Manual

For Operation

AutoWave

Portable solution to simulate and measure Battery Supply Voltage Variation

FM Version ≥ 8.03.04

The Automotive industry is facing the necessity to investigate the behavior of the battery voltage variations and their effects to electronic components connected to the supply network of the cars, testing emission and immunity.
The two major international standards describing test procedures to simulate different phenomena's related to the battery supply lines are ISO 16750-2 for 12V and 24V supply voltages and ISO 21780 for 48V supply voltage.

- ISO 7637-2
- ISO 16750-2
- ISO 21780
- SAE J1113
- Manufacturer spec as per GM, Ford, Chrysler, Mercedes, BMW, VW, PSA, Fiat .....

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Foreword

Thank you for purchasing the AutoWave generator. This user's manual lists precautions that must be taken during use, and contains useful information about the functions and operating procedure of the device. To ensure correct use, please read this manual thoroughly before beginning operation. After reading the manual, keep it in a convenient location for quick reference whenever a question arises during operation.

This manual contains a selection of typical system setup with the correct wiring diagram.
For information about using and handling with the software AutoWaveControl, see the manual for this product

Notes

The contains of this manual are subject to change without prior notice as a result of continuing improvements to the instrument's performance and functions. The figures given in this manual may differ from those that actually appear on your display and screen.

Every effort has been made in the preparation of this manual to ensure the accuracy of this contents. Should you have any questions or find any errors, please contact your AMETEK CTS representative or send an email to AMETEK CTS.

Trademarks

Version

This manual is written for AutoWave Firmware version 8.03.04 and higher

Content

1. Model Overview

1.1. AutoWave Models and extension modules

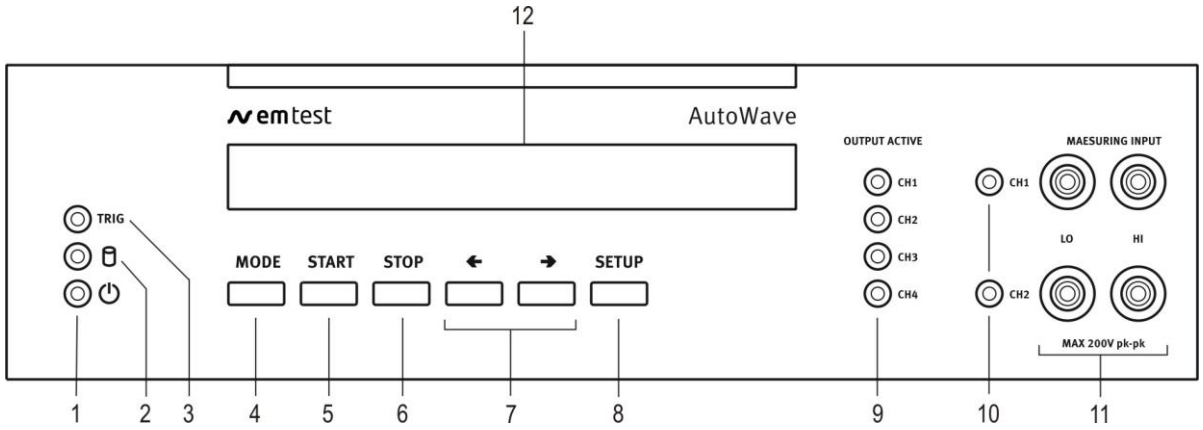
Model / article	Description	Remark
Current AutoWave models		
AutoWave	On-Board Supply simulator 2 output channel	
Options:		
Option “ExtBoard”	Extension board, 2 additional output channels.	separately available
OPT AW1-FAST *	To meet MAN 3499 slew rate requirement <3us Only compliant when using a VDS 200x.2 generator	upgrade available
AutoWave-WR	On-Board Supply simulator 4 output channels 2 input channel (ExtBoard included) Built-in WaveRecorder	
Options:		
OPT AW1-FAST *	To meet MAN 3499 slew rate requirement <3us Only compliant when using a VDS 200x.2 generator	upgrade available
Discontinued AutoWave model		
Autowave	On-Board Supply simulator 2 output channel	Discontinued June 2021
Options:		
Ext Board	Extension board for AutoWave with 2 additional output channels. The two measuring input channels are only activated by the additional option WaveRecorder.	upgrade possible
“WaveRecorder”	Module to support the record and replay functions of the AutoWave. Includes upload and download functions, waveform editing and report generation capabilities. Requires the ExtBoard option built into the AutoWave simulator.	upgrade possible
OPT AW1-FAST **	To meet MAN 3499 slew rate requirement <3us Only compliant with the standard when using a VDS 200Qx.2 generator	Availability depends on age of the AutoWave generator

* Depending on the production date, some AutoWave and AutoWave-WR models have this feature firmly built in. For identification see page 13.

