1. Open the unit as described in **Opening Unit**.
2. Remove the 2-pole converter plug and the flat cable connector for the display from the PCB Mainboard.
3. Undo the screws which hold the converter.
4. Undo the 4 screws which hold the display and remove it.

DAS PCB

To remove the DAS PCB, do the following.

1. Open the unit as described in **Opening Unit**.
2. Remove the 2-pole converter plug and the flat cable connector for the display from the PCB Mainboard.
3. Tilt the display frame with the DAS board towards the front.
4. Disconnect the DAS flat cable connector.
5. Remove NIBP tubing from DAS PCB.
6. Undo the 4 screws which hold the DAS PCB and remove it.

DAS Input Assembly

To remove the DAS Input Assembly, do the following.

1. Open the unit as described in **Opening Unit**.
2. Remove the 2-pole converter plug and the flat cable connector for the display from the PCB Mainboard.
3. Tilt the display frame with the DAS board towards the front.
4. Loosen the DAS input assembly and remove it
5. Remove NIBP tubing from DAS input assembly.

DASH 2000 Assembly

1. Open the unit as described in **Opening Unit**.
2. Remove the 2-pole converter plug and the flat cable connector for the display from the PCB Mainboard.
3. Tilt the display frame with the DAS board towards the front.
4. Disconnect the DAS flat cable connector.
5. Loosen the DAS input assembly.
6. Remove NIBP tubing from DAS input.
7. Remove Alarm Light cable from PCB Main Connector

For devices equipped with writer:

8. Open writer and remove paper.
9. Loosen the 2 screws in the writer housing and carefully pull out the writer.
10. Remove writer cable which is attached to the PCB Mainboard by means of a screw.
11. Loosen writer bracket and carefully pull it out towards the inside.

12. Remove speaker from PCB Mainboard.
13. Remove 4 screws at the rear panel.
14. Remove 4 screws at the foot pad.
15. Remove 2 screws at the bottom of the enclosure.
16. Remove ground wire from enclosure.
17. Carefully pull the DASH2000 assembly from the enclosure

PCB Main Connector

1. Disassemble the **DASH 2000 Assembly** as described above.
2. Undo the 3 screws from PCB Main Connector and remove it.

PCB NIBP

1. Disassemble the **DASH 2000 Assembly** as described above.
2. Disconnect battery connector and remove the 2 screws from the battery bracket.
3. Disconnect the NIBP connector from the Mainboard.
4. Undo the 3 screws which hold the NIBP board on the battery bracket.
5. Remove NIBP tubing from the pump.
6. Disconnect NIBP Pump connector and remove NIBP board.

PCB Mainboard

1. Disassemble the **DASH 2000 Assembly** as described above.
2. Disconnect battery connector and remove the 2 screws from the battery bracket.
3. Disconnect the NIBP connector from the Mainboard and remove the battery bracket with NIBP board.
4. Remove the battery and the battery pad.

5. Undo the 3 screws which hold the PCB Mainconnector and remove it.
6. Disconnect DAS flat cable from PCB Mainboard.
7. Remove ground wire from PCB Mainboard.
8. Undo the 2 hexagonal spacers and the 3 screws which hold the PCB Mainboard.
9. Pull the PCB Mainboard from the Power Supply Connector.

Power Supply PCB

1. Disassemble the **PCB Mainboard** as described above.
2. Disconnect the AC-Line Connector from the Power Supply PCB
3. Undo the 4 screws which hold the Power Supply PCB and remove it.

NOTE

When reassembling the Power Supply PCB on the frame be sure the ferrite ring is on the upper left distance bolt and the shield carton is under the Power Supply PCB.

Assembly Note

NOTE

When reassembling the PCBs or the DASH 2000 use the above described disassembly instructions in reverse order.

Spare Parts List

Printed circuit boards and assemblies*

Part	Part Description	Part Number
Pcb. Main Board	Pcb. Mainboard with latest software in english language	303 44808 S
Pcb.Main Board	Exchange Pcb. Mainboard with latest software in english language	389 00434 S
Pcb. Main Connector	Pcb. Main Connector (high pot tested)	303 44809
DAS Ass.	DAS Assembly (high pot tested) with latest software	303 44810 S
DAS Ass.	Exchange DAS Assembly (high pot tested) loaded with latest software	389 00435 S
Pcb.Dash2000 Expansion PT	Pcb. Expansion Board for connection of Dogging Station	801550-001
Pcb.Converter DC-AC	Pcb. Converter DC-AC for monochrome display	93011708
Pcb. Converter		
DC-AC	Pcb. Converter DC-AC for color display	93011863
Pcb. NIBP	Pcb. NIBP incl. Valve and Pressure Sensor	388 032 78
Pcb. Power Supply	Pcb. Power Supply	93011859
Pcb. DAS Input	DAS Input Assembly with ECG, IBP, TEMP, NIBP and SpO2 connectors. Labels (language dependent) have to be ordered seperately.	38803277
Thermal Printer	Thermal Printer 50mm (CS2) loaded with latest software.	419743-002 S

* Boards and Assemblies signed with S are loaded with latest software and may be overloaded in the field. We support to deliver these boards completely configured and loaded with the desired software. This has to be mentioned in the order with the following added information: S/N of Dash, language, P/N of Dash and Software Version.

Mechanical Parts

Part	Part Description	Part Number
Front Bezel	Front Bezel incl. Filter. Labels (language dependent) have to be ordered seperately.	2000347-001
Chassis	Housing rear (metal) not for field replacement	419030-004
Bracket Writer MTG	Bracket as housing for the recorder.	421263-001
Cover Side wo/writer	Cover Side for Dash 2000 without printer	419378-001
Plug Holder	Plug Holder for mains plug and doggin connector	43252584
Bracket for Inverter	Bracket DC-AC converter for monochrome display	43252577
Pump Bracket	Pump Bracket (rubber)	43252580
Battery Socket	Battery Socket	43252551
Plastik Cover	Plastic Cover to close blood pressure connector	43252618
Foot Pad	Foot Pad (plastic)	421877-001
Plate Mount GCX	Plate Mount GCX (metal socket for GCX bracket)	420001-001
Handle Half Front	Handle Half Front Dash (part of the complete handle)	419998-001
Handle Half Rear	Handle Half Rear Dash (part of the complete handle)	419998-002
Alarm Light Dash	Alarm Light Insert Dash Handle (part of the complete handle)	422309-001
Blank Insert Dash Handle	Blank Insert Dash Handle (part of the complete handle)	422296-002

Switch Assemblies/Cables/Connectors

Part	Part Description	Part Number
Keypad Assembly	Keypad Assembly incl. Trim Knob potentiometer	418957-001
Flex Recorder Connector	Flex cable for Recorder connection	38803300
Flex Cable	Flex Cable to keypad assembly	91920394
Cable Dash Alarm Light	Cable from Dash Alarm Light to Mainboard	422647-001
Flat Cable 15 pin	Flat Cable 15 pin for Color Display	91920395

Labels

All the labels for one specific language for Dash 2000 are on one label set

Part	Part Description	Part Number
Label Kit English	Label Kit with labels for Dash 2000 in English language	422691-001
Label Kit German	Label Kit with labels for Dash 2000 in German language	422691-002
Label Kit French	Label Kit with labels for Dash 2000 in French language	422691-003
Label Kit Spanish	Label Kit with labels for Dash 2000 in Spanish language	422691-005

Displays

Part	Part Description	Part Number
LCD Module Monochrome	LCD-Module Grafik 320 x 240 Backlight (HLM 8619-010200)	93011717
LCD Module Color	LCD-Modul Grafik 320 x 240 Color (KCS 057 QV1AA-A07)	93011862

Miscellaneous

Part	Part Description	Part Number
Battery NC	Battery rechargeable, NC, 12 V 2,0 Ah	92916781
Pump Assembly	Pump Assembly (pump incl. Wiring)	2000355-001
Manifold Valve	Manifold Valve	414621-001
Speaker	Speaker 66 mm SQ water rsstnts	419482-001
Trim Knob	Trim Knob	92607501
Filter	Filter 1/8 for NIBP	92916708
Check Valve	Check Valve for NIBP	91920320
NIBP Connector	NIBP Connector insert	43252398
Power Receptacle	Power Receptacle	91541520
Pot.Equalization Connector	Pot. Equalization Connector	91541408
Cable Assy. Cinch MDC 7P15	Defi Sync. Cable for 7 pole DIN connectore Dash 2000/ Dash 3000 with one open end (3m)	2000633-001
Power Cord	Power Cord angeled 2,5 m (Europe)	422845-001

Documents

Part	Part Description	Part Number
Service Manual	Service Manual Dash 2000 V1	2000412-001
User Manual	User Manual V1 US/English	22749904
User Manual	User Manual V2 German	22749901
User Manual	User Manual V2 French	22749902
User Manual	User Manual V2 Spanish	22749903
User Manual	User Manual V2 Italian	22749905
User Manual	User Manual V2 US/English	22749906

8 ASSEMBLY DRAWINGS

Contents

Introduction

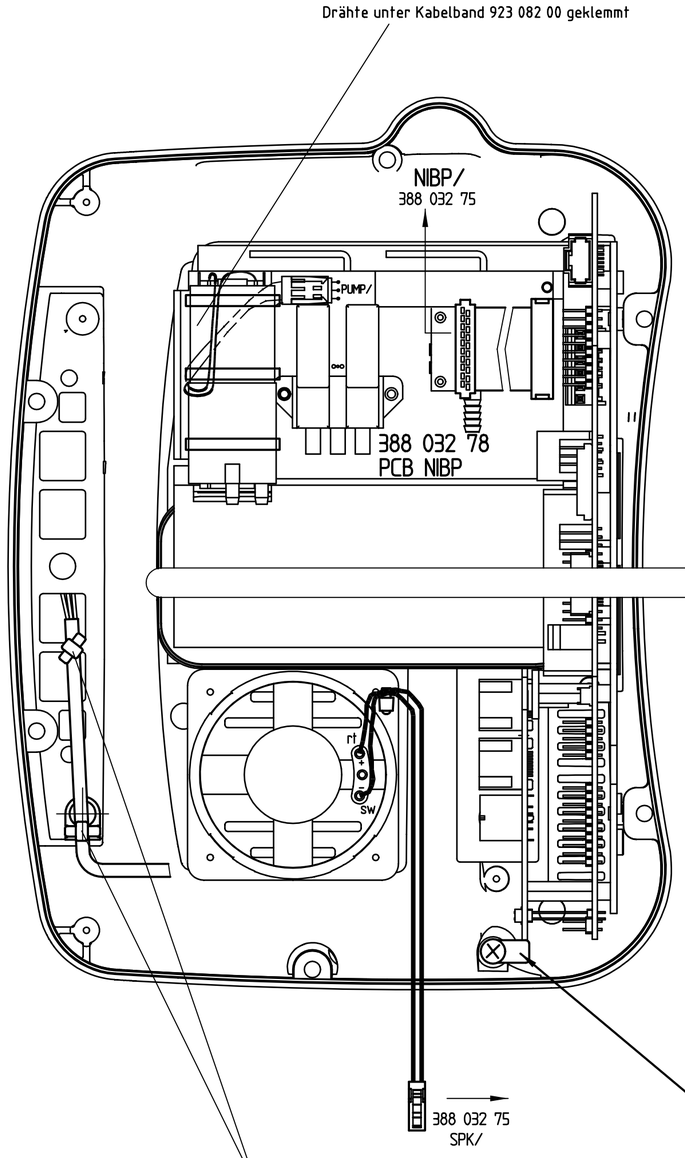
Included in this section is a complete set of mechanical diagrams, reference diagrams, schematic diagrams and parts lists.

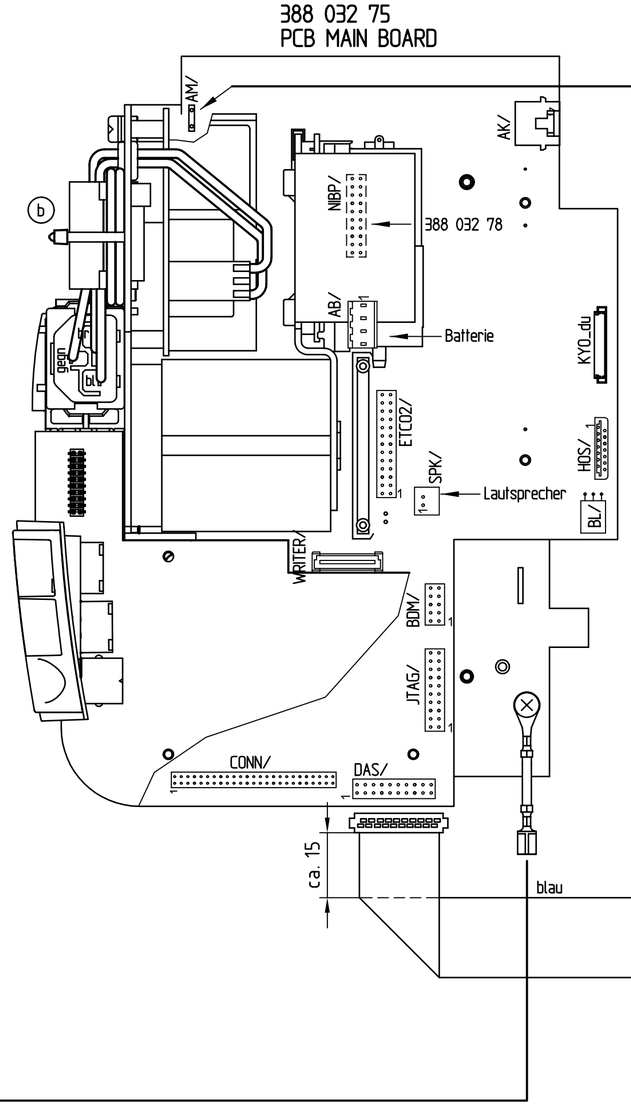
Mechanical diagrams — These diagrams show the mechanical assembly of the Dash 2000 monitor.

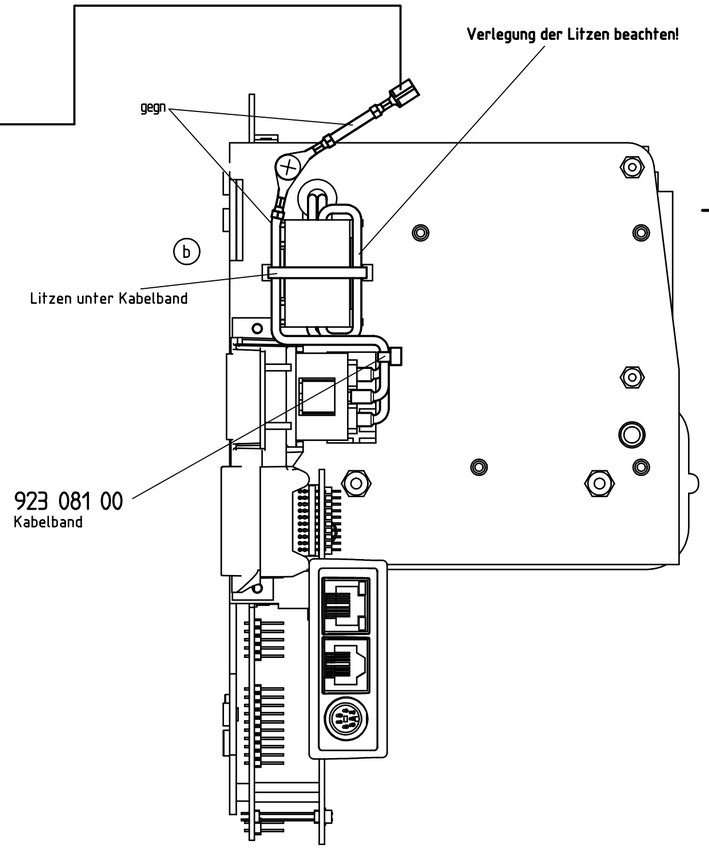
Reference diagrams — These diagrams provide a reference and view of the used components in the schematic.

Schematic diagrams — These diagrams show the electrical wired connections between the used analog and digital electronics components.

Schutzvermerk nach DIN 34 beachten







Kabelbaum mit Kabelbinder 923 081 00
an Befestigungssokel 923 096 04 und an der
Gehäusestrebe befestigt.

c	1x	062855	Lage der Kabelbaumes dargestellt	27.07.99	G.Krieg
b	2x	062224	Lage der Litzen dargestellt	21.06.99	G.Krieg
a	--	neu	keine Aenderungen	30.03.99	G.Krieg
Aend.Index Revision	kannt vor numbers	ECO No.	Änderungsbeschreibung - Change Description	Datum - Date	Name

Marquette Hellige GmbH
Munzinger Str. 3
D-79111 Freiburg

Werkstoff - Material

Rohteil

Freimaßtoleranz - Tolerance

File Name: 30344633-D03_SZ01

Dokument Bezeichnung - Document Description: doc schem SZ01

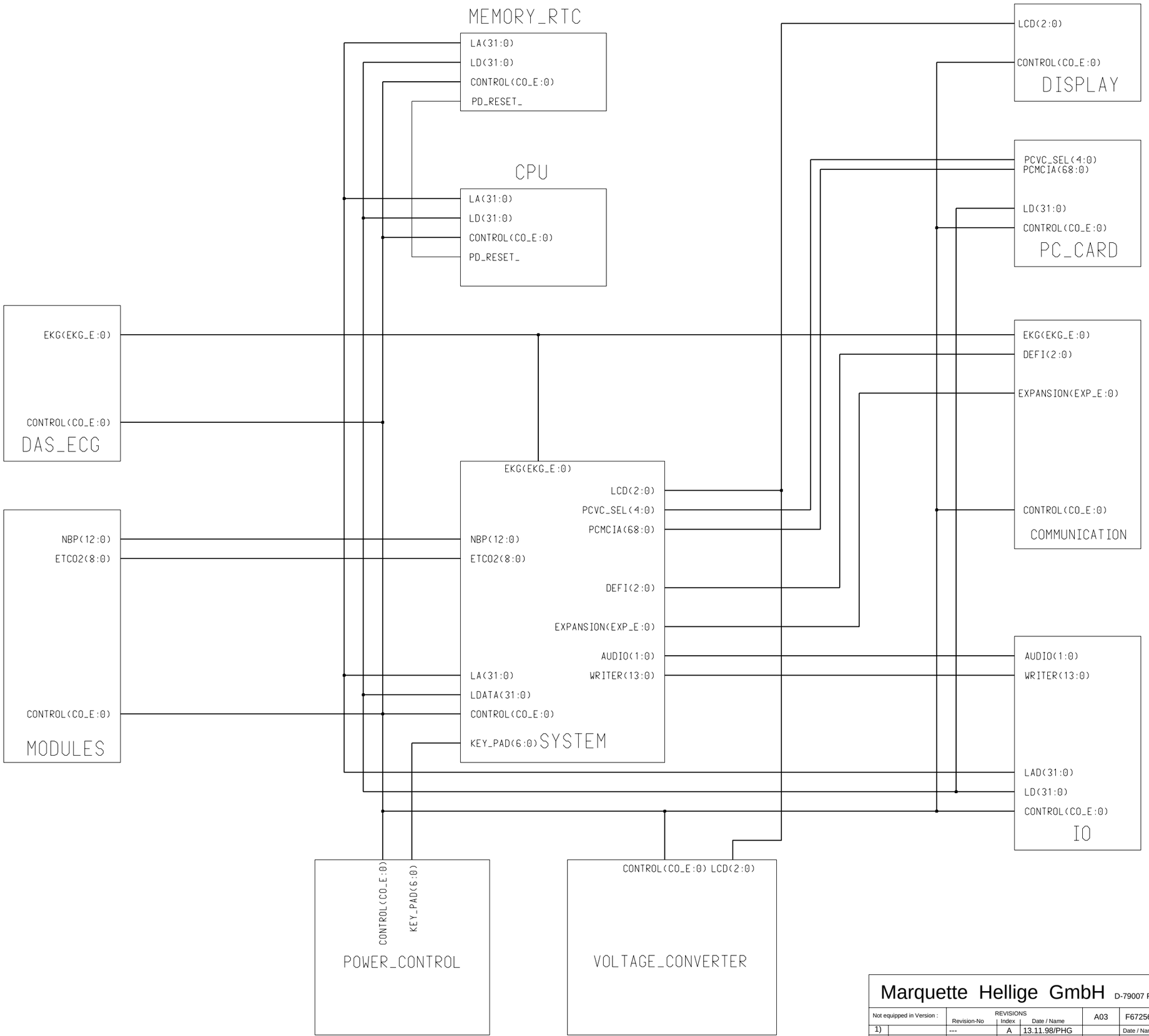
Dokument Nr. - Document No.: 30344633-D03

Projektion	Format	Maßstab - Scale	Oberfläche - Finish		Datum - Date	Name
	A2	1:1		Entworfen-Drawn	26.01.99	G.Kaltenbach
				Geprüft-Approved	26.01.99	W.Löhning
				Geprüft-Approved		

Zeichn.Art/Blatt Nr.: SZ/01

Teil Bezeichnung - Part Description: DASH 2000 vormontiert

Teil Nr. - Part Number: 303 446 33



Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 75 P	Sheet: 1 of 13
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67256	
1)		---	A	13.11.98/PHG		Date / Name	LPL Main Board
2)		---	B	02.03.99/PHG	DRAWN	13.11.98/PHG	
3)					APPROVED	13.11.98/PHG	PCB Main Board
4)							
5)					ISSUED	PH.GEIGER	

[1997, 10, 22, 4]
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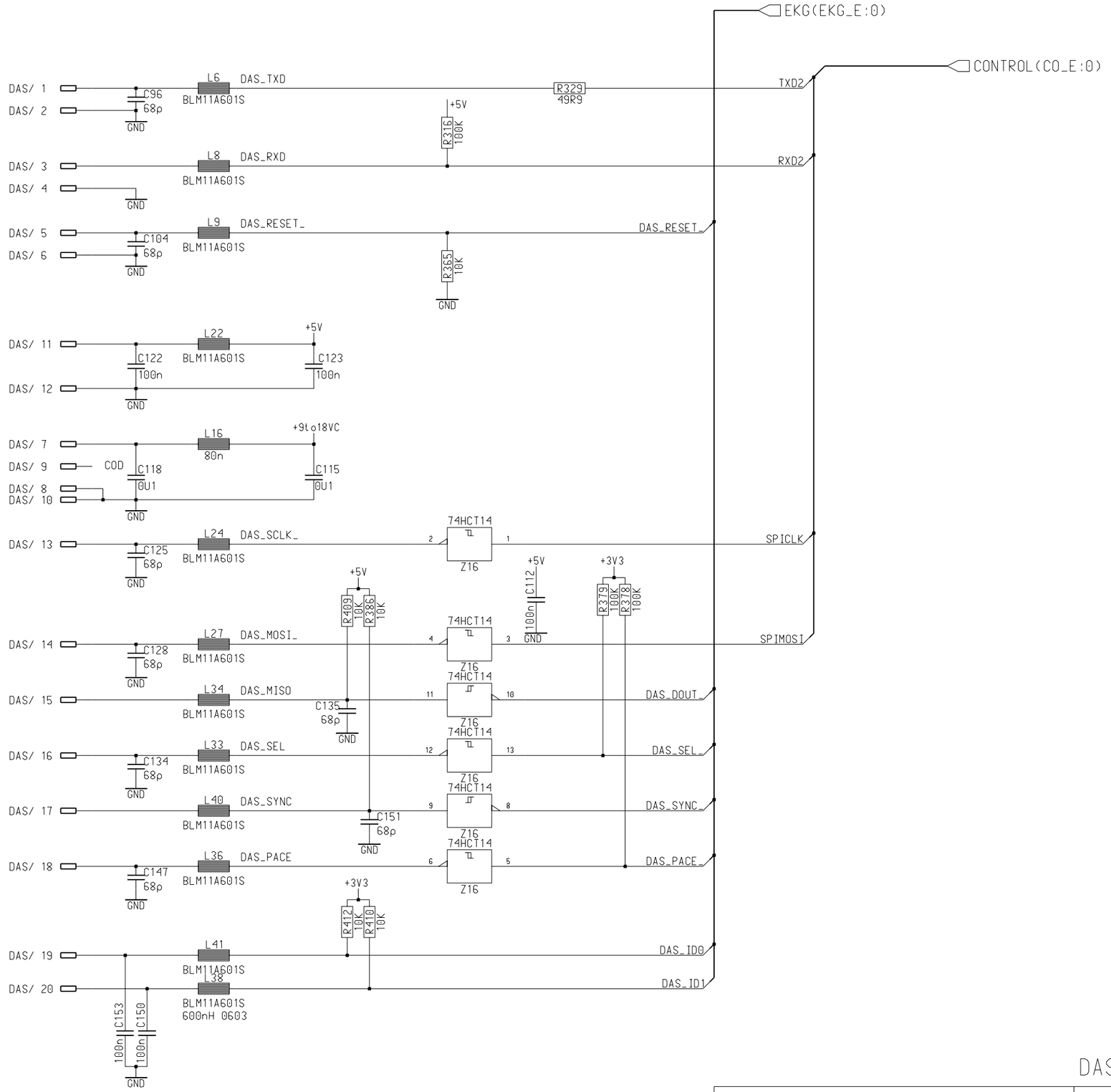

DAS_ECG

Marquette Hellige GmbH D-79007 Freiburg					388 032 75 P	Sheet: 2 of 13
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67256
1)		---	A	13.11.98 / WHL		Date / Name
2)		---	B	02.03.99 / WHL	DRAWN	13.11.98/PHG
3)					APPROVED	13.11.98/PHG
4)						
5)					ISSUED	PH.GEIGER
					LPL Main Board	
					PCB Main Board	

Schutzvermerk nach DIN 34 beachten

[1997, 12, 17, 4]
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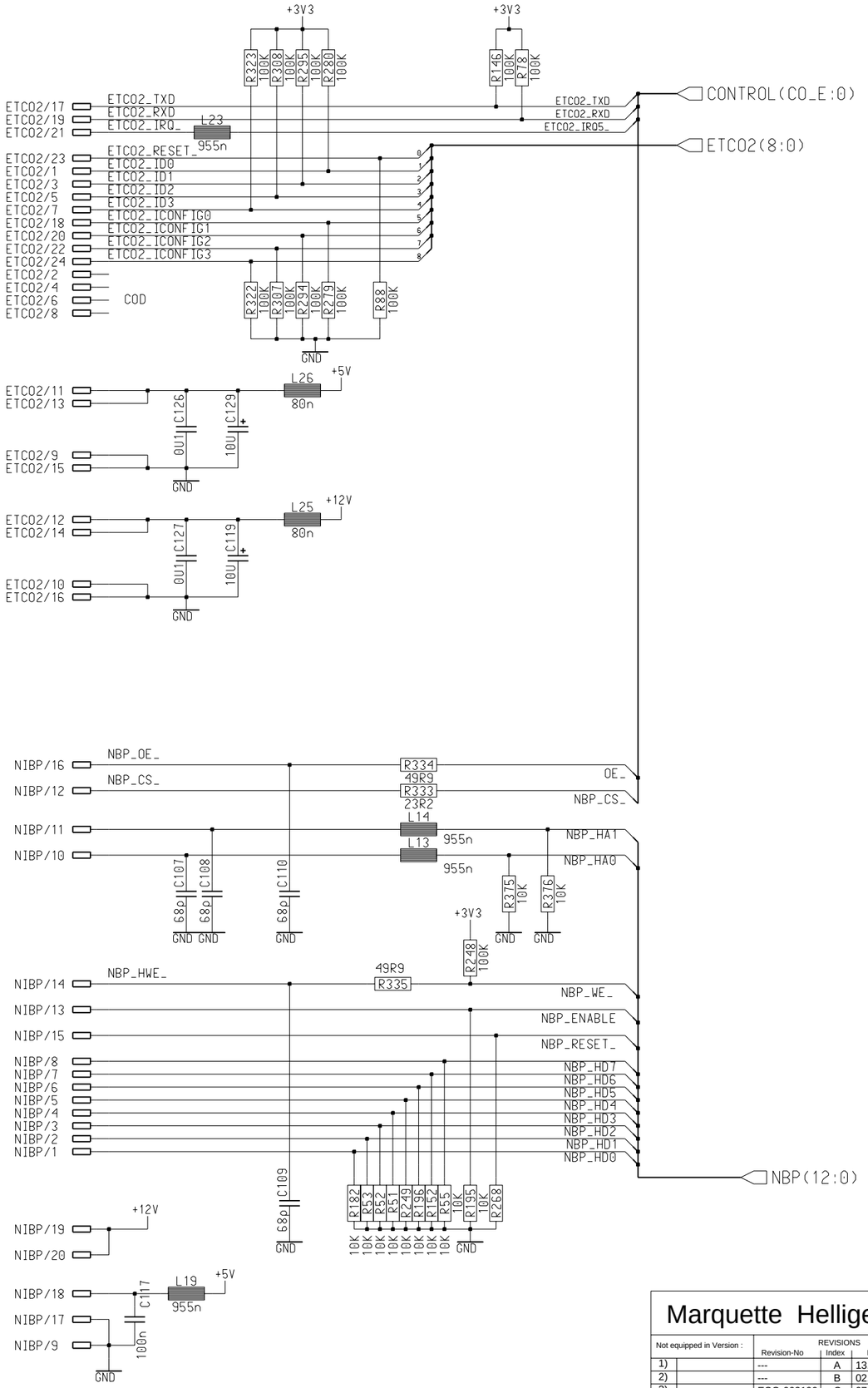

MODULES

Marquette Hellige GmbH D-79007 Freiburg						388 032 75 P	Sheet: 3 of 13
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67256	
1)		---	A	13.11.98/PHG		Date / Name	LPL Main Board
2)		---	B	02.03.99/PHG	DRAWN	13.11.98/PHG	
3)		ECO-062190	C	07.05.99/PHG	APPROVED	13.11.98/PHG	PCB Main Board
4)							
5)					ISSUED	PH.GEIGER	

4MB DRAM (3.3V)
1M x 32Bit

PD_RESET_

CONTROL(CO_E:0)

LA(31:0)

LD(31:0)

Vcc=+3V3 HM51W16165 Z5: DRAM_RAS_, CAS0_, CAS1_, GPL_A2_, OE_ → RAS_, UCAS_, LCAS_, W_, OE_; LA29..LA18 → A0..A11; LD15..LD0 → DQ0..DQ15; NC1..NC5 ← GPL_A2_, DRAM_RAS_, OE_, CAS0_, CAS1_

Vcc=+3V3 HM51W16165 Z6: RAS_, UCAS_, LCAS_, W_, OE_ ← DRAM_RAS_, CAS2_, CAS3_, GPL_A2_, OE_; LA31..LA18 → A0..A11; LD31..LD16 → DQ0..DQ15; NC1..NC5 ← GPL_A2_, DRAM_RAS_, OE_, CAS2_, CAS3_

RDWR_, OE_, WE0_IORD, WE1_IOWR, SRAM_CS_

74AC08 Z10 (&, Vcc=+3V3)

74LV4066D Vcc=+3V3BAT Z1 (X1)

R2 10K (+3V3BAT)

C24 100n, C23 100n (+3V3, GND)

C26 100n, C25 100n (+3V3, GND)

512KB SRAM (3.3V BAT)

TC554161FTL-70V Vcc=+3V3BAT Z2: RW_, OE_, UB_, LB_, CE_; LA30..LA13 → A0..A17; LD15..LD0 → IO0..IO15

C2 100n, C4 100n (+3V3BAT, GND)

R6 10K, R8 10K (+3V3BAT); 74LV4066D Vcc=+3V3BAT Z1 (X1)

Flash (3.3V)

E28F016SV Z3 (FLASH 1MBIT x16, Vcc=+3V3): LD15..LD0, LA29..LA9, NC_P29, NC_P30, NC_P3, 3_5 VPP, BYTE, RY_BY, WP, RP, CE1, CE0, WE, OE

E28F016SV Z4 (FLASH 1MBIT x16, Vcc=+3V3): LD31..LD16, LA29..LA9, NC_P29, NC_P30, NC_P3, 3_5 VPP, BYTE, RY_BY, WP, RP, CE1, CE0, WE, OE

C61 100n (+3V3, GND); C74 100n (+3V3, GND)

C7 100n (+5V)

10K R17 (FLASH_WP); 10K R15 (FLASH_WP_); HRESET_

FLASH_CS_, FLASH_CS_

10K R21 (+3V3, FLASH_WE0_); 10K R11 (+3V3, FLASH_WE1_)

OE_, OE_

74AC08 Z10 (&, Vcc=+3V3)

EEPROM

NM24C16LM8 Z13: VCC, NC1, SCL, SDA, A0, A1, A2, GND

I2CSCL, I2CSDA

R155 10K (+5V); R185 10K, R165 10K (GND)

RTC

RTC8593SA X3: OSC1, INT_, SCL, SDA, VDD, GND, RESET_

R200 4K75, R212 4K75, R234 4K75 (+5V)

C66 10P; C71 0U1 (VDD, GND)

D14 BAS32 (+5V); D15 BAS85 (+3V3BAT)

I2CSCL, I2CSDA

HRESET_ → 74HCT14 Z17 → 74HCT14 Z17 → BAS85 D16 → RESET_

MEMORY

Marquette Hellige GmbH D-79007 Freiburg						388 032 75 P
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F67256	Sheet: 4 of 13
1)	---	A	13.11.98/PHG		Date / Name	
2)	---	B	02.03.99/PHG	DRAWN	13.11.98/PHG	LPL Main Board
3)				APPROVED	13.11.98/PHG	PCB Main Board
4)						
5)				ISSUED	PH.GEIGER	

[1997, 12, 10, 4]
$USER_CAE_B/dash2000/main_board/design/memory

MPC821

Z8

CONTROL(CO_E:0)

LA(31:0)

LD(31:0)

Reset Configuration

POWER MONITOR

Clock Generator

CPU 1

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg					388 032 75 P	Sheet: 5 of 13
Not equipped in Version :	REVISIONS			A03	F67256	
	Revision-No	Index	Date / Name		Date / Name	
1) 38803275	---	A	3.11.98/PHG			
2)	---	B	02.03.99/PHG	DRAWN	13.11.98/PHG	LPL Main Board
3)	ECO-062190	C	07.05.99/PHG	APPROVED	13.11.98/PHG	PCB main board
4)						
5)				ISSUED	PH.GEIGER	

[1997, 12, 10, 4]
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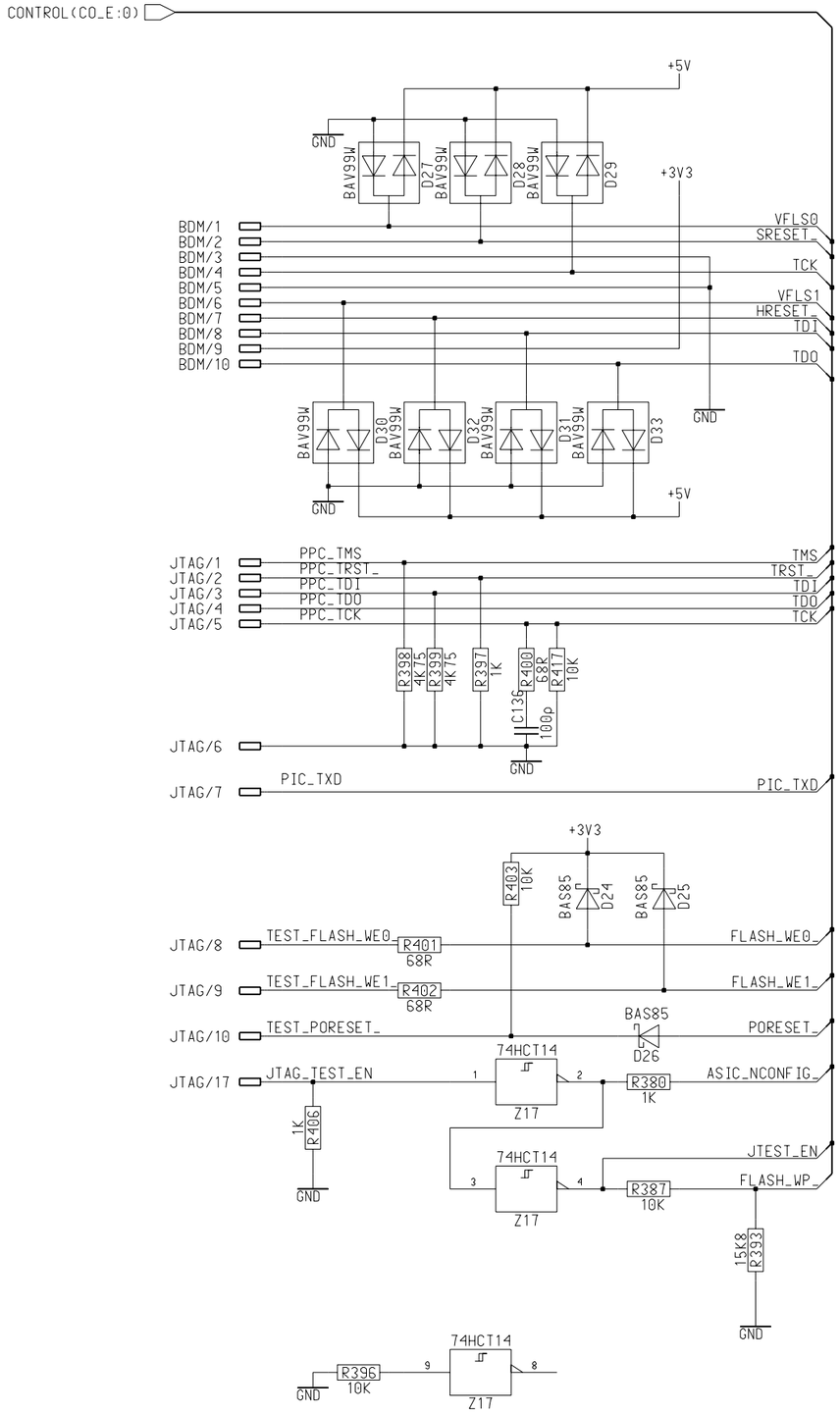

BackGroundDebug Port

JTAG Port

CPU 2 TEST PORT

Marquette Hellige GmbH D-79007 Freiburg						388 032 75 P
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F67256	Sheet: 6 of 13
1)	---	A	13.11.98/PHG		Date / Name	LPL Main Board
2)	---	B	02.03.99/PHG	DRAWN	13.11.98/PHG	
3)				APPROVED	13.11.98/PHG	PCB Main Board
4)						
5)				ISSUED	PH.GEIGER	

Schutzvermerk nach DIN 34 beachten

[1998, 3, 6, 6]
$USER_CAE_B/dash2000/main_board/design/cpu

PCMCIA(68:0)
PCVC_SEL(4:0)
WRITER(13:0)
ETCO2(8:0)
KEY_PAD(6:0)
NBP(12:0)
EKG(EKG_E:0)
EXPANSION(EXP_E:0)
DEFI(2:0)
CONTROL(CO_E:0)
AUDIO(1:0)
LCD(2:0)
LDATA(31:0)
LA(31:0)
ETCO2_ID0
WR_RD_
NBP_HA0
NBP_HA1
NBP_HD5
WR_READY
WR_D4
BPCWE_A_
BCE2_A_
PCCA25
AUTO_ID_TX
AUTO_ID_RX
PER_AUTO_ID_TX
PER_AUTO_ID_LOOP
+3V3
GND
EPF6024ABC256
Z18
SYSTEM ASIC
Watchdog Enable = ON
LCD_ MONO= OFF
LCD_ COLOR= ON
DRAM_ID0
DRAM_ID1
DRAM_ID
ASIC_TCK
ASIC_TDO
ASIC_TMS
ASIC_TDI
JTAG/11
JTAG/12
JTAG/13
JTAG/14
JTAG/15
JTAG/16
JTAG/18
JTAG/19
JTAG/20
COD
LD5
MP1
MP2
MP3
MP4
MP5
MP6
MP7
MP8
MP9
R33 100K
R144 10K
R85 10K
R262 1K
R181 1K
R193 1K
R404 1) 100R
R128 1K
R32 10K
R58 1K
R113 1K
R104 1K
R50 10K
R115 30R1
R76 10K
R49 10K
R34 1) 10K
R29 1) 10K
R28 10K
R30 10K
C94 100n
C51 100n
C31 100n
C22 100n
C42 100n
C32 100n
C20 100n
C21 100n
C54 100n
C39 100n
C38 100n
C72 100n
C19 100n
C73 100n
C37 100n
C63 100n
S1

Not equipped in Version :		REVISIONS			A03	F67256
		Revision-No	Index	Date / Name		Date / Name
1)		---	A	13.11.98/PHG		
2)		---	B	02.03.99/PHG	DRAWN	13.11.98/PHG
3)					APPROVED	13.11.98/PHG
4)						
5)					ISSUED	PH.GEIGER

Marquette Hellige GmbH D-79007 Freiburg

388 032 75 P

Sheet: 7 of 13

LPL Main Board

PCB Main Board

Schutzvermerk nach DIN 34 beachten

[1997, 12, 11, 5]
$USER_CAE_B/dash2000/main_board/design/system

POWERSUPPLY

POWER REGULATOR

VOLTAGE REGULATOR

NC-BATTERY

GAS GAUGE

KEYPAD AC

POWER CONTROLLER

ON OFF INTERFACE

Schutzvermerk nach DIN 34 beachten

Not equipped in Version :		REVISIONS			A03	F 67 256	
		Revision-No	Index	Date / Name		Date / Name	
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2)		---	B	02.03.99 / WHL	DRAWN	13.11.98/ WHL	
3)		061670	C	08.07.99 / HAW	APPROVED	13.11.98 / WHL	
4)							
5)					ISSUED	PH.GEIGER	

Marquette Hellige GmbH D-79007 Freiburg

388 032 75 P

Sheet: 8 of 13

LPL MAIN BOARD

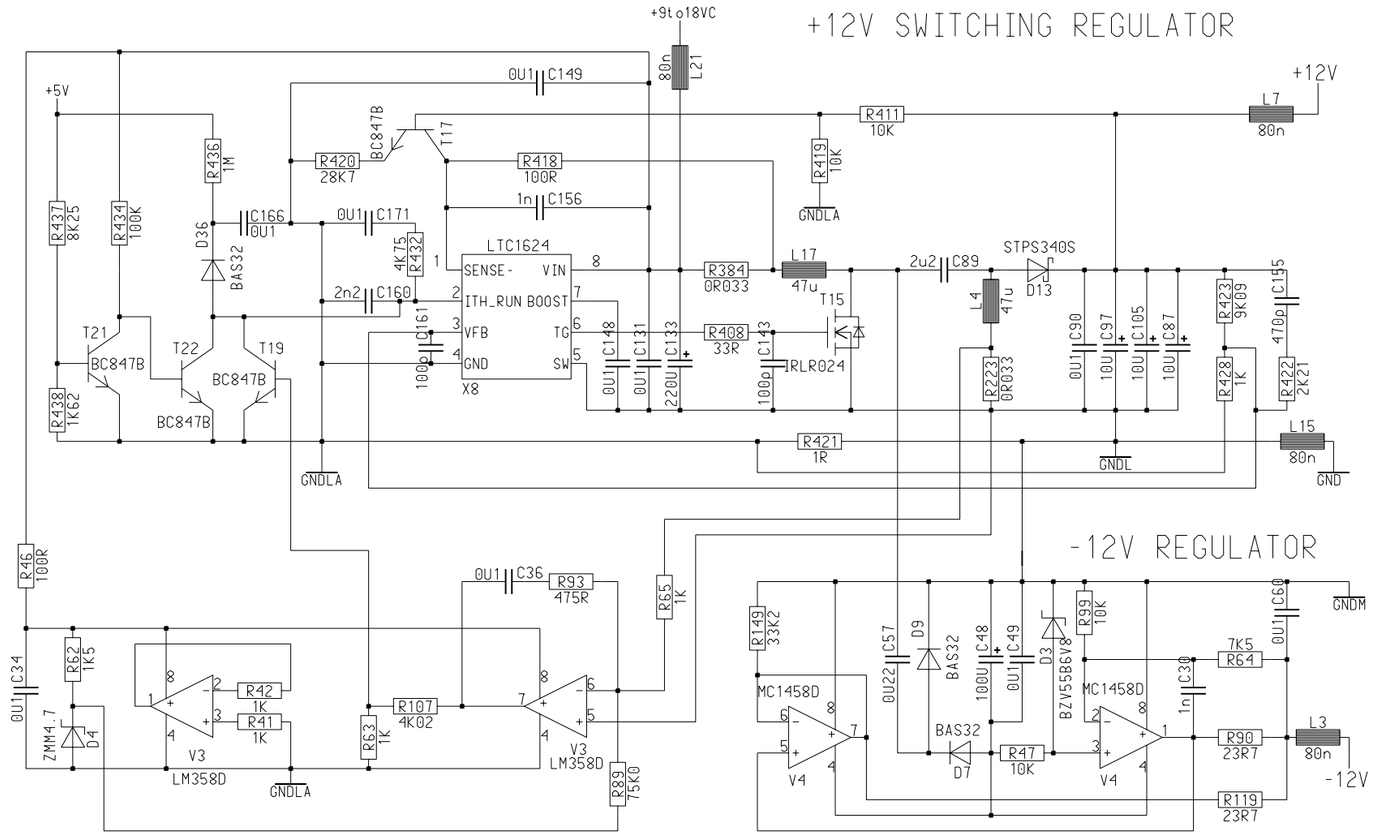
PCB MAIN BOARD

POWER_CONTROL

[1997, 11, 28, 6]