** Availabilty depends on age of the AutoWave unit.

2. Put in service Functions

2.1. Front view



1 LED Power
2 LED Running
3 LED Trigger
4 Mode
5 Start
6 Stop
7 Cursor "←" "→"
8 Setup
9 LED display output channels 1...4
10 LED display input channels 1...2
11 Input channel 1 & 2 (option)
12 Display

1. LED power

The LED power indicates the power on status.

2. LED Running

The LED Running indicates the running play- or measuring status

3. LED Trigger

The LED Trigger indicates
- Manual, external or remote trigger event
- Start of a sequence

4. Mode

Pressing this button will cyclicly rotate between the main menus.
- Wave Generator
- Wave Recorder
- Wave Manager

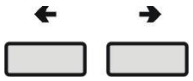
5. Start

Start button for measurement and running arbitrary waves.
START: “Start” or “Continue” a measurement or a running Arbwave.

6. Stop

Stop button for measurement and running arbitrary waves.
STOP: Stops a measurement or a running Arbwave
2nd STOP: Exit the record or play function

7. Cursor key "←" "→"



Cursor Key with the following functions
- Scrolling in the menus
- Setting the values up / down

8. Setup

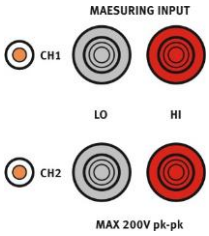
Menu button for the device configuration menu.

See Chapter 3.2.2. Setup Menu

9. LED output active channel CH1 to CH4

LED display for indicating the active output channels.
Depends of extension 2 or 4 channels are built in.
Example:
CH 1: Default channel for the battery power supply.
CH 2: Auxiliary DC power for dips
CH 3: Auxiliary channel for Ford specs.
CH 4: Auxiliary channel for Ford specs.

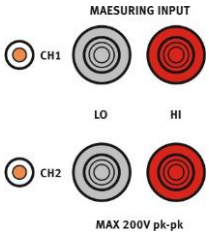
10. LED display input channel 1 + 2



The LED indicates the state of the measuring channel CH1 and CH2.

LED Status
OFF : Standby
ON : Recording

11. Measuring input channel 1 + 2

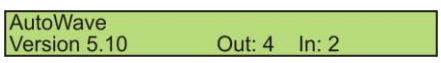


Input plugs for the two measuring channels CH1 and CH2

Maximum input voltage is 200V peak – peak

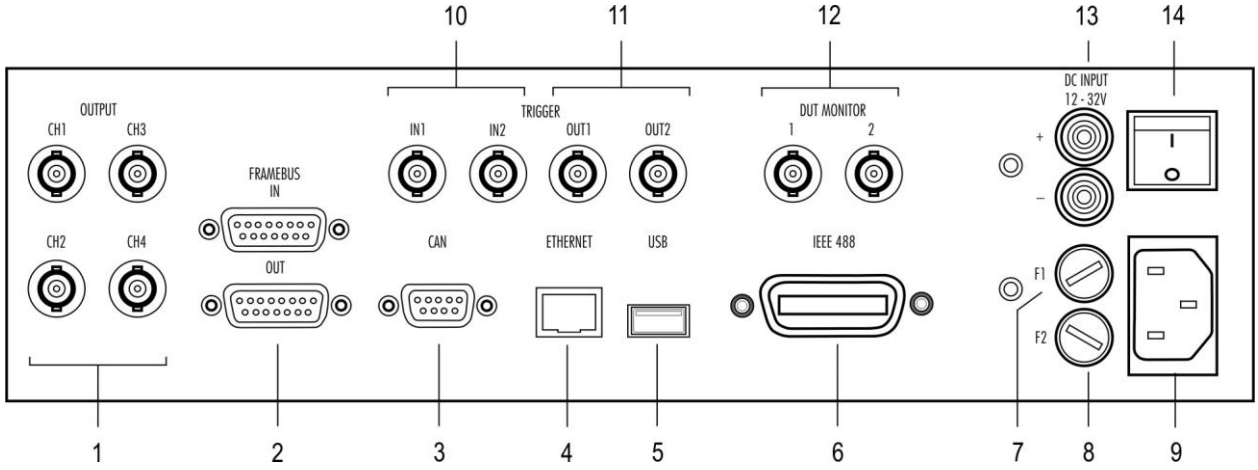
Not available on all models.
Only if WaveRecorder option is built-in.

12. Display



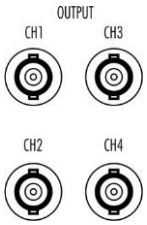
LCD display 2 x 40 characters

2.2. Rear view



1 Output channel 1...4
2 Framebus IN / OUT
3 CAN port
4 Ethernet port
5 USB port
6 GPIB / IEEE 488 port
7 Fuse F1 DC 3.15A
8 Fuse F2 AC 1A
9 Mains 90V – 250V
10 Trigger IN1 / IN2
11 Trigger OUT1 / OUT2
12 DUT monitor
13 DC supply 12 – 32V
14 Power on switch

1. Output Channel 1...4



BNC output plug to controll external DC sources.

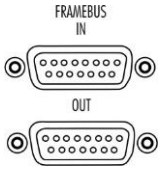
Example:
CH 1: Default channel for the battery power supply.
CH 2: Auxiliary DC power for dips
CH 3: Auxiliary channel for Ford specs.
CH 4: Auxiliary channel for Ford specs.

Output range:±10V

Note: The output channels 1..4 were designed to control a VDS 200 and have a high output impedance, and a very low current. For verification of the output voltage, please use a differential probe.

Per default CH1/CH2 are available on all AutWave models.
CH3/CH4 are not available on all models, only if ExtBoard is built-in.

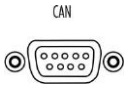
2. Framebus IN / OUT

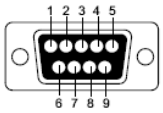


Daisy Chain bus with Sub D 15 poles male and female connectors.

This port is used as communication and control bus between EM Test devices.

3. CAN port





CAN port 9 pole Sub D female connector

The Philips PCA82C251 CAN transceiver for 24V system serves as the interface between the CAN protocol controller and the physical bus. It is primarily intended for applications (up to 1 Mbaud)

Note1:
The CAN- BUS is function is inactive

Note2:
At the current models after mid 2021 the connector is not mounted anymore (metal cover).

Pin assignment
1: nc
2: CAN_L
3: CAN GND
4: nc
5: CAN SHLD
6: CAN GND B
7: CAN_H
8: nc
9: +VCAN

4. Ethernet port

The network controller supports a 10 / 100Base-Tinterface. The device auto-negotiates the use of a 10Mbit/sec or 100Mbit/sec connection.

Pin assignment
1: TXD+
2: TXD
3: RXD+
4: RXD-

5. USB port

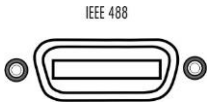
USB memory port for data transfer to or from a memory stick.

The power contacts for USB devices are not protected. They are suitable to supply connected USB devices with a maximum of **500mA** power dissipation. Don't supply external USB devices with a higher power dissipation through this interface.

Only FAT 32 with a maximum capacity of 32GB are supported

Pin assignment
1: GND
2: +DATA
3: -DATA
4: VCC

6. GPIB / IEEE 488 port



Parallel interface GPIB / IEEE 488, IEEE 488 interface with IEEE connector.

7. Fuse F1

Fuse F1 for DC power supply

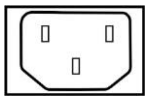
Fuse type: 3.15 slow blow
Dimension: 5 x 20mm

8. Fuse F2

Fuse F1 for AC power supply

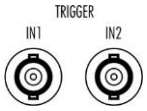
Fuse type: 1A slow blow
Dimension: 5 x 20mm

9. Mains input



The plug is part of the mains filter. (90 - 250V / 1A)