$USER_CAE_B/dash2000/main_board/design/power_control

+12V SWITCHING REGULATOR


+9to18VC
L21 80n
+5V
0U1 C149
+12V
L7 80n
R411 10K
R419 10K
GNDLA
R420 28K7
BC847B T17
R418 100R
1n C156
R436 1M
R437 8K25
R434 100K
D36 BAS32
C166 0U1
0U1 C171
4K75 R432
2n2 C160
LTC1624
SENSE- VIN
ITH_RUN BOOST
VFB TG
GND SW
X8
R384 0R033
L17 47u
2u2 C89
STPS340S D13
T15 IRLR024
L4 47u
R223 0R033
0U1 C90
10U C97
10U C105
10U C87
R423 9K09
C155 470p
R422 2K21
R428 1K
R421 1R
L15 80n
GND
GNDL
T21 BC847B
T22 BC847B
T19 BC847B
R438 1K62
C161 100p
C148
C131 0U1
C133 0U1
220U
R408 33R
C143 100p
R46 100R
C34 0U1
R62 1K5
ZMM4.7 D4
R42 1K
R41 1K
V3 LM358D
GNDLA
R107 4K02
R63 1K
C36 0U1
R93 475R
R65 1K
R89 75K0
R149 33K2
C57 0U22
D9 BAS32
C48 100U
C49 0U1
D3 BZV55B6V8
R99 10K
C60 0U1
GNDM
MC1458D
V4
BAS32 D7
R47 10K
7K5 R64
R90 23R7
R119 23R7
L3 80n
-12V
C30 1n
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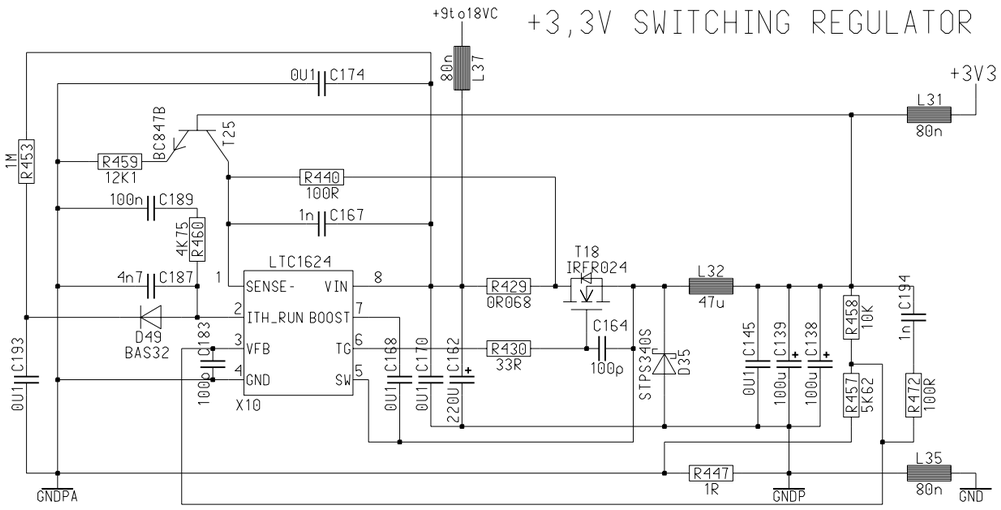
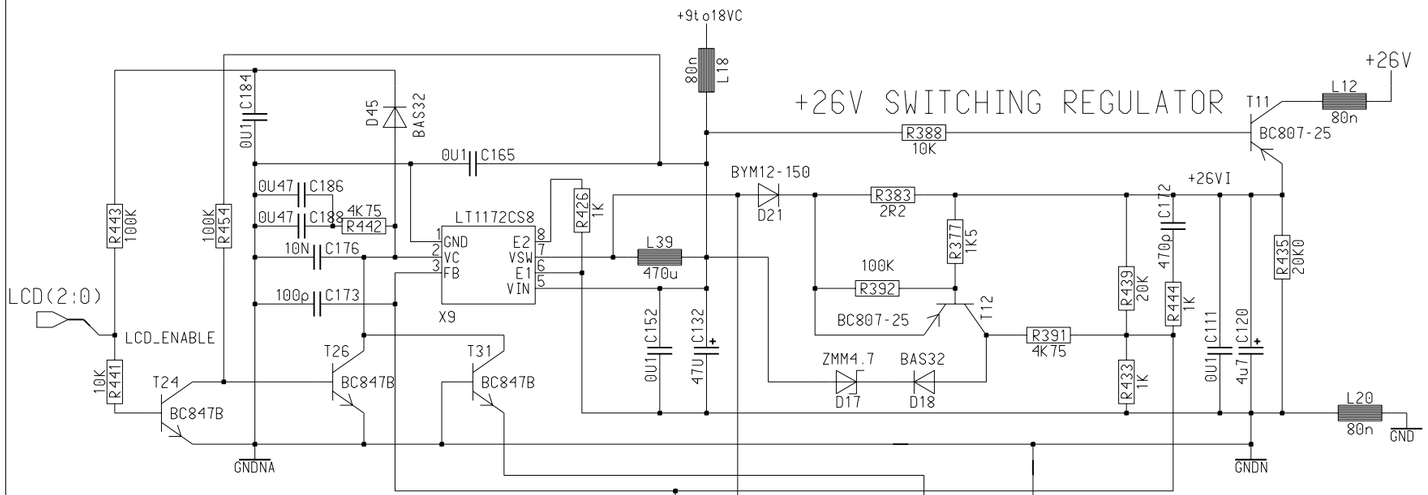
## +3,3V SWITCHING REGULATOR

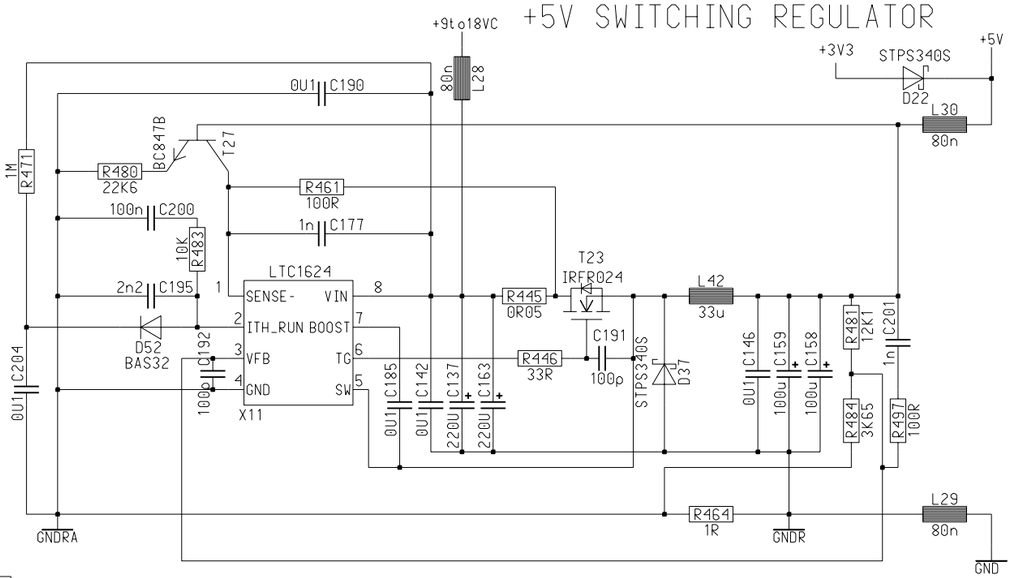



## -12V REGULATOR

## +26V SWITCHING REGULATOR




## +5V SWITCHING REGULATOR

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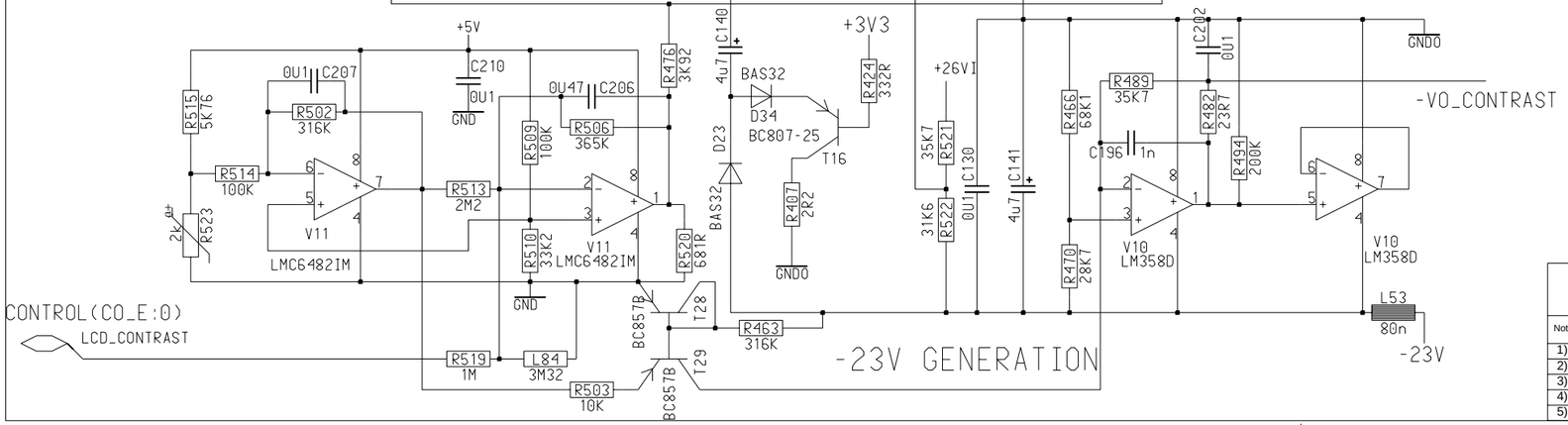
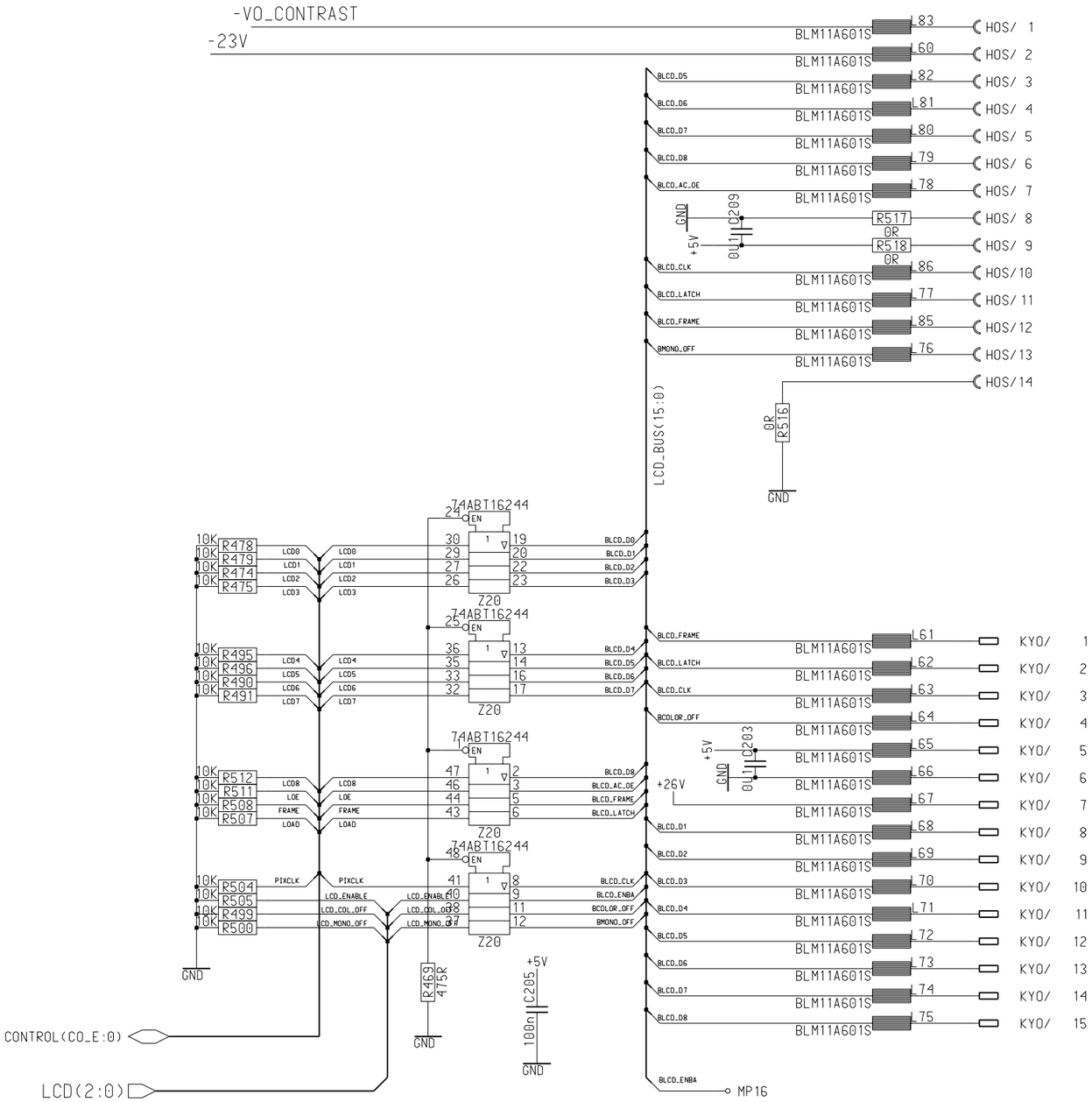
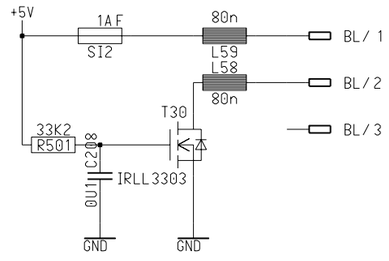



VOLTAGE_CONVERTER

| | | | | | | |
|---|---|---|---|---|---|---|
| Marquette Hellige GmbH D-79007 Freiburg | | | | | 388 032 75 P | Sheet: 9 of 13 |
| Not equipped in Version : | REVISIONS Revision-No | Index | Date / Name | A03 | F67256 | |
| 1) | --- | A | 22.10.98 / WHL | | Date / Name | |
| 2) | --- | B | 02.03.99/PHG | DRAWN | 13.11.98/WHL | LPL Main Board |
| 3) | | | | APPROVED | 13.11.98/PHG | PCB Main Board |
| 4) | | | | | | |
| 5) | | | | ISSUED | PH.GEIGER | |

Schutzvermerk nach DIN 34 beachten
```





LCD

Marquette Hellige GmbH D-79007 Freiburg						388 032 75 P	Sheet: 10 of 13
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67256	LPL Main Board
1)		---	A	13.11.98/PHG		Date / Name	
2)		---	B	02.03.99/PHG	DRAWN	13.11.98/PHG	PCB Main Board
3)					APPROVED	13.11.98/PHG	
4)							
5)					ISSUED	PH.GEIGER	

Schutzvermerk nach DIN 34 beachten

[1997, 12, 18, 5]
$USER_CAE_B/dash2000/main_board/design/lcd

LD(31:0)

CONTROL(CO_E:0)

PCMCIA(68:0)

PCVC_SEL(4:0)

+3V3

C75 100n

GND

SN74LVCH16245ADGG

CE1_A_ 48
RDWR_ 1
G3 VCC=+3V3
3EN1 [BA]
3EN2 [AB]
2▽
▽1

PCCD7 47 — 2 LD0
PCCD6 46 — 3 LD1
PCCD5 44 — 5 LD2
PCCD4 43 — 6 LD3
PCCD3 41 — 8 LD4
PCCD2 40 — 9 LD5
PCCD1 38 — 11 LD6
PCCD0 37 — 12 LD7
[A] [B]

Z15

SN74LVCH16245ADGG

U_IOIS16_A_ — IOIS16_A_
U_RDBSY_A_ — RDBSY_A_
U_BVD2_A_ — BVD2_A_
U_BVD1_A_ — BVD1_A_
CE2_A_ 25
RDWR_ 24
G3 VCC=+3V3
3EN1 [BA]
3EN2 [AB]
2▽
▽1

PCCD15 36 — 13 LD8
PCCD14 35 — 14 LD9
PCCD13 33 — 16 LD10
PCCD12 32 — 17 LD11
PCCD11 30 — 19 LD12
PCCD10 29 — 20 LD13
PCCD9 27 — 22 LD14
PCCD8 26 — 23 LD15
[A] [B]

Z15

U_WAIT_A_ — WAIT_A_
U_INPACK_ — INPACK_

+3V3

R299 10K
R314 10K
R351 10K
R359 10K

CD2_A_
VS2_A_
VS1_A_
CD1_A_

PCMCIA/ 1 — PCCD3 — BCE1_A_ — R321 10K
PCMCIA/ 2 — PCCD4
PCMCIA/ 3 — PCCD5
PCMCIA/ 4 — PCCD6
PCMCIA/ 5 — PCCD7
PCMCIA/ 6 — BCE1_A_
PCMCIA/ 7 — PCCA10
PCMCIA/ 8 — BPCOE_A_ — R306 10K
PCMCIA/ 9 — PCCA11 — R278 100K
PCMCIA/ 10 — PCCA9 — R266 100K
PCMCIA/ 11 — PCCA8 — R247 100K
PCMCIA/ 12 — PCCA13 — R265 100K
PCMCIA/ 13 — PCCA14 — R246 100K
PCMCIA/ 14 — BPCWE_A_ — R292 10K
PCMCIA/ 15 — U_RDBSY_A_ — R277 10K
PCMCIA/ 16 — PCVCC
PCMCIA/ 17 — PCVPP
PCMCIA/ 18 — PCCA16 — R245 100K
PCMCIA/ 19 — PCCA15 — R263 100K
PCMCIA/ 20 — PCCA12 — R264 100K
PCMCIA/ 21 — PCCA7 — R261 100K
PCMCIA/ 22 — PCCA6 — R244 100K
PCMCIA/ 23 — PCCA5 — R260 100K
PCMCIA/ 24 — PCCA4 — R259 100K
PCMCIA/ 25 — PCCA3 — R243 100K
PCMCIA/ 26 — PCCA2 — R242 100K
PCMCIA/ 27 — PCCA1 — R258 100K
PCMCIA/ 28 — PCCA0 — R256 100K
PCMCIA/ 29 — PCCD0
PCMCIA/ 30 — PCCD1
PCMCIA/ 31 — PCCD2
PCMCIA/ 32 — U_IOIS16_A_ — R290 10K
PCMCIA/ 33
PCMCIA/ 34
GND

PCMCIA/ 35 — PCCD11 — BCE2_A_ — R293 10K
PCMCIA/ 36 — PCCD12 — BIORD_A_ — R320 10K
PCMCIA/ 37 — PCCD13 — BIOWR_A_ — R305 10K
PCMCIA/ 38 — PCCD14 — PCCA17 — R80 100K
PCMCIA/ 39 — PCCD15 — PCCA18 — R87 100K
PCMCIA/ 40 — BCE2_A_ — PCCA19 — R103 100K
PCMCIA/ 41 — PCCA20 — R130 100K
PCMCIA/ 42 — BIORD_A_ — PCCA21 — R132 100K
PCMCIA/ 43 — BIOWR_A_ — PCVCC — R332 100K
PCMCIA/ 44 — PCCA17 — PCVPP — R331 100K
PCMCIA/ 45 — PCCA18 — PCCA22 — R147 100K
PCMCIA/ 46 — PCCA19 — PCCA23 — R153 100K
PCMCIA/ 47 — PCCA20 — PCCA24 — R164 100K
PCMCIA/ 48 — PCCA21 — PCCA25 — R183 100K
PCMCIA/ 49 — PCVCC
PCMCIA/ 50 — PCVPP
PCMCIA/ 51 — PCCA22
PCMCIA/ 52 — PCCA23
PCMCIA/ 53 — PCCA24
PCMCIA/ 54 — PCCA25
PCMCIA/ 55 — PC_RESET
PCMCIA/ 56 — U_WAIT_A_ — R319 10K
PCMCIA/ 57 — U_INPACK_ — R304 10K
PCMCIA/ 58 — BREG_A_ — R291 10K
PCMCIA/ 59 — U_BVD2_A_ — R303 10K
PCMCIA/ 60 — U_BVD1_A_ — R318 10K
PCMCIA/ 61
PCMCIA/ 62
PCMCIA/ 63
PCMCIA/ 64
PCMCIA/ 65
PCMCIA/ 66
PCMCIA/ 67
PCMCIA/ 68
GND

BAS32 D10
R40 100K
PCVCC

PC_VCC +3V3
R309 100K
C82 0U1
GND GND

MAX1602

+3V3
R468 10K
PCVPP C95 0U1
R232 100K
PCVCC C93 0U1
GND

VPP 3
VCC1 4
VCC2 6
VCC3 7
VCC4 9
FAULT_ 16
CODE 15
12IN 2
VX 5
VY1 8
VY2 10
A0VPP 11
A1VPP 12
A0VCC 13
A1VCC 14
GND 1
X2

+12V
+5V
+3V3
C79 0U1
C68 100n
C65 100n
GND GND GND

PC_A0VPP
PC_A1VPP
PC_A0VCC
PC_A1VCC

R240 100K
R230 100K
R213 100K
R204 100K

R267 10K
GND

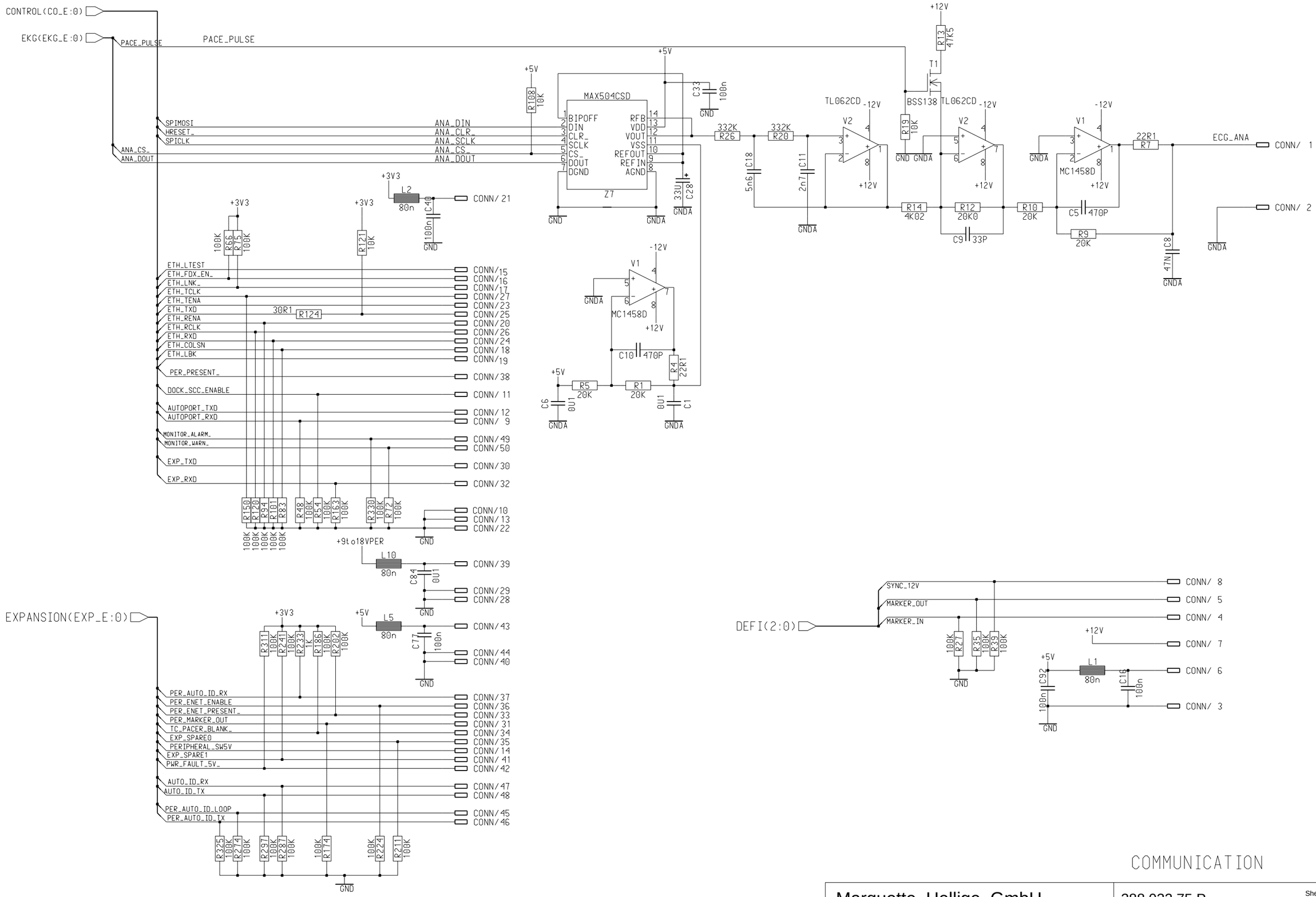
PC_FAULT_

PC_CARD

Marquette Hellige GmbH D-79007 Freiburg						388 032 75 P	Sheet: 11 of 13
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67256	
1)	38803275	---	A	13.11.98/PHG		Date / Name	LPL Main Board
2)		---	B	02.03.99/PHG	DRAWN	13.11.98/PHG	
3)		ECO-062190	C	07.05.99/PHG	APPROVED	13.11.98/PHG	PCB Main Board
4)		061670	D	08.07.99/HAW			
5)					ISSUED		

Schutzvermerk nach DIN 34 beachten

[1997, 12, 10, 4]
$USER_CAE_B/dash2000/main_board/design/pc_card



COMMUNICATION

Marquette Hellige GmbH D-79007 Freiburg						388 032 75 P
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67256
1)		---	A	13.11.98/PHG		Date / Name
2)		---	B	02.03.98/PHG	DRAWN	13.11.98/PHG
3)					APPROVED	13.11.98/PHG
4)						
5)					ISSUED	PH.GEIGER

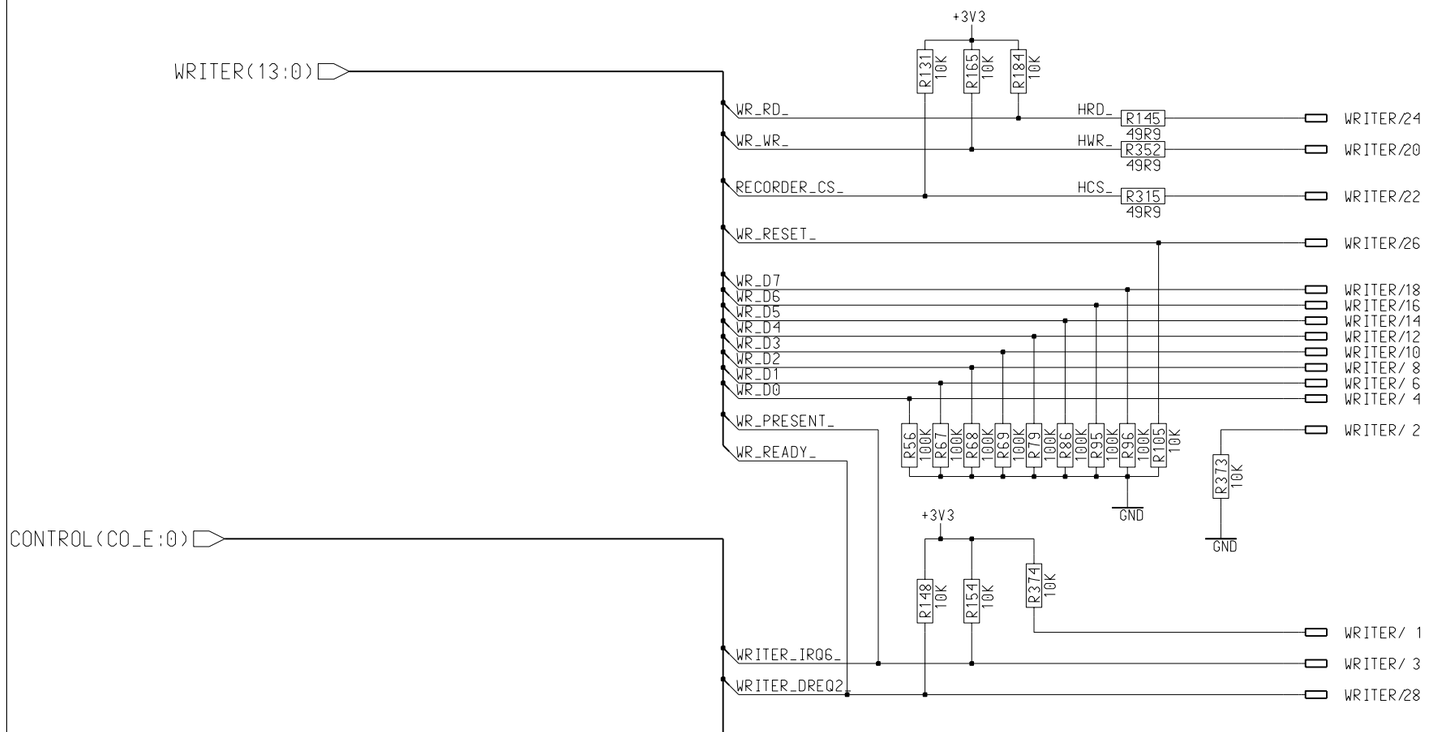
Sheet: 12 of 13

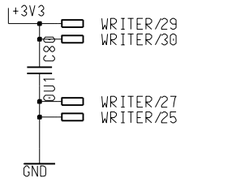
LPL Main Board

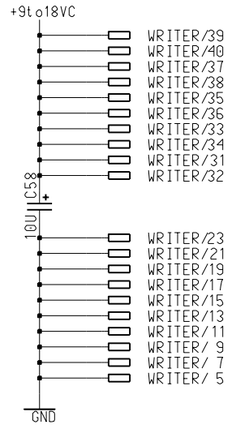
PCB Main Board

Schutzvermerk nach DIN 34 beachten

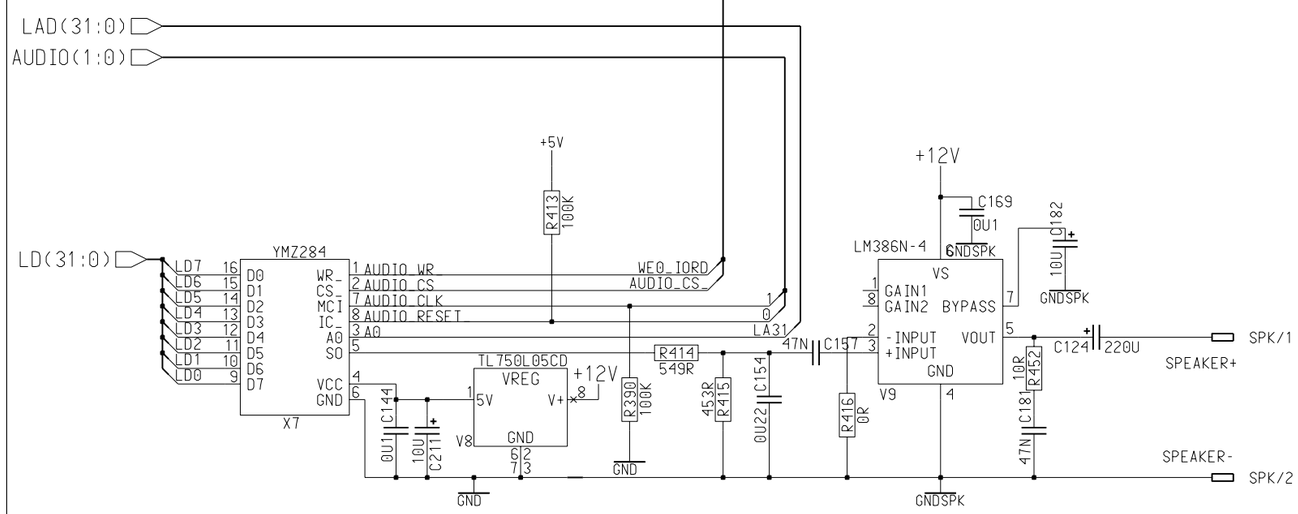
[1998, 1, 23, 6]
$USER_CAE_B/dash2000/main_board/design/connect







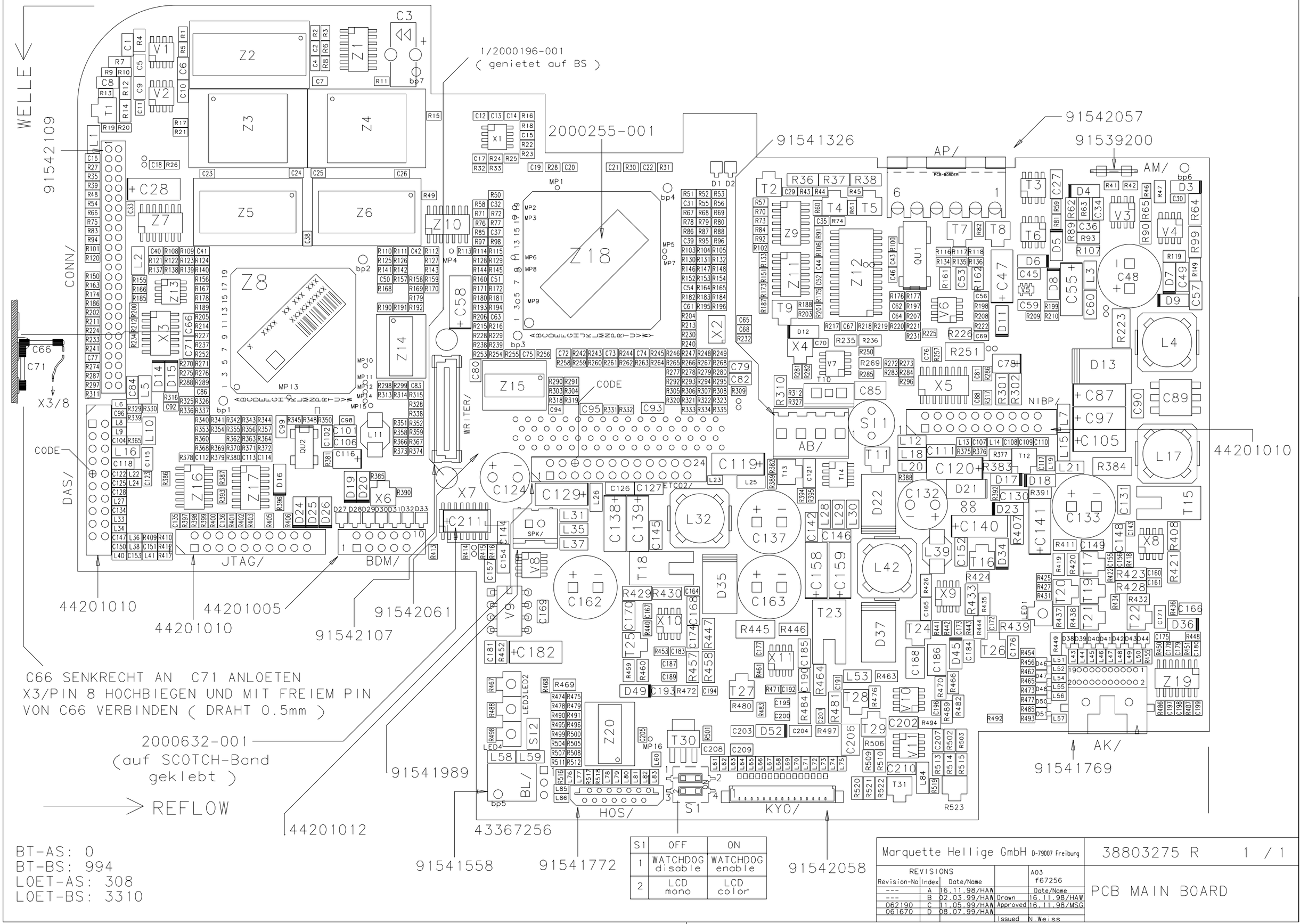
WRITER



AUDIO

IO

Marquette Hellige GmbH D-79007 Freiburg						388 032 75 P	Sheet: 13 of 13
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67256	
1)		---	A	13.11.98/PHG		Date / Name	
2)		---	B	02/03.99/PHG	DRAWN	13.11.98/PHG	LPL Main Board
3)		ECO-062190	C	07.05.99/PHG	APPROVED	13.11.98/PHG	
4)							PCB Main Board
5)					ISSUED	PH.GEIGER	



S1	OFF	ON
1	WATCHDOG disable	WATCHDOG enable
2	LCD mono	LCD color

Marquette Hellige GmbH D-79007 Freiburg				38803275 R 1 / 1
REVISIONS			A03 f67256	
Revision-No	Index	Date/Name		Date/Name
---	A	16.11.98/HAW		
---	B	02.03.99/HAW	Drawn	16.11.98/HAW
062190	C	11.05.99/HAW	Approved	16.11.98/MSG
061670	D	08.07.99/HAW		
			Issued	N.Weiss

PCB MAIN BOARD

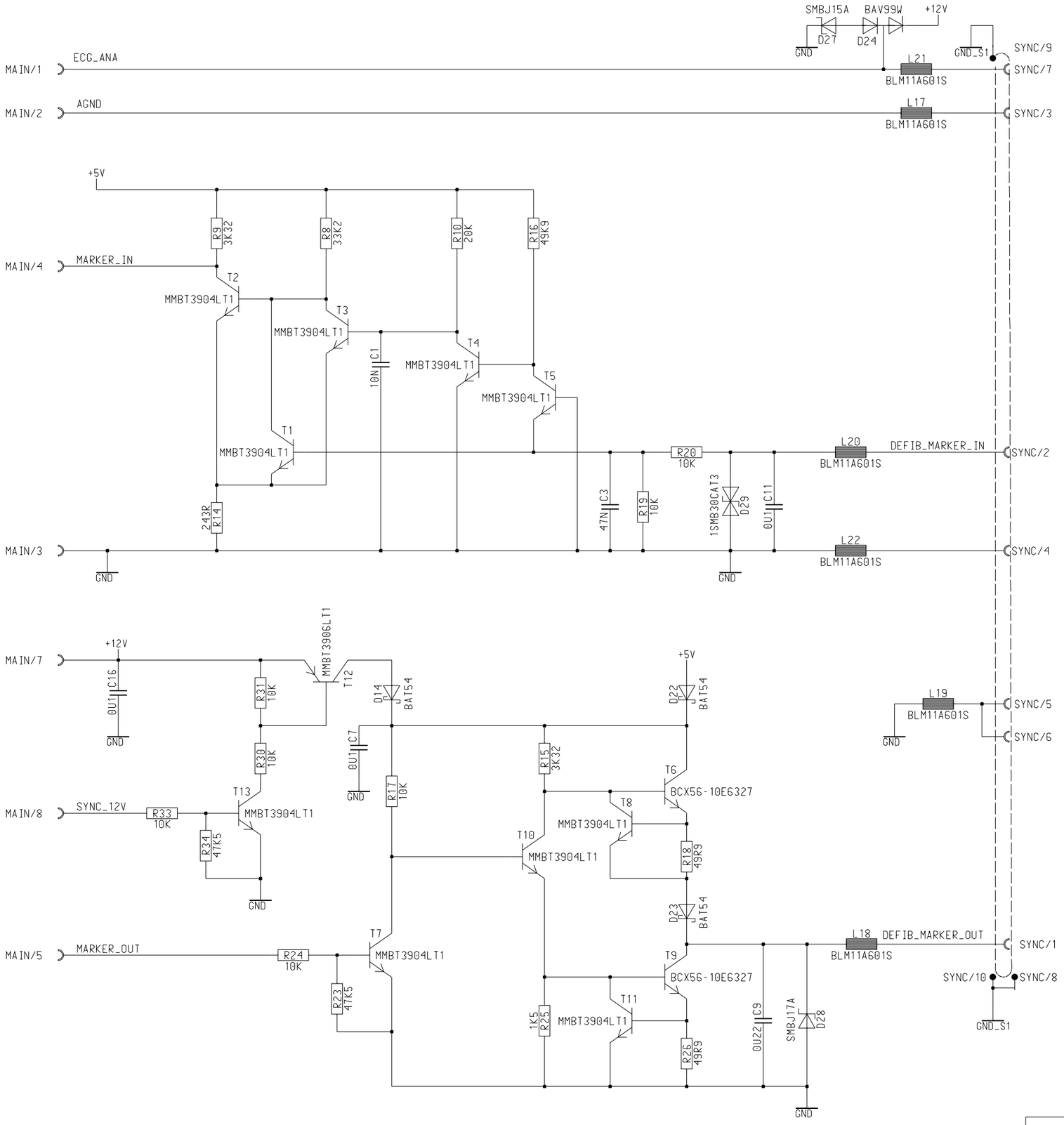
Schutzvermerk nach DIN 34 beachten.

MAIN/6
MAIN/13
MAIN/11
MAIN/12
MAIN/10
MAIN/9
MAIN/48
MAIN/47
MAIN/46
MAIN/45
MAIN/44
DOCK_SCC_ENABLE
DOCK_SCC_ENABLE_
AUTOPORT_TXD
AUTOPORT_TXD_INTERN
AUTOPORT_RXD
AUTOPORT_RXD_INTERN
AUTO_ID_TX
AUTO_ID_RX
PER_AUTO_ID_TX
PER_AUTO_ID_LP
MAX845EUA
MAX883CSA
ADM202EARU
HCPL063A
MBR0520LT1
74LVC00
74LVT125
SP721AB
SMBJ15A
BAV99W
PORT_232_DTR
PORT_+5V
PORT_232_TX
PORT_232_RTS
PORT_232_RX
PORT_SPARE
PORT_GND
PORT_ID
PER_AUTOPORT_TXD
PER_AUTOPORT_RXD
PER_AUTOPORT_ID_TXD
APORT/8
APORT/1
APORT/6
APORT/7
APORT/3
APORT/2
APORT/4
APORT/5
DOCK/20
DOCK/15
DOCK/16
AUTPORT INTERFACE (ISO)
DOCKING AUTOPORT

Schutzvermerk nach DIN 34 beachten

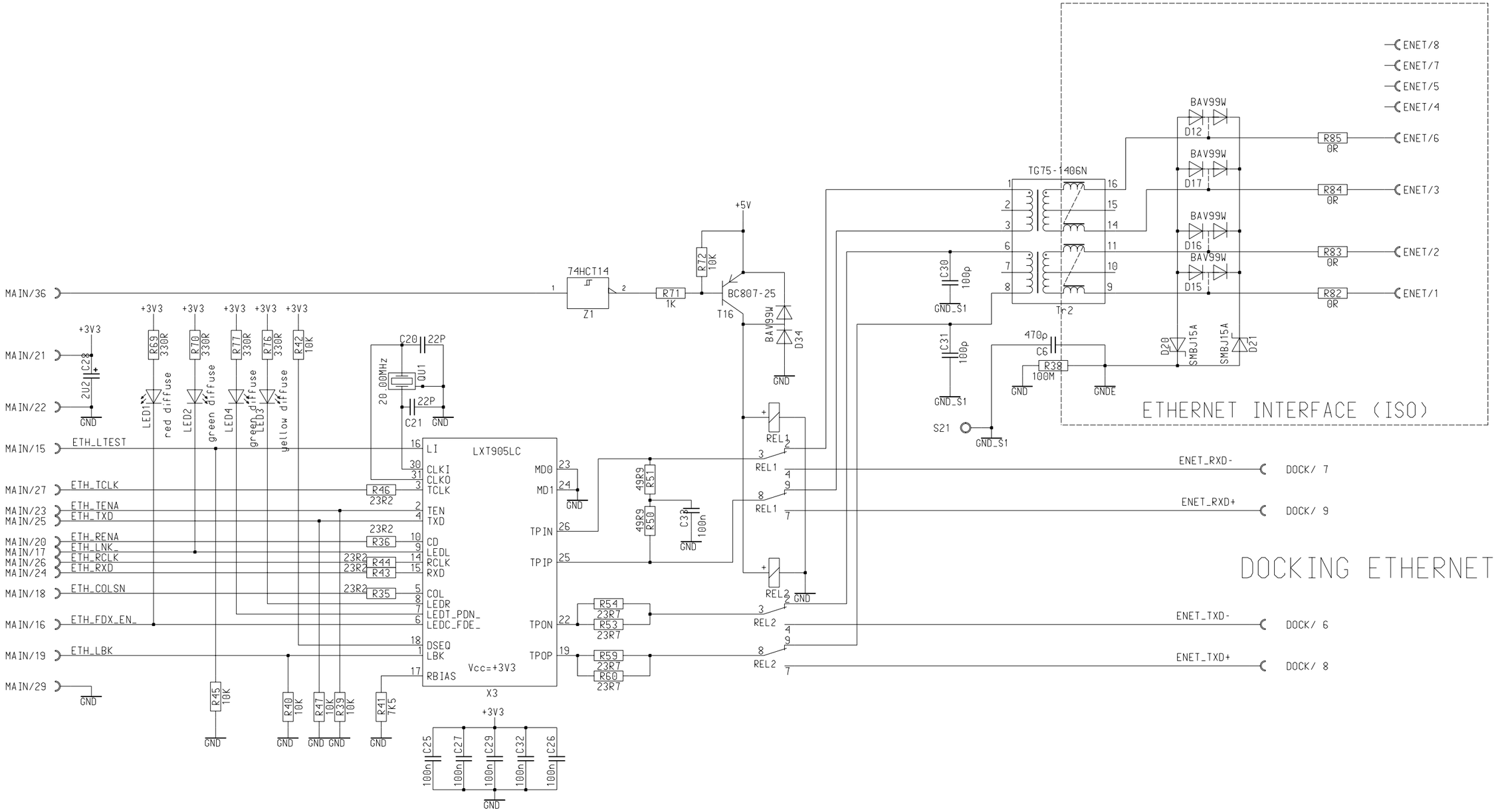
Marquette Hellige GmbH D-79007 Freiburg						388 032 76 P	Sheet: 1 of 4
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F67257	LPL MAIN CONNECTOR	
1)		A	7.12..98/PHG		Date / Name		
2)		B	17.03.99/PHG	DRAWN	03.12.97/JOK	PCB MAIN CONNECTOR	
3)				APPROVED	22.04.98/PHG		
4)							
5)				ISSUED	P. GEIGER		

[1997, 11, 28, 6]
$USER_CAD_A/f67257/design



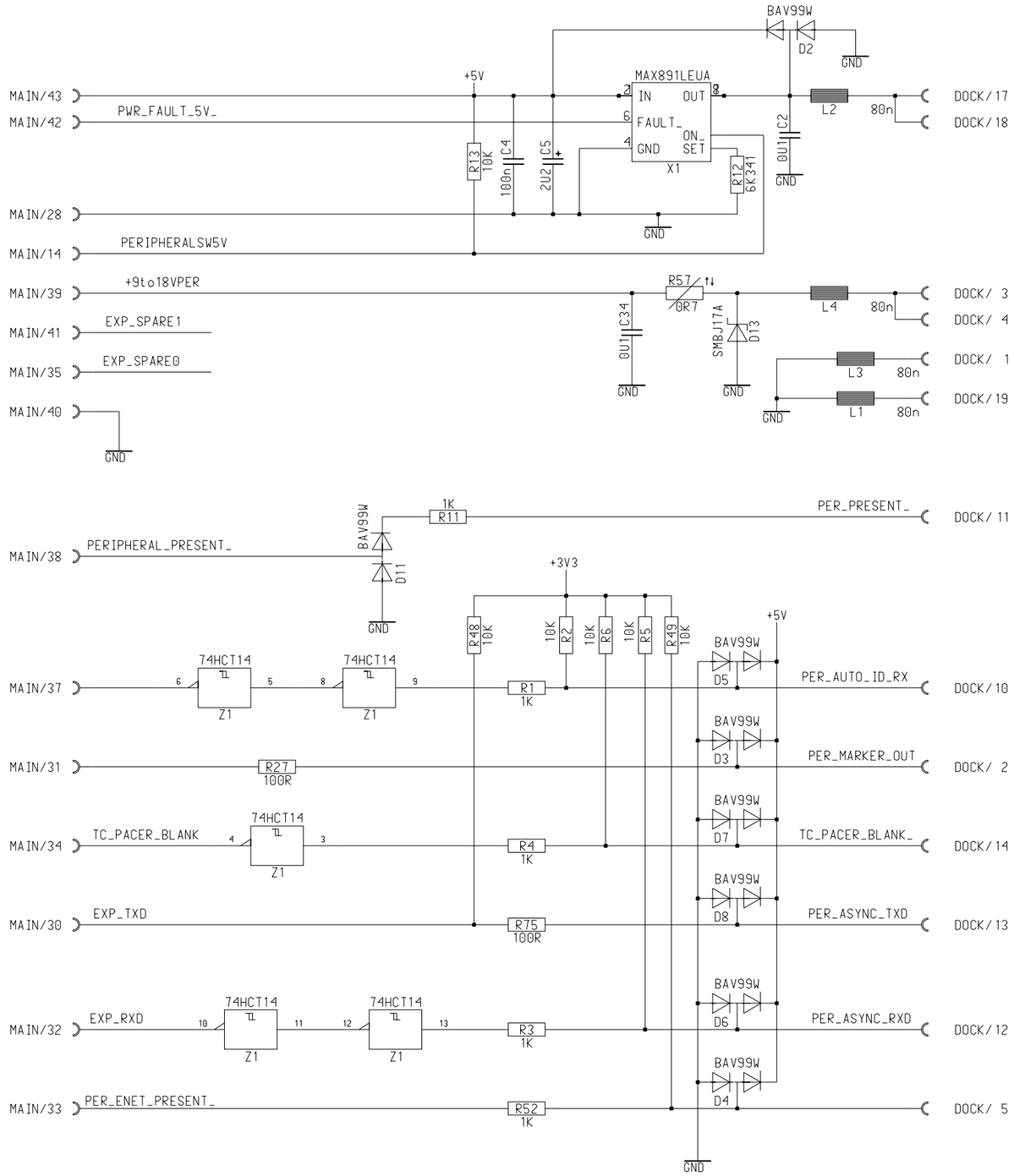
ECG ANALOG / Defi Sync

Marquette Hellige GmbH D-79007 Freiburg						388 032 76 P	Sheet: 2 of 4
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F67257	LPL MAIN CONNECTOR	
1)		A	30.11.98/PHG		Date / Name		
2)		B	17.03.99/PHG	DRAWN	03.12.97/JOK	PCB MAIN CONNECTOR	
3)				APPROVED	30.04.98/PHG		
4)							
5)				ISSUED	Ph. GEIGER		

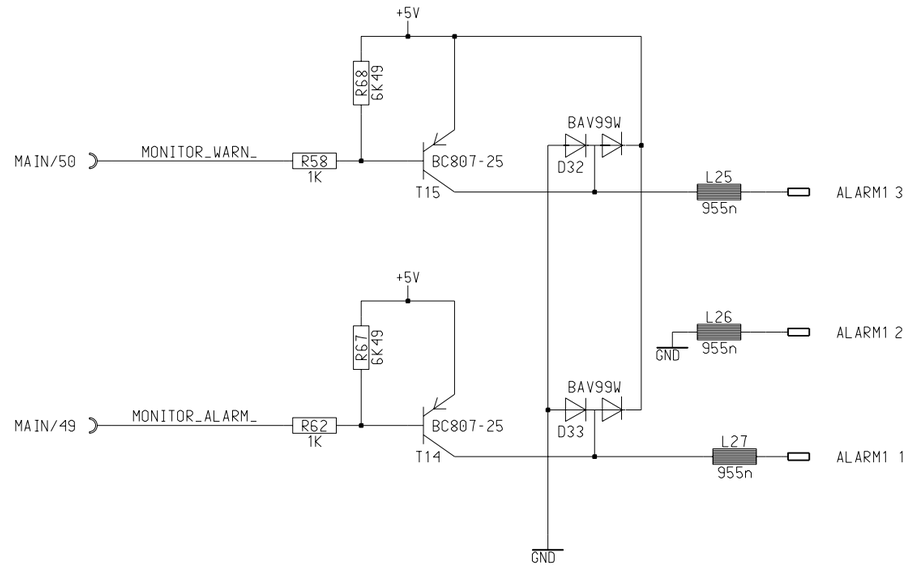


Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 76 P
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F67257	Sheet: 3 of 4
1)		A	7.12..98/PHG		Date / Name	LPL MAIN CONNECTOR
2)		B	17.03.99/PHG	DRAWN	22.04.98/PHG	
3)	ECO-062191	C	07.05.99/PHG	APPROVED	4.5.98/PHG	PCB MAIN CONNECTOR
4)						
5)				ISSUED	Ph.GEIGER	



DOCKING STATION INTERFACE



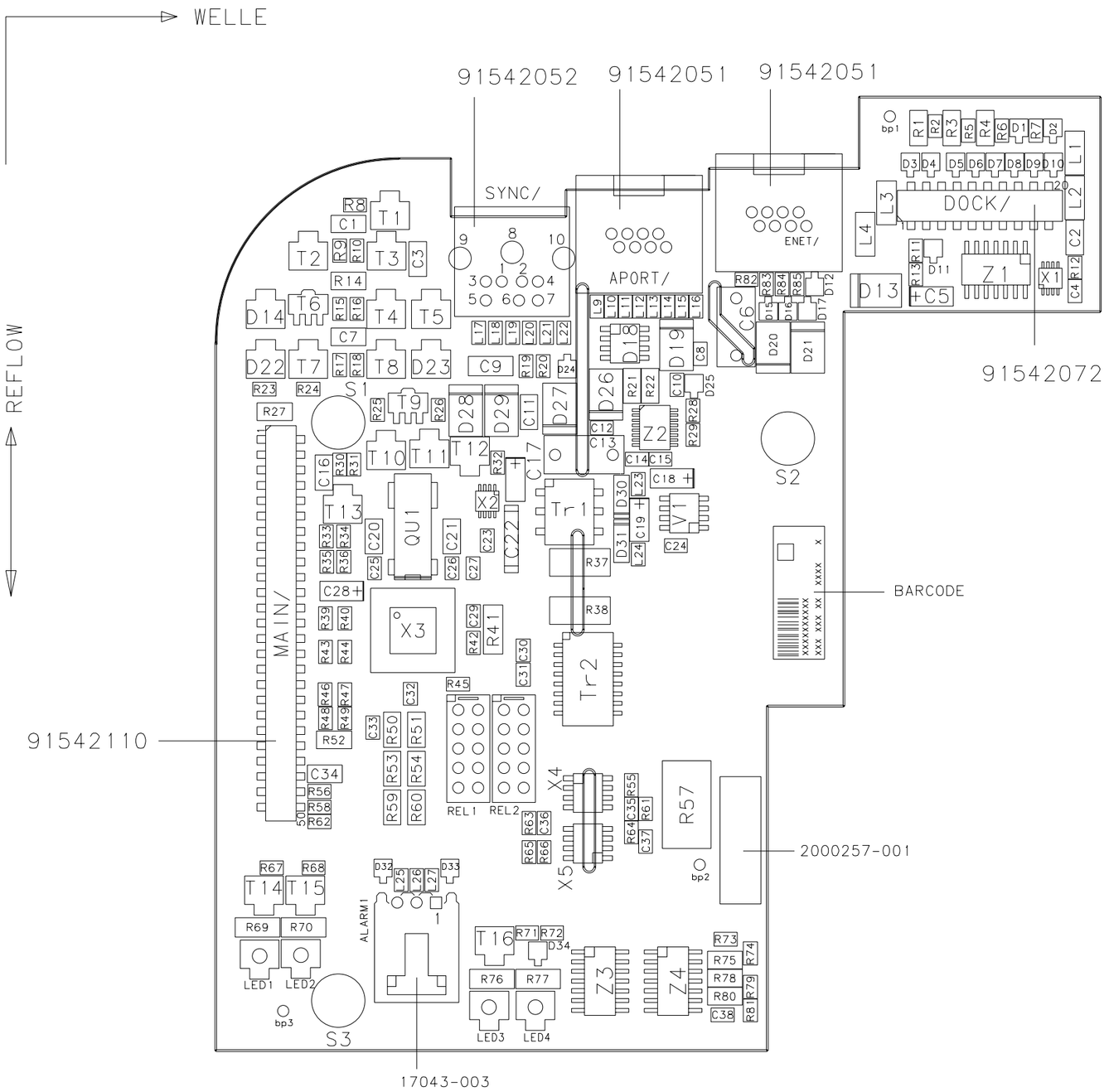
ALARM_LIGHT DRIVER

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 76 P
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F67257	Sheet: 4 of 4
1)		A	7.12..98/PHG		Date / Name	LPL MAIN CONNECTOR
2)		B	17.03.99/PHG	DRAWN	03.12.97/JOK	PCB MAIN CONNECTOR
3)				APPROVED	30.4.98/PHG	
4)						
5)				ISSUED	Ph.GEIGER	

[1998, 4, 24, 6]
$USER_CAD_A/67257/design

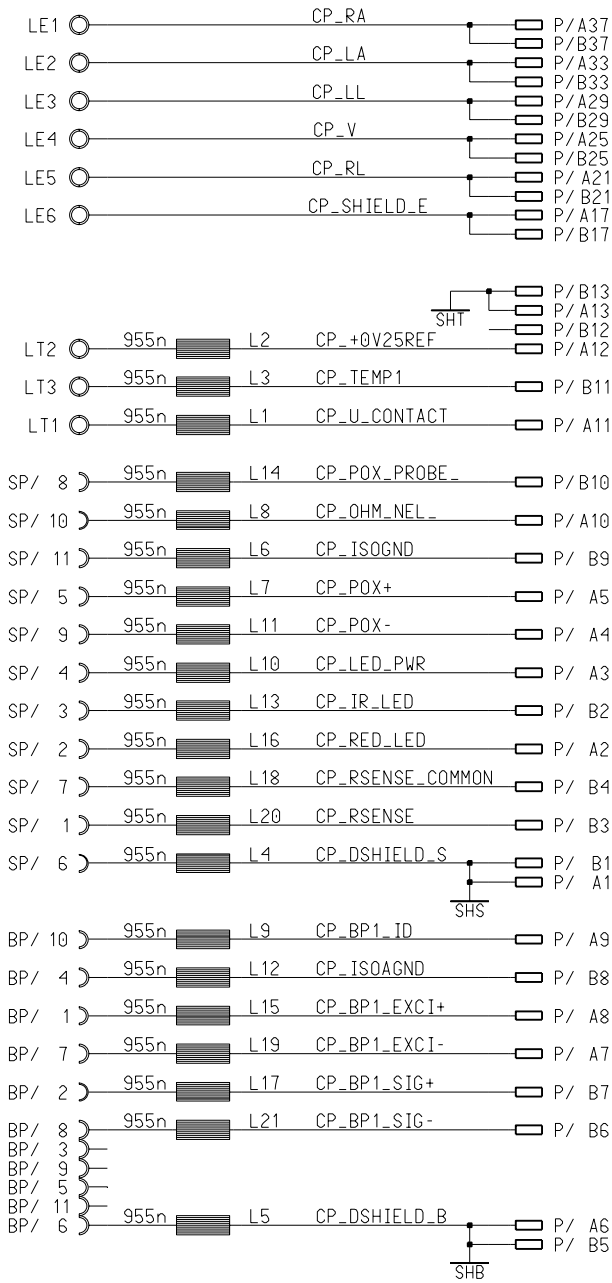
BT-AS = 0
BT-BS = 224
LOET-AS = 56
LOET-BS = 677



Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg				38803276 R 1 / 1
REVISIONS				A03 F67257
Revision-No	Index	Date/Name		Date/Name
---	A	8.12.98 HAW		
---	B	24.03.99 HAW	Drawn	4.12.98/HAW
ECO-062191	C	11.05.99/MSG	Approved	4.12.98/PHG
			Issued	M. GUTMANN

PCB MAIN-CONNECTOR

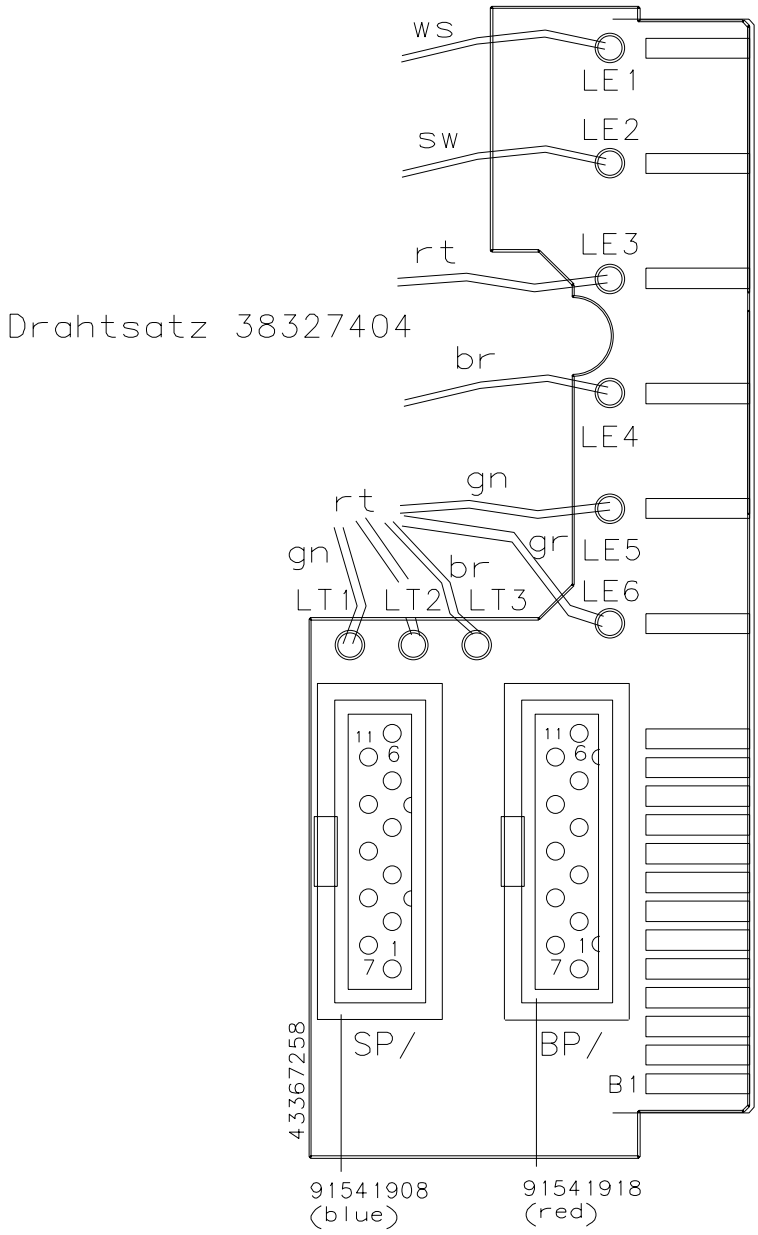


Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 77 P	Sheet: 1 of 1
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A04	F 672 58	LPL DASH 2000 DAS INPUT	
1)	---	A	18.03.99 / WHL		Date / Name		
2)				DRAWN	14.07.98 / WHL	PCB DASH 2000 DAS INPUT	
3)				APPROVED	29.07.98 / WHL		
4)							
5)				ISSUED	W.LOEHNING		

BT-BS : 11

LOET-BS : 0



WELLE

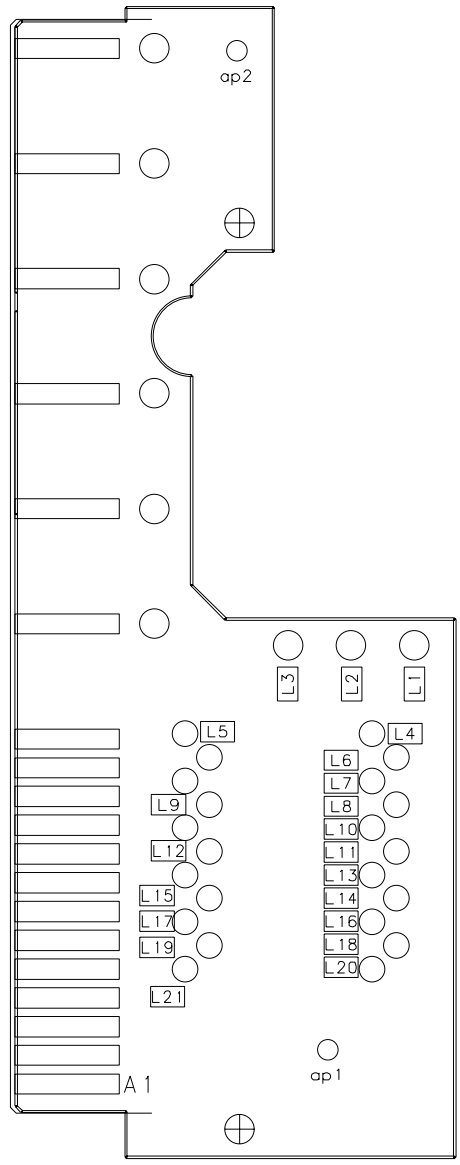
Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg				38803277 R 1 / 3
REVISIONS				A04 F67258
Revision-No	Index	Date/Name		Date/Name
---	A	26.03.99/MSG		
ECO-062339	B	21.05.99/MSG	Drawn	23.07.98/HAW
			Approved	23.07.98/MSG
			Issued	N.WEISS

PCB DASH 2000 DAS INPUT

BT-AS : 21

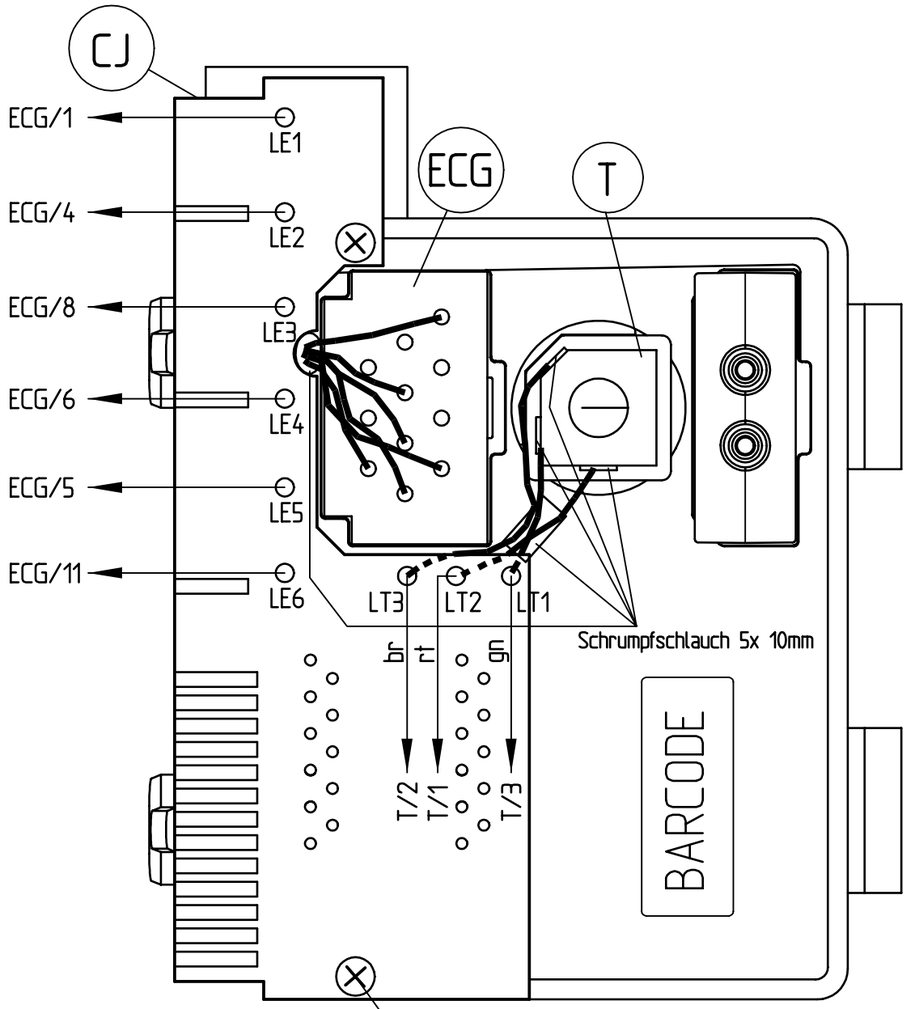
LOET-AS : 92

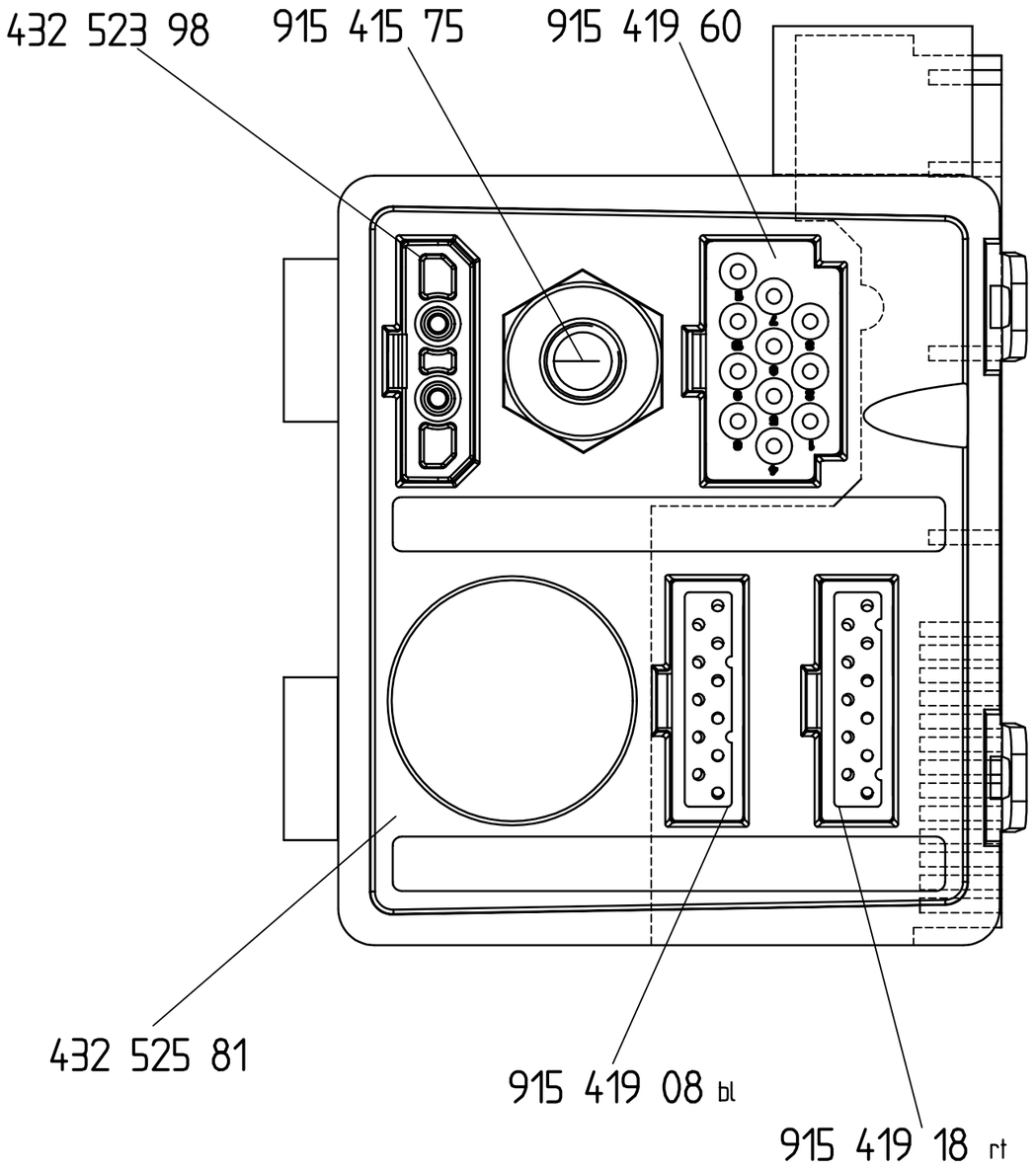


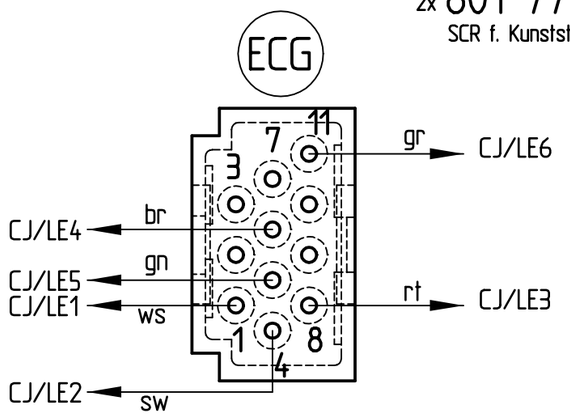
KLEBEN

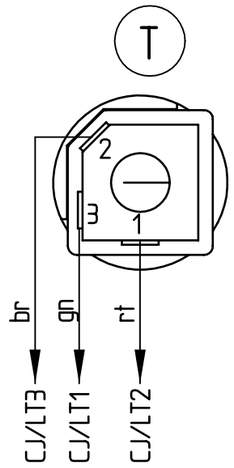
Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg				38803277 R 2 / 3
REVISIONS				A04 F67258
Revision-No	Index	Date/Name		Date/Name
---	A	25.03.99/MSG		
			Drawn	23.07.98/HAW
			Approved	23.07.98/MSG
			Issued	N.WEISS
PCB DASH 2000 DAS INPUT				





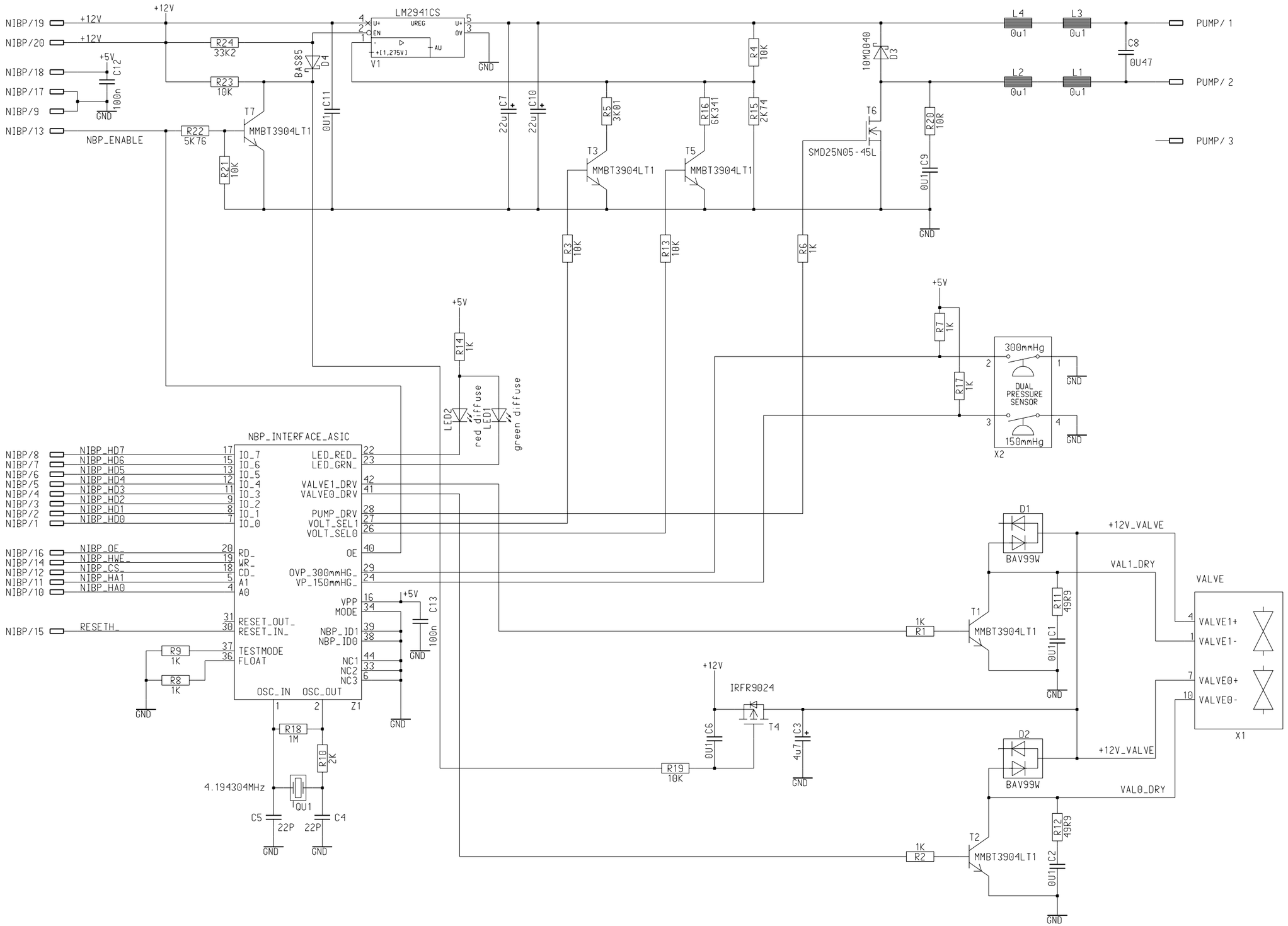




Hierzu Drahtsatz 383 274 04

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH Munzinger Str. 3 D-79111 Freiburg					
Werkstoff - Material					
Rohteil					
	a	-	neu	--	12.04.99 G.Kaltenbach
	Änd.Index Revision	kommt vor numbers	ECO No.	Änderungsbeschreibung - Change Description	Datum - Date / Name
Freimaßtoleranz - Tolerance	Projektion	Format	Maßstab - Scale	Oberfläche - Finish	Datum - Date / Name
		A3	1,5:1		Entworfen-Drawn 17.12.98 G.Kaltenbach
File Name 38803277-D04__RP03					Geprüft-Approved 12.04.99 W.Löhning
					Geprüft-Approved
Dokument Bezeichnung - Document Description doc ref dwg RP03	Zeichn.Art/Blatt Nr.	Teil Bezeichnung - Part Description			Teil Nr. - Part Number
Dokument Nr. - Document No. 38803277-D04	RP/03	PCB DASH 2000 DAS INPUT			388 032 77

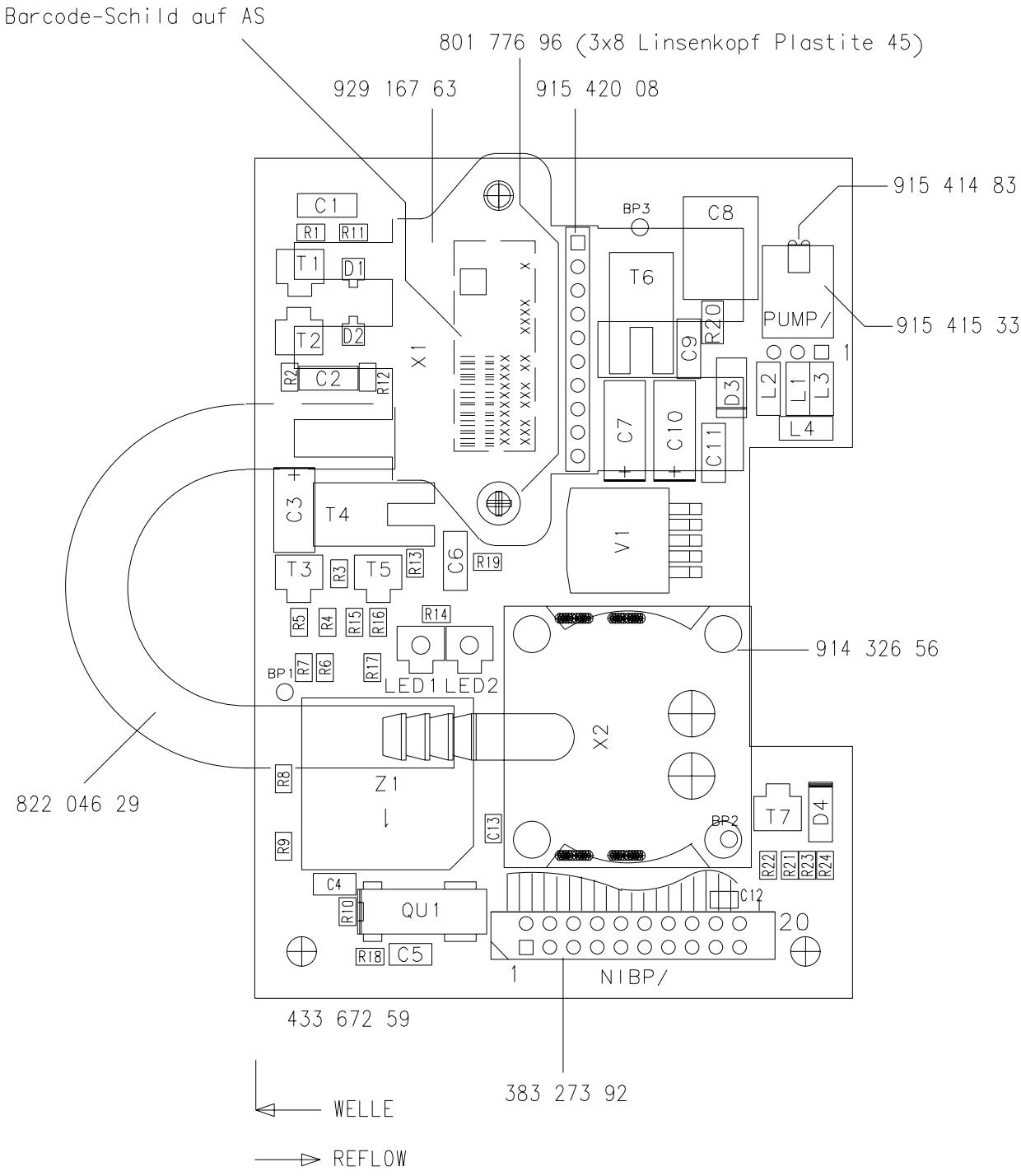


Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 78 P
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F67259	Sheet: 1 of 1
1)	---	A	10.02.99/PHG		Date / Name	LPL NIBP
2)				DRAWN	26.11.97/JOK	
3)				APPROVED	27.11.97/PHG	PCB NIBP
4)						
5)				ISSUED	P. GEIGER	

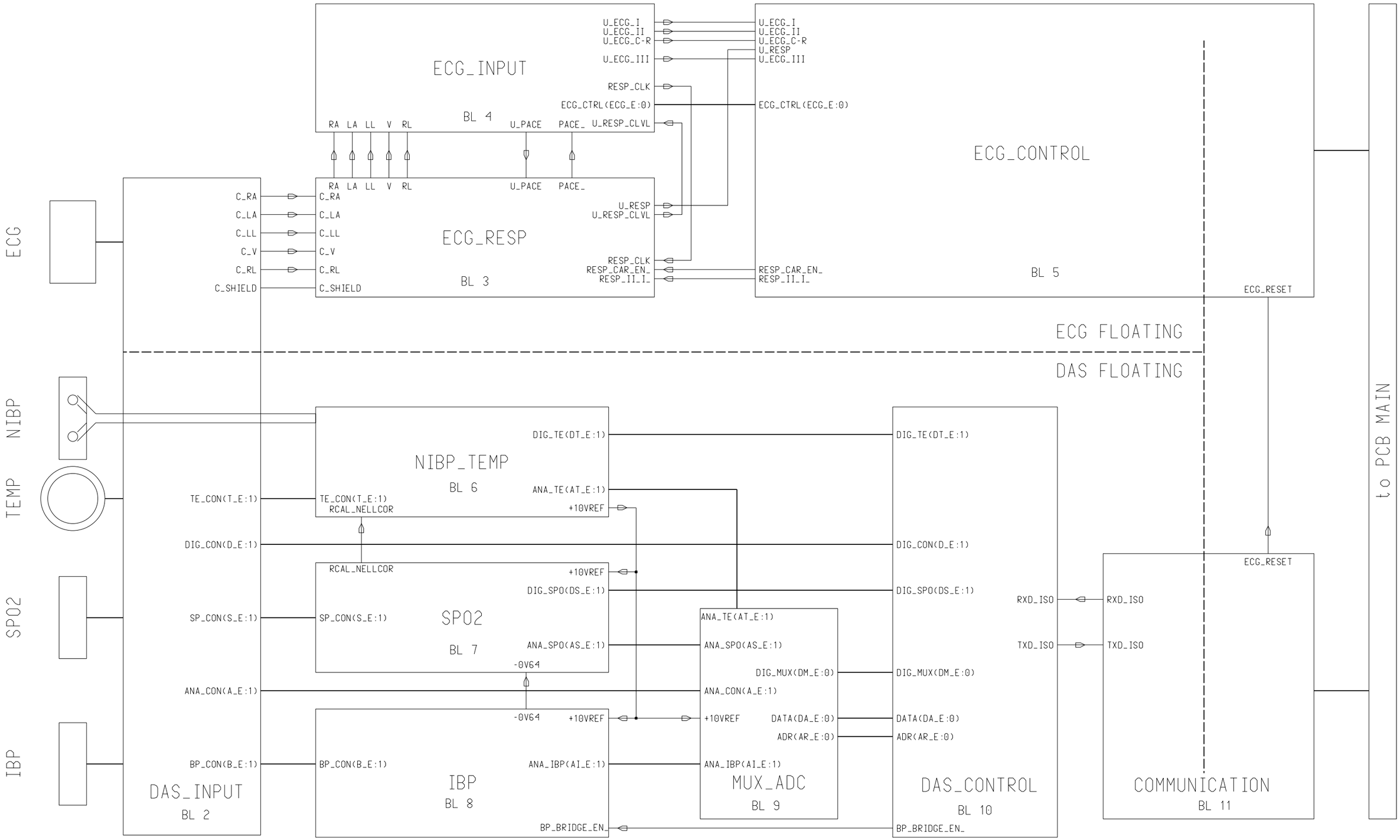
[1997, 11, 24, 2]
$USER_CAD_A/67259/design

BT auf BS: 61
Loet auf AS: 37
Loet auf BS: 176



Marquette Hellige GmbH D-79007 Freiburg				38803278 R 1 / 1
REVISIONS			A04 F67259	
Revision-No	Index	Date/Name		Date/Name
---	A	11.02.99/MSG		
			Drawn	27.11.97/JOK
			Approved	27.11.97/MSG
			Issued	P. GEIGER
PCB NIBP				

Schutzvermerk nach DIN 34 beachten.



Schutzvermerk nach DIN 34 beachten

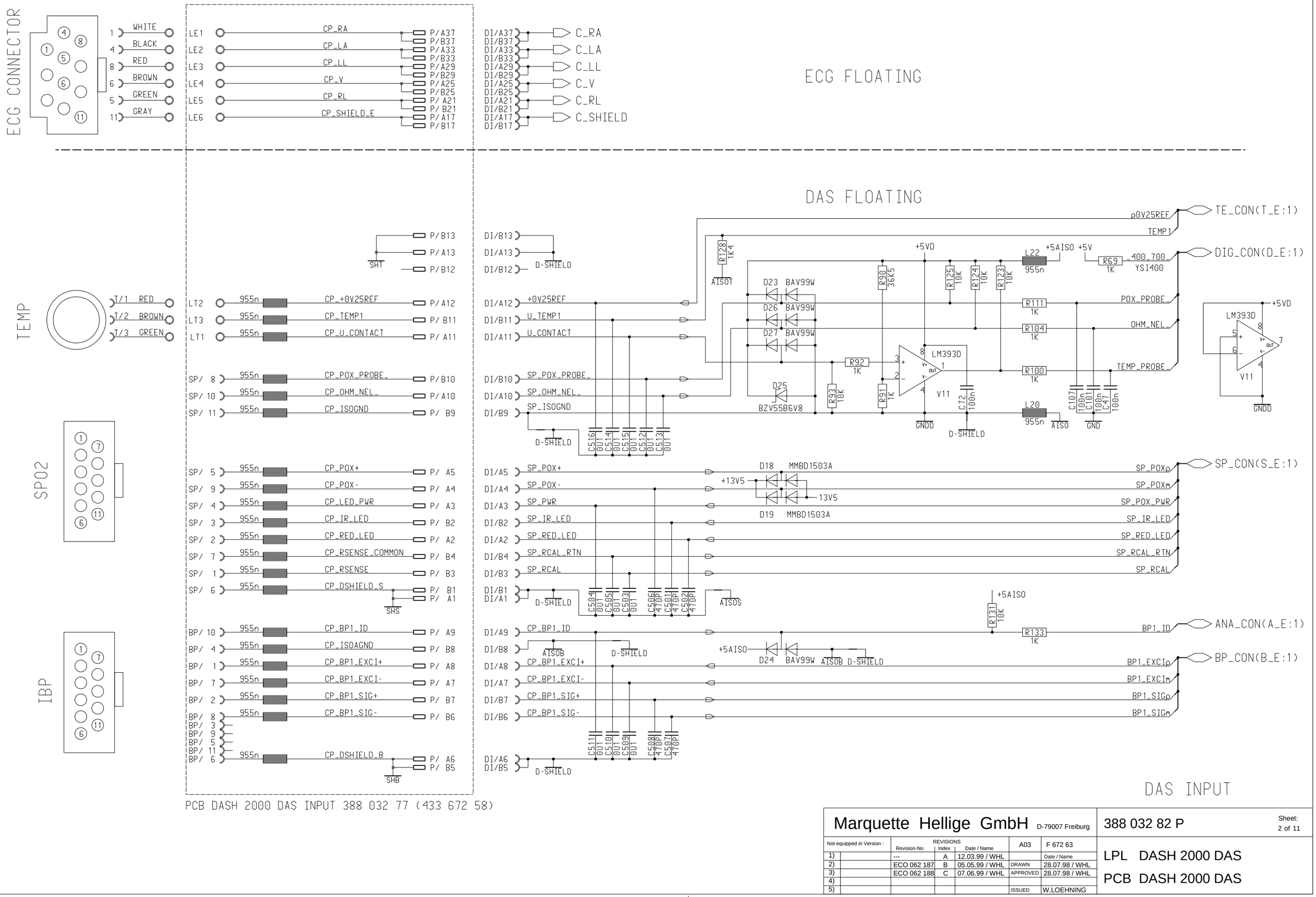
Marquette Hellige GmbH D-79007 Freiburg						388 032 82 P
Not equipped in Version :	REVISIONS				A03	F 672 63
	Revision-No	Index	Date / Name			Date / Name
1)	---	A	12.03.99 / WHL		DRAWN	28.07.98 / WHL
2)					APPROVED	28.07.98/ WHL
3)						
4)					ISSUED	W.LOEHNING
5)						

LPL DASH 2000 DAS

PCB DASH 2000 DAS

Sheet: 1 of 11

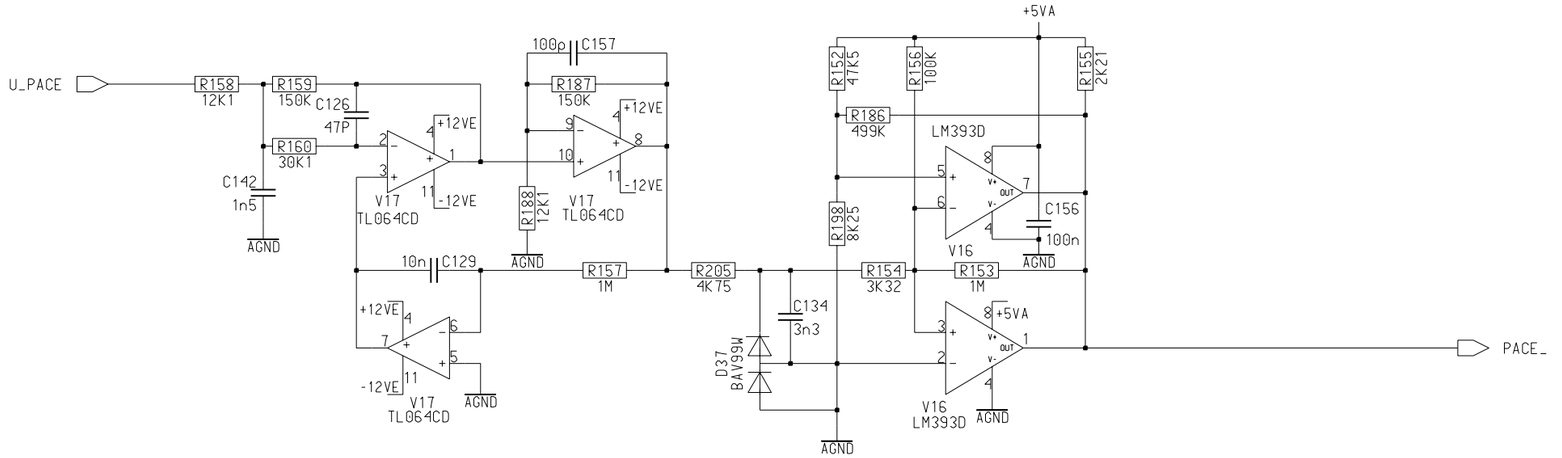
[1998, 4, 23, 5]
$USER_CAE_B/dash2000/das_board/design



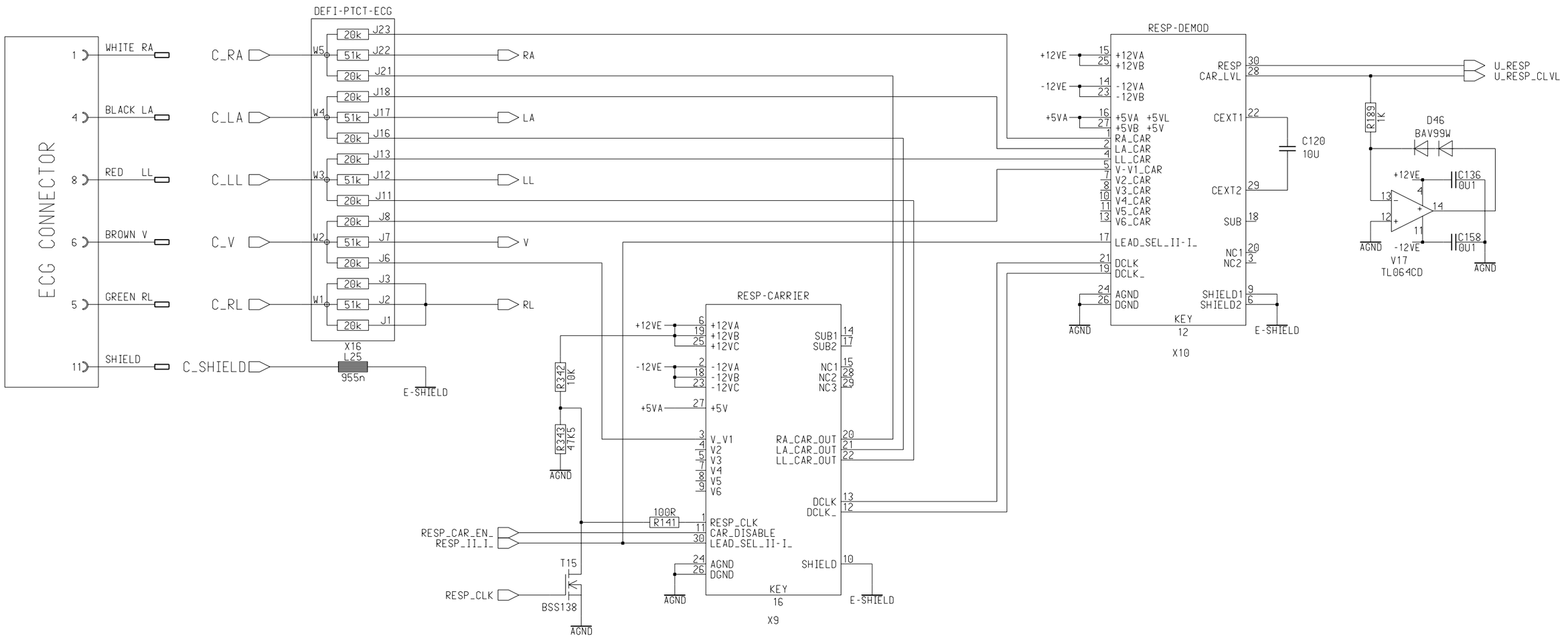
Marquette Hellige GmbH D-79007 Freiburg						388 032 82 P
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F 672 63	Sheet: 2 of 11
1)	---	A	12.03.99 / WHL		Date / Name	LPL DASH 2000 DAS
2)	ECO 062 187	B	05.05.99 / WHL	DRAWN	28.07.98 / WHL	PCB DASH 2000 DAS
3)	ECO 062 188	C	07.06.99 / WHL	APPROVED	28.07.98 / WHL	
4)						
5)				ISSUED	W.LOEHNING	

[1998. 4. 23. 5]
$USER_CAE_B/dash2000/das_board/das_input

PACE DISCRIMINATOR



RESPIRATION



ECG RESP

Marquette Hellige GmbH D-79007 Freiburg						388 032 82 P	Sheet: 3 of 11
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F 672 63	
1)		---	A	12.03.99 / GHH		Date / Name	
2)		ECO 062 187	B	05.05.99 / WHL	DRAWN	28.07.98 / WHL	LPL DASH 2000 DAS
3)		ECO 062 188	C	07.06.99 / WHL	APPROVED	28.07.98 / GHH	PCB DASH 2000 DAS
4)							
5)					ISSUED	W.LOEHNING	

Schutzvermerk nach DIN 34 beachten

[1998, 4, 2, 5]
$USER_CAE_B/dash2000/das_board/design/ecg_resp

ELECTRODE AMPLIFIER

SLEWRATE LIMITER

ECG CONTROLLER

ECG INPUT

RA, LA, LL, V, RL, U_EPR

+12VE / -12VE

MMBD1503A D65 (ER), D60 (EL), D51 (EF), D47 (EC), D36 (EN), D38

R280 100K, R245 100K, R224 100K, R180 100K

R279 62M, R244 62M, R223 62M, R179 62M

C240 100p, C213 100p, C188 100p, C152 100p, C124 220p, C146 2n2

R, L, F, C, VR, VL, VF, VC

R277 24K3, R287 47K5, C251 10P, R301 68K1, C257 100P, C239 100P

R271 24K3, R260 47K5, C227 10P, R241 68K1, C214 100P, C211 100P

R237 24K3, R231 47K5, C201 10P, R215 68K1, C192 100P, C181 100P

R210 24K3, R197 47K5, C173 10P, R178 68K1, C159 100P, C150 100P

V25 TLE2082CD, V22 TLE2082CD, V20 TLE2082CD, V18 TLE2082CD

R259 24K3, R240 24K3, R212 24K3, R289 24K3

100P C228, C194, C160, C258

R274 68K1, R234 68K1, R206 68K1, R306 68K1

C265 0U1, C238 0U1, C179 0U1, C151 0U1

R250 4K99, R249 4K99, R325 4K99, R326 4K99

R263 6K81, R254 6K81, R323 6K81, R324 6K81

C217 22N, C216 22N, C272 22N, C273 22N

470p C230, C229, C262, C263

R255 715K, R262 715K, R314 715K, R315 715K

R284 18K2, R296 18K2, R327 18K2, R285 18K2

R283 499K, R311 499K, R328 499K, R290 499K

100n C242, C274, C276, C244

C243 100n, C275 100n

C250 0U1, C249 0U1

R269 10K, R268 10K, R248 10K

R267 10K, R266 10K, R247 10K

R308 10K, R307 10K, R333 10K

R309 10K, R310 10K, R334 10K

D56 BAV99W, D58 BAV99W, D70 BAV99W, D71 BAV99W

V24 TL064CD, V26 TL064CD

+5VA, -5VA, AGND, GNDP

CD4066B Z17 (Vcc=+5VA, Ground=-5VA)

U_ECG_I, U_ECG_II, U_ECG_C-R, U_ECG_III

Z13 MAX329CWE XUMOXUM

Vcc=+12VE, GROUND=AGND, Vee=-12VE

Pins 14, 15, 3

C189 0U1, C203 0U1

R170 24K3, R140 24K3

R200 24K3, R202 24K3, R204 24K3

R199 68K1, R201 68K1, R203 68K1

D41 BAV99W, D42 BAV99W, D43 BAV99W, D44 BAV99W

R193 24K3, R192 24K3, R191 24K3, R190 24K3

NGEG_SEL1, NGEG_SEL2

Z12 CD4051B XUMOXUM

VCC=+5VE, GROUND=AGND, VEE=-5VE

Pins 16, 8, 7

ELEC_SEL1, ELEC_SEL2

C169 100n, C176 100n

R175 221K, R172 221K, R173 221K, R174 221K

C164 0U22, C161 0U22, C162 0U22, C163 0U22

R163 221K, R171 221K, R169 221K, R165 2M32, R168 221K

C135 2n2, C138 47P, C141 4n7, C145 4n7

V14 TL064CD

C130 0U1, C131 0U1

R166 75K0, R161 75K0, R162 150K, R164 150K

R167 1K, C125 0U22, R145 68K1

R144 24K3, R146 221K

R148 24K3, R147 24K3, R150 24K3, R151 24K3

1n C127, C133 1n

V15 LMC6484IM

+2V5REF, -2V5REF

R149 4K75, BAS85 D34

R304 1K, red diffuse LED3

ECG_RES_, R142 4K75, C132 100n

QU3 8.00MHz, C143 22p, C137 22p, R177 453R

C174 100n, C167 100n, R143 100R

PIC16C73A-10 Z11

+5VP

RB0 ELEC_SEL1, RB1 ELEC_SEL2, RB2 PIC_INIT, RB3 NGEG_SEL1, RB4 NGEG_SEL2, RB5 PACE_DEFI_, RB6 TSYN, RB7

RC0 RESP_ERR, RC1 RESP_CLK, RC2 EL_R, RC3 EL_L, RC4 EL_F, RC5 EL_C, RC6 LEITUNG_5_3_, RC7 PACE_ECG

RA0 +2V5REF, RA1, RA2, RA3, RA4 PACE_SEL1, RA5 PACE_SEL2

PACE_SEL1, PACE_SEL2, PACE_DEFI_G

Z14 MAX329CWE XUMOXUM

T13 BSS84, R317 49K9

C204 0U1, C236 0U1

PACE_, U_PACE, ECG_CTRL(ECG_E:0), U_RESP_CLVL

D35 BAV99W

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH	D-79007 Freiburg
388 032 82 P	Sheet: 4 of 11
LPL DASH 2000 DAS	
PCB DASH 2000 DAS	

Not equipped in Version :

	REVISIONS Revision-No	Index	Date / Name	A03	F 672 63
1)	---	A	12.03.99 / GHH		Date / Name
2)				DRAWN	28.07.98 / WHL
3)				APPROVED	28.07.98 / GHH
4)					
5)				ISSUED	W.LOEHNING

[1998, 4, 2, 5]

$USER_CAE_B/dash2000/das_board/ecg_input

U_ECG_I
U_ECG_II
U_ECG_C-R
U_RESP
U_ECG_III
SDM_HEC2
Z15
DIGI_HEC2
Z10
ECG_CTRL(ECG_E:0)
HEC_CLK
HEC_PD
RESP_CAR_EN_
RESP_II_I_
ECG_RES_
MAX809LEUR
X15
SWITCHING REGULATOR FLOATING | NONFLOATING
REFERENCE GENERATION
ECG CONTROL
U_EPR
ECG_RESET
M_DAS/13
M_DAS/14
M_DAS/18
M_DAS/16
M_DAS/15
M_DAS/17
DAS_SCLK_
DAS_MOSI_
DAS_PACE
DAS_SEL
DAS_MISO
DAS_SYNC
PACE_DEFI_ECG_RES_
PACE_SEL1
PACE_SEL2
LEITUNG_5_3
PIC_INIT
EL_R
EL_L
EL_F
EL_C
RESP_ERR
PACE_ECG
HEC_PD
HEC_CLK
TSYN
+2V5REF
-2V5REF
+5VE
+5VA
-5VA
+5VN
+12VE
-12VE
+5VP
-5VE
+9to18SR
3.932160MHz
VCC=+5VN,GROUND=GNDN

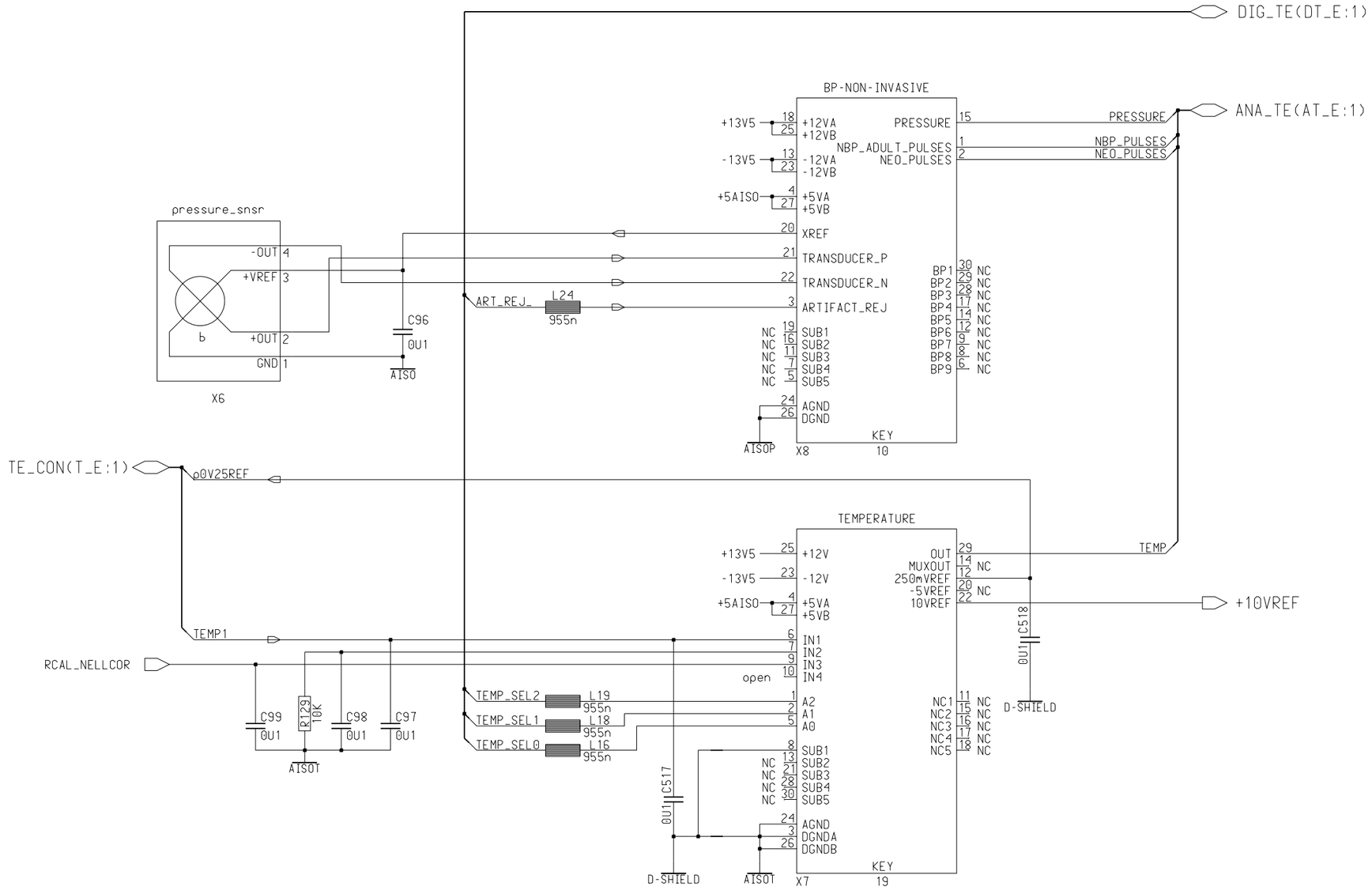
Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg	388 032 82 P
	Sheet: 5 of 11
LPL DASH 2000 DAS	
PCB DASH 2000 DAS	

Not equipped in Version :

		REVISIONS Revision-No	Index	Date / Name	A03	F 672 63
1)		---	A	12.03.99 / GHH		Date / Name
2)		ECO-062188	B	08.06.99 / GHH	DRAWN	28.07.98 / WHL
3)					APPROVED	28.07.98 / GHH
4)						
5)					ISSUED	W.LOEHNING

[1998, 4, 2, 5]
$USER_CAE_B/dash2000/das_board/design/ecg_control



NIBP TEMP

Marquette Hellige GmbH D-79007 Freiburg						388 032 82 P	Sheet: 6 of 11
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F 672 63	
1)		---	A	12.03.99 / WHL		Date / Name	
2)		ECO 062 187	B	05.05.99 / WHL	DRAWN	28.07.98 / WHL	LPL DASH 2000 DAS
3)		ECO 062 188	C	07.06.99 / WHL	APPROVED	28.07.98 / WHL	
4)							PCB DASH 2000 DAS
5)					ISSUED	W.LOEHNING	

Schutzvermerk nach DIN 34 beachten

SP_POXp
SP_POXm
L17 288uH
L17 288uH
C37 0U1
R56 1K
AISOS
R34 1K
C19 22p
C9 0U1
V4 LT1055S8
+13V5
-13V5
C38 0U1
AISOS
4K02
R39
R54 499K
R14 499K
C31 10n
+10VREF
RN1 10K0
V6 LT1013DS8
R47 100R
-4VREF
C41 470p
RN1 10K0
RN1 10K0
RN1 10K0
RN1 10K0
RN1 10K0
RN1 10K0
RN1 10K0
V7 LT1013DS8
R49 1K
MX7543KCWE
VREF RFB
SRI OUT1
CLR_ OUT2
LD1_
LD2_
VDD
STB1
STB2 AGND
STB3_
STB4 DGND
X2
SPI_MOSI
POX_CLR_
LOADDAC_
SPI_SCLK
SPI_CS1_
+5AISO
C42 1n
C25 10n
C24 1U0
C39 0U1
C49 0U1
V6 LT1013DS8
DC OFFSET
SPI_MOSI
POX_CLR_
LOADDAC_
SPI_SCLK
SPI_CS2_
+5AISO
MX7543KCWE
X3
C35 1n
C32 10n
C33 1U0
C43 0U1
C34 0U1
V7 LT1013DS8
AC GAIN
R4 23K7
R5 23K7
C2 1n
C1 470p
V1 LT1013DS8
C8 330n
R10 499K
R9 511R
C23 0U1
C10 0U1
V1 LT1013DS8
POX_PREAC
POX_SUM
POX_PINT
C11 150p
R12 499K
R11 4K99
V3 LT1013DS8
R41 4K99
RESTORE_
POX_CTRL0
POX_CTRL1
L1 955n
L8 955n
L3 955n
DG413DY
V- GND
V+ VL
Z1
C20 0U1
C7 0U1
C29 100n
R40 75K0
C15 10n
C3 0U1
C4 0U1
R22 75K0
V3 LT1013DS8
POX
SP_CON(S_E:1)
SP_RCAL
RCAL_NELLCOR
R46 150R
SP_RCAL_RTN
D14 BAV99W
D15 BAV99W
SP_POX_PWR
R1 1K
R2 1K
AD_IR
AD_RED
R37 10R0
R24 100K
R15 10R0
R27 100K
MMBT3906LT1
T4
R33 4K99
R25 4K99
NEL_IR_
NEL_RED_
MMBT3906LT1
T1
BAV99W D11
SP_RED_LED
BAV99W D2
SP_IR_LED
BAS32 D12
MMBT3904LT1
T2
R26 4K99
MMBT3904LT1
T5
R28 4K99
R38 10R0
T3 BSS138
T6 BSS138
L5 955n
L2 955n
RED_ENBL_
IR_ENBL_
+5V8
LP2951CM
VIN
VOUT FB
SENSE VTAP
ERR SHDN
GND
V2
C13 22U
C12 10n
C5 100n
L6 955n
POX_EN_
ANA_SPO(AS_E:1)
DIG_SPO(DS_E:1)
MX7543KCWE
X4
C26 0U1
C51 0U1
1n C44
C27 1U0
C22 10n
V5 LT1013DS8
-0V64
SPI_MOSI
POX_CLR_
LOADDAC_
SPI_SCLK
SPI_CS3_
+5AISO
SP02

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg

388 032 82 P

Sheet: 7 of 11

LPL DASH 2000 DAS

PCB DASH 2000 DAS

Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F 672 63
1)		---	A	12.03.99 / WHL		Date / Name
2)					DRAWN	28.07.98 / WHL
3)					APPROVED	28.07.98 / WHL
4)						
5)					ISSUED	W.LOEHNING

[1998, 4, 28, 3]
$USER_CAE_B/dash2000/das_board/design/spo2

PRESS AMPLIFIER

FILTER 50HZ

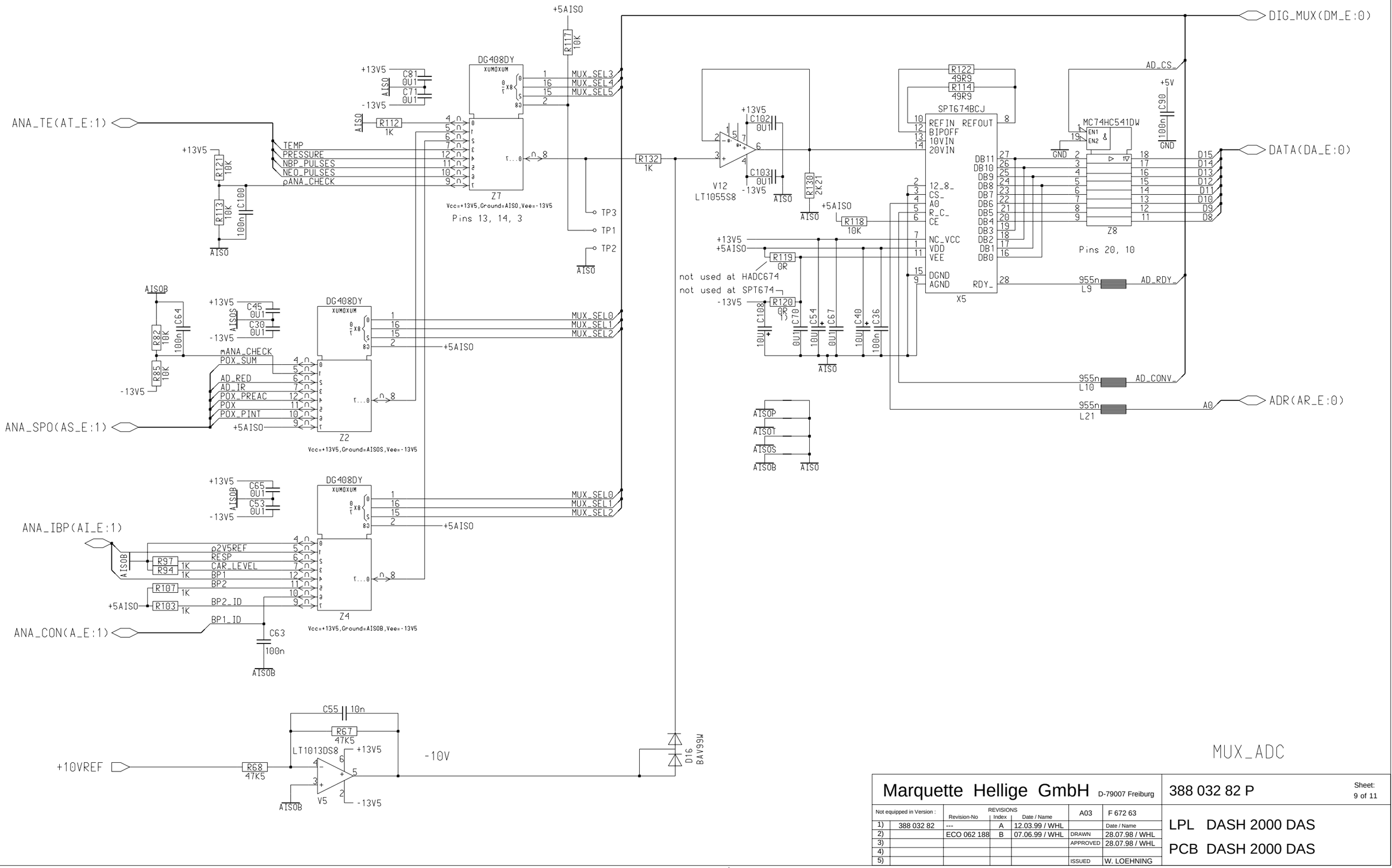
OFFSET

PRESS DRIVER

BP1_SIGp
BP1_SIGm
BP_CON(B_E:1)
BP1_EXCIp
BP1_EXCIm
ANA_IBP(AI_E:1)
+10VREF
-0V64
BP_BRIDGE_EN_
p2V5REF
BP1
+5V8
+13V5
-13V5
-3V74
AISOB
D22 MMBD1503A
D21 MMBD1503A
D17 ZMM4.7
D20 BAV99W
V8 TL064CD
V9 AD620AR
V10 LP2951CM
R87 1K
R83 10M
R89 499K
R110 10M
R71 10K
R84 10K
R88 511R
R101 10K
R102 10K
R72 100K
R78 10K
R77 50R5
R79 10K
R74 0R 1)
R73 100R
R70 100R
R86 825K
R95 825K
R96 0R 1)
R106 150R
R109 100R
R105 100R
R116 22K6
R115 60K4
R76 4K75
R75 75K0
R80 10K0 0.1%
R81 10K0 0.1%
C76 4n7
C83 4n7
C59 4n7
C72 100K
C89 4n7
C62 47N
C74 4n7
C79 0U1
C60 47N
C58 47N
C68 47N
C85 47N
C80 2n7
C86 5n6
C61 10n
C95 15U
C69 100n
C75 100n

IBP

Marquette Hellige GmbH D-79007 Freiburg							388 032 82 P	Sheet: 8 of 11
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F 672 63		
1)	388 032 82	---	A	12.03.99 / WHL		Date / Name	LPL DASH 2000 DAS	
2)					DRAWN	28.07.98 / WHL		
3)					APPROVED	28.07.98 / WHL	PCB DASH 2000 DAS	
4)								
5)					ISSUED	W.LOEHNING		



MUX_ADC

Marquette Hellige GmbH D-79007 Freiburg						388 032 82 P	Sheet: 9 of 11
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F 672 63	
1)	388 032 82	---	A	12.03.99 / WHL		Date / Name	LPL DASH 2000 DAS
2)		ECO 062 188	B	07.06.99 / WHL	DRAWN	28.07.98 / WHL	
3)					APPROVED	28.07.98 / WHL	PCB DASH 2000 DAS
4)							
5)					ISSUED	W. LOEHNING	

Schutzvermerk nach DIN 34 beachten

ADR(AR_E:0)
DATA(DA_E:0)
DIG_CON(D_E:1)
DIG_TE(DT_E:1)
DIG_SPO(DS_E:1)

MC68332ACPV-16
Z3

HM628128LFP-7
Z6

AM29F010-70JC
Z5

74HCT14
Z9

MAX809LEUR
X1

BP_BRIDGE_EN_
L40
955n

DIG_MUX(DM_E:0)

GND von VDDSYN

not used at
PCB 388 032 82

CONTROL(CO_E:0)

RXD_ISO
TXD_ISO

BDM/10
BDM/ 8
BDM/ 4
BDM/ 6
BDM/ 2
BDM/ 7
BDM/ 1
BDM/ 9
BDM/ 3
BDM/ 5

DAS CONTROL

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 82 P
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F 672 63	Sheet: 10 of 11
1) 388 032 82	---	A	12.03.99 / WHL		Date / Name	
2)				DRAWN	28.07.98 / WHL	LPL DASH 2000 DAS
3)				APPROVED	28.07.98 / WHL	
4)						PCB DASH 2000 DAS
5)				ISSUED	W. LOEHNING	

[1998, 4, 28, 3]
$USER_CAE_B/dash2000/das_board/design/das_control

ISOLATION BARRIER

RXD_ISO → 74HCT14 Z9 → 74HCT14 Z9 → HCNW2611 X12 (VCC, VE, GND; C122 68p, C123 100n, R137 1K, GND) → BAV99W D64 / R288 681R → 74HCT14 Z16 (VCC=+5VN,GROUND=GNDN) → DAS_TXD → M_DAS/ 1
+5VN, C255 100n, GNDN; R305 100K, GNDN; C149 68p, GNDNE

TXD_ISO → 74HCT14 Z9 → D33 BAS85 / R136 681R → HCNW2611 X11 (VCC, VE, GND; GND)
L37 955n, L26 955n, L39 955n; +5VN, R298 1K; C147 100n, C148 0U1, C264 68p; GNDNE, GNDN
74HCT14 Z16 (VCC=+5VN,GROUND=GNDN) → 74HCT14 Z16 (VCC=+5VN,GROUND=GNDN) → L38 955n → DAS_RXD → M_DAS/ 3

DAS_IDE0 → M_DAS/19
DAS_IDE1 → M_DAS/20
388 032 82: DAS_IDE0 low
DAS_IDE1 open
R340 0R, R341 0R 1); GNDN

FLOATING | NONFLOATING

SWITCHING REGULATOR

+13V5, -13V5; C104 10U, C111 0U1, C106 47U, C105 10U, C109 0U1
V13: MAX883CSA (VIN, VOUT, LBI, OFF, SET, LBO, GND2 GND1); +5AISO, +5V
C93 47U, C115 100n; C116 47U, C119 0U1, C117 100U
D29 BAS29 / R135 23R7 / C112 220P; D30 BYM12-150 / R138 23R7 / C114 470P; R134 23R7 / C113 220P / D28 BAS29
+5V8; S2, S1, S4, S3, W1, W2, TR1
D-SHIELD AISO GND; D39 SMBJ20C; R139 33M D-SHIELD
R251 150R, R261 68R, D53 BAS29; R236 10R0, C206 1N5, D54 BAS29, R252 392R; D61 BAS29, C207 1N
T12 BC857B; C200 0U1; R243 75K0; T9 BC857B
+9to18VC; +9to18SR; L31 80n, L32 80n → M_DAS/ 9 COD., M_DAS/ 7
ZMM4.7 D45; R230 47K5; C144 0U1, C284 0U1
X14 LT1170CQ (VSW, VIN, FB, VC, GND); C193 0U1, R246 100K; C187 1n, R229 47K5, C195 100n, R222 18K2
R213 511R, R226 511R; C178 4n7; C282 0U1
T8 BC847B, R228 47K5; T10 BC847B, R227 10K; R276 22K1, R336 10K
C166 47U, C155 0U1
ECG_RESET; DAS_RESET_ → M_DAS/ 5
L30 80n, L33 80n → M_DAS/10, M_DAS/ 8; GNDSR
GNDI

+5V → C110 100n → GND; 74HCT14 Z9

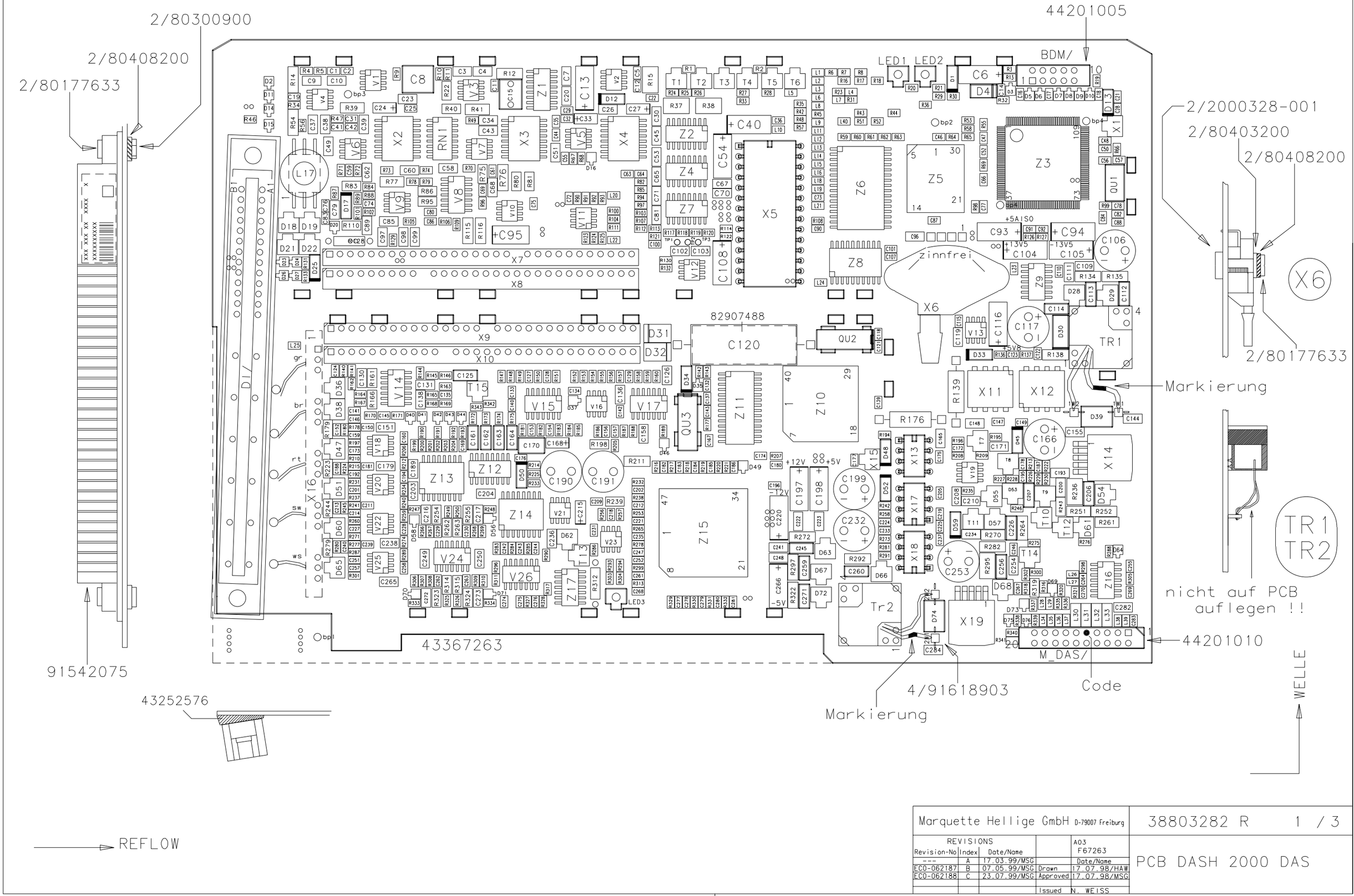
+5VN, C283 100n, GNDN → M_DAS/11, M_DAS/ 2, M_DAS/ 4, M_DAS/ 6, M_DAS/12

COMMUNICATION

Marquette Hellige GmbH D-79007 Freiburg						388 032 82 P	Sheet: 11 of 11
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F 672 63	
1)	388 032 82	----	A	12.03.99 / WHL		Date / Name	
2)					DRAWN	28.07.98 / WHL	LPL DASH 2000 DAS
3)					APPROVED	28.07.98 / WHL	
4)							PCB DASH 2000 DAS
5)					ISSUED	W.LOEHNING	

Schutzvermerk nach DIN 34 beachten

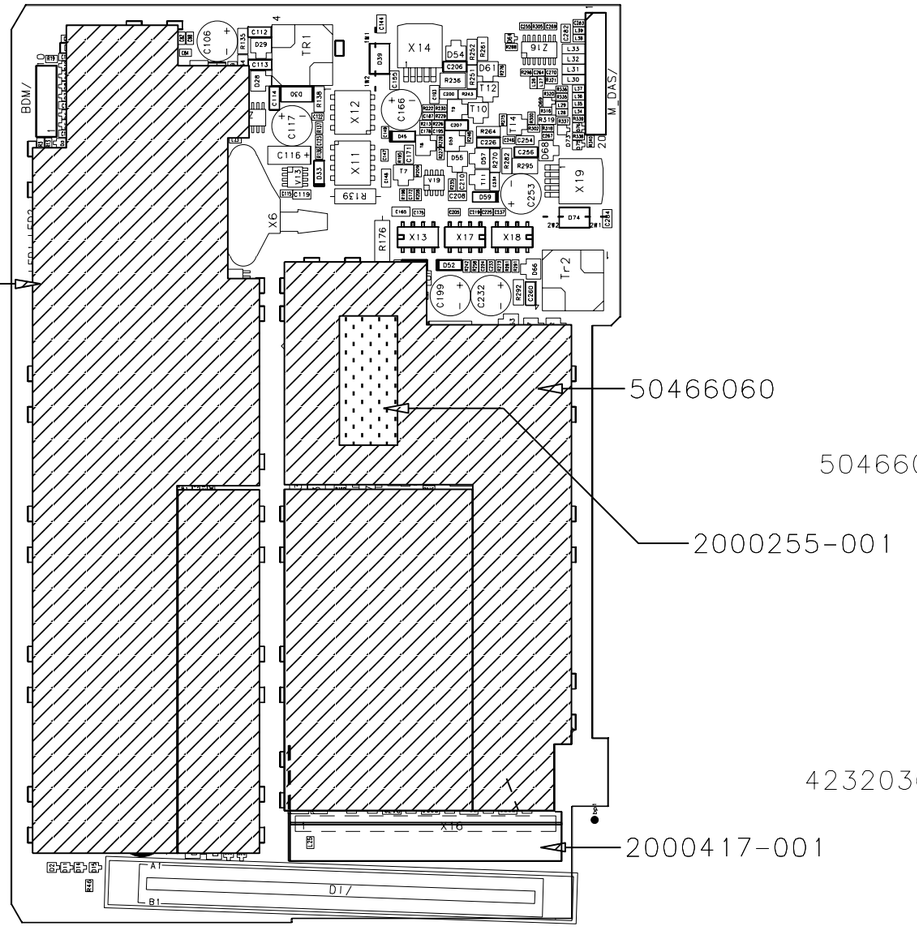
BT-AS : 18
BT-BS : 894
LOET-AS : 429
LOET-BS : 2428



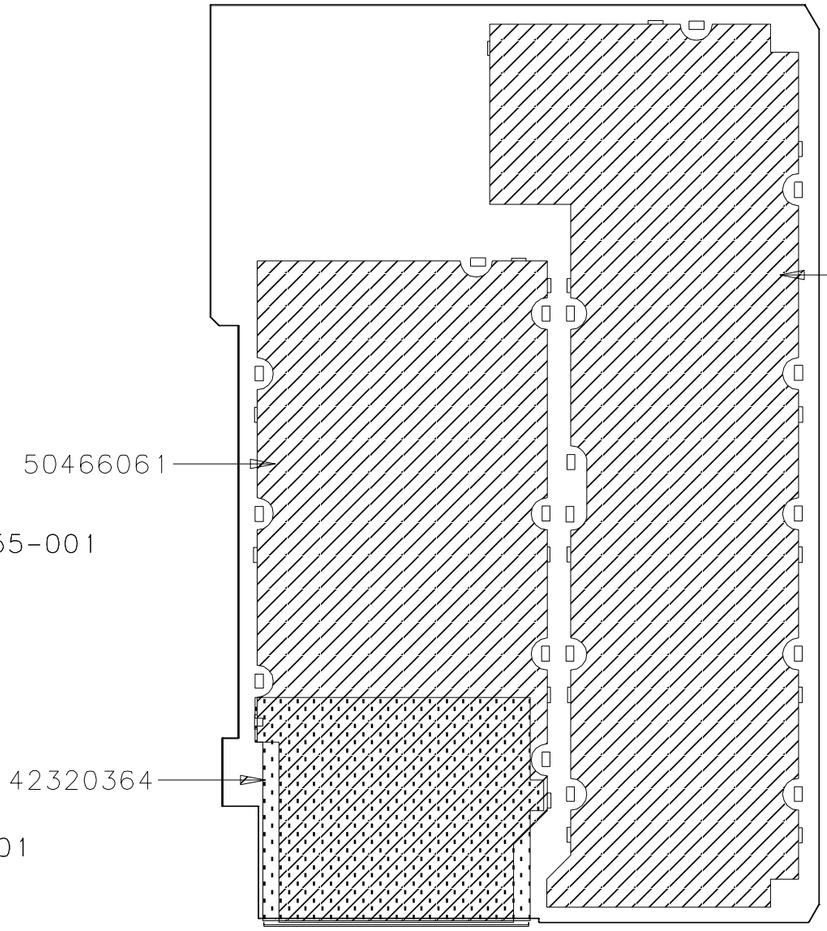
Marquette Hellige GmbH D-79007 Freiburg				38803282 R 1 / 3
REVISIONS				A03 F67263
Revision-No	Index	Date/Name		Date/Name
---	A	17.03.99/MSG		
ECO-062187	B	07.05.99/MSG	Drawn	17.07.98/HAW
ECO-062188	C	23.07.99/MSG	Approved	17.07.98/MSG
			Issued	N. WEISS

PCB DASH 2000 DAS

BS



AS

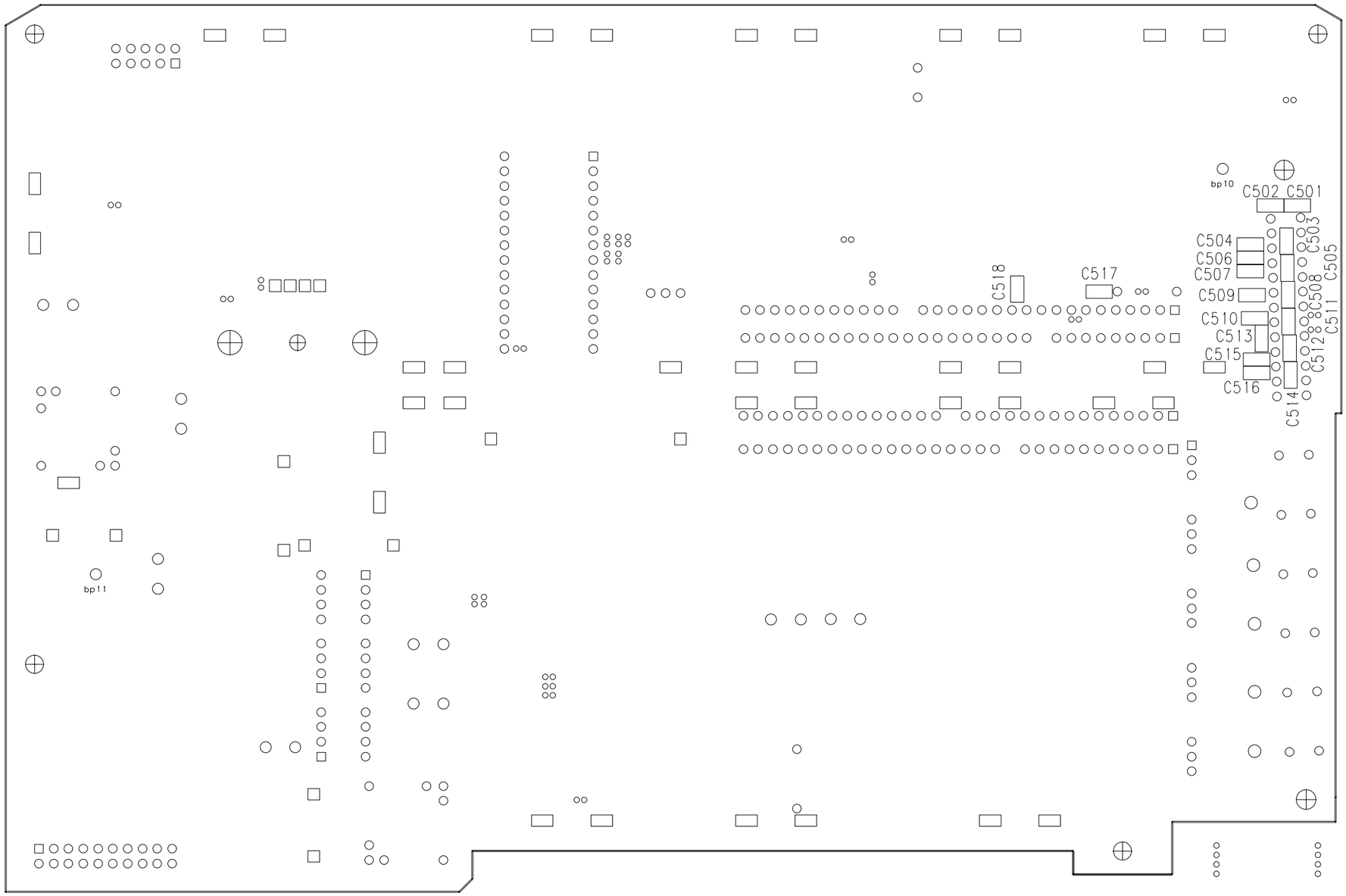


Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg				38803282 R 2 / 3
REVISIONS				A03 F67263
Revision-No	Index	Date/Name		Date/Name
---	A	16.03.99/MSG		
ECO-062187	B	07.05.99/MSG	Drawn	16.03.99/MSG
ECO-062188	C	10.06.99/MSG	Approved	16.03.99/GWK
			Issued	M. GUTMANN

PCB DASH 2000 DAS

BT-AS : 18
BT-BS : 894
LOET-AS : 429
LOET-BS : 2428



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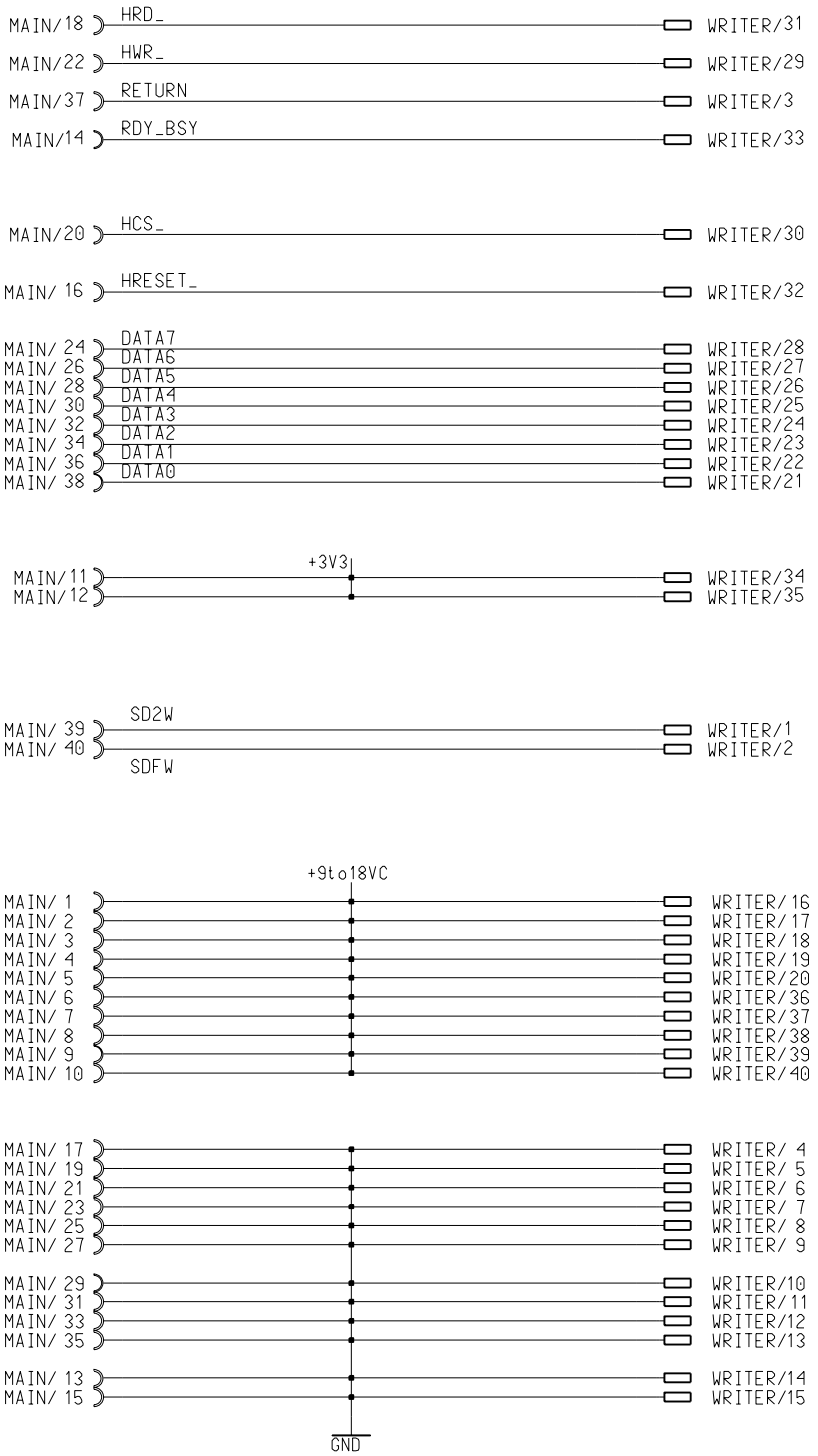
KLEBEN

Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg					38803282 R 3 / 3
REVISIONS				A03 F67263	
Revision-No	Index	Date/Name		Date/Name	
ECO-062187	A	07.05.99/MSG			
ECO-062188	B	10.06.99/MSG	Drawn	07.05.99/MSG	PCB DASH 2000 DAS
			Approved	07.05.99/HAW	
			Issued	M. GUTMANN	



Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 033 00 P	Sheet: 1 of 1
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A04	F67277	
1)		---	A	01.04.99/HAW		Date / Name	LPL VERBINDUNG RECORDER
2)		ECO-062234	B	10.05.99/PHG	DRAWN	08.12.98/PHG	
3)					APPROVED	09.12.98/MSG	PCB CONNECTION RECORDER
4)							
5)					ISSUED	GEIGER	

[1998, 12, 10, 5]
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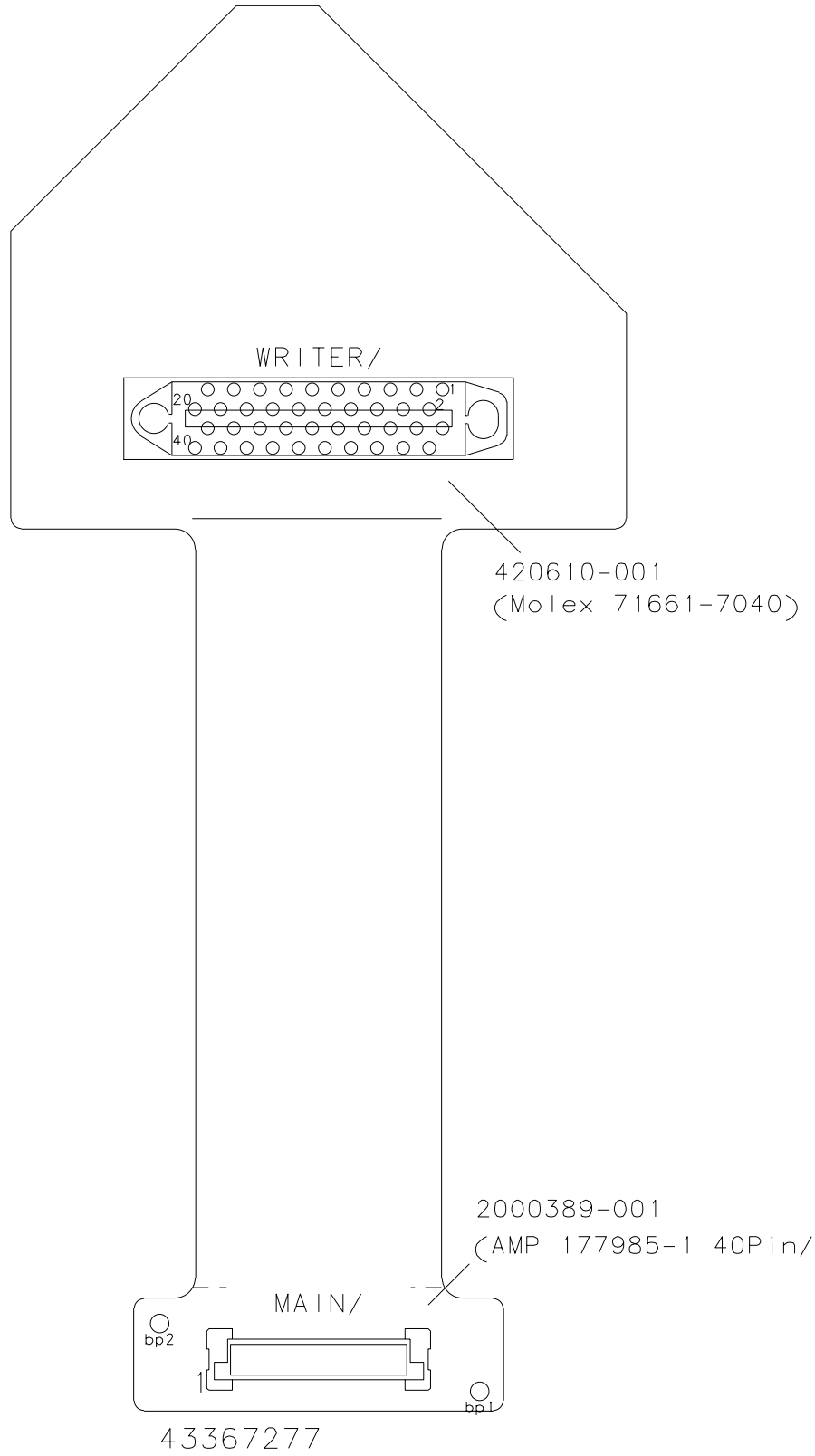
BT-AS: 0
BT-BS: 2
LOET-AS: 40
LOET-BS: 40



Marquette Hellige GmbH D-79007 Freiburg					38803300 R 1 / 1
REVISIONS				A04 F67277	REF DWG PCB Verbindung Recorder
Revision-No	Index	Date/Name		Date/Name	
---	A	29.03.99/HAW			
ECO-062234	B	10.05.99/MSG	Drawn	11.12.98/MSG	
ECO-061670	C	30.06.99/HAW	Approved	11.12.98/PHG	
			Issued	P. GEIGER	

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