10. Trigger IN

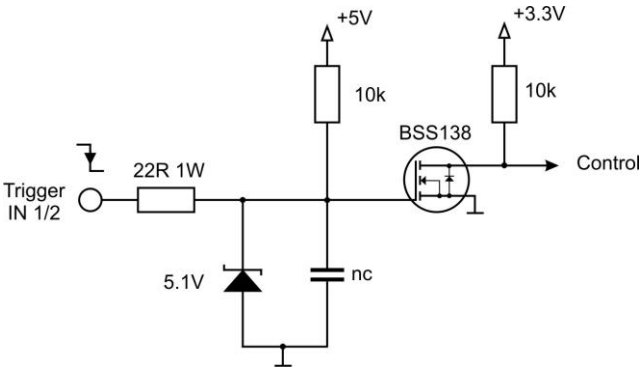


Start Stop

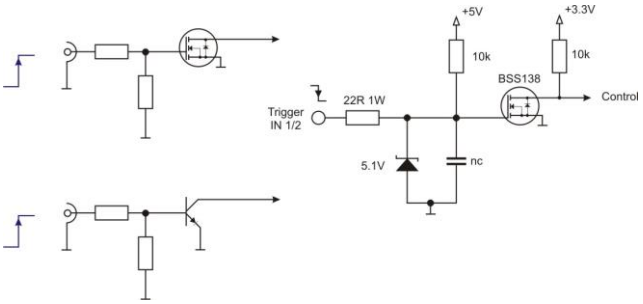
Trigger input for event triggering. This trigger inputs are connected directly to the DSP signal processor.

Input Signal: Negative slope

Input	Function	Remarks
Trigger IN 1:	Wave **start**	
Trigger IN 2:	Wave **stop**	(Vers. >1.30)

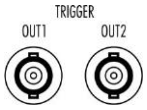


Proposal design of external circuit for using positive edge trigger signal.



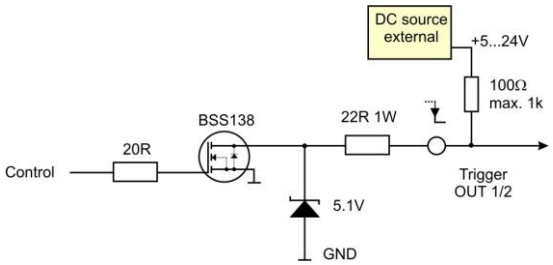
External trigger circuit Trigger Input

11. Trigger OUT

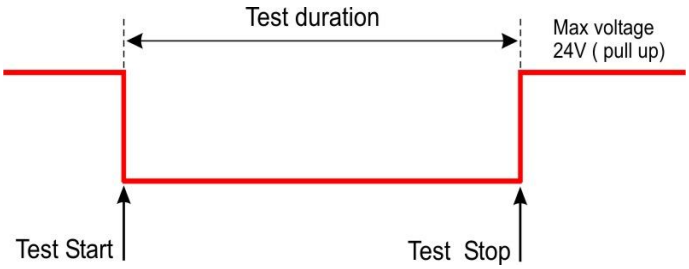


Trigger outputs for event triggering. This trigger outputs are generated from the DSP signal processor.
Max. voltage: 24V (pull up)
Current: 100mA

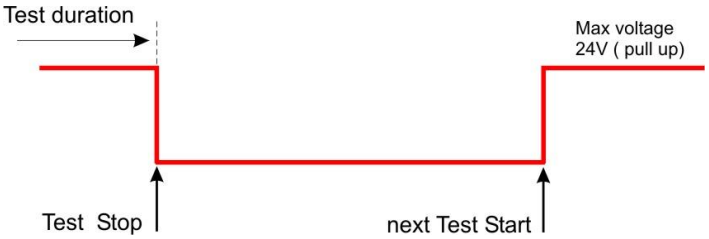
NOTE: For use the trigger out the user has to connect an external DC source for pull up the trigger signal



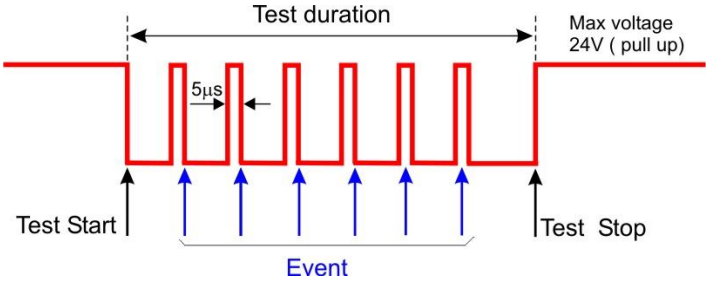
Trigger OUT at Start



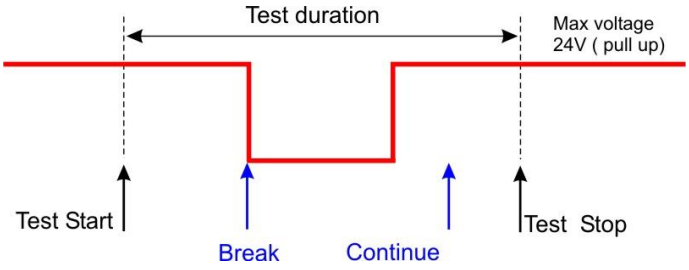
Trigger OUT at Stop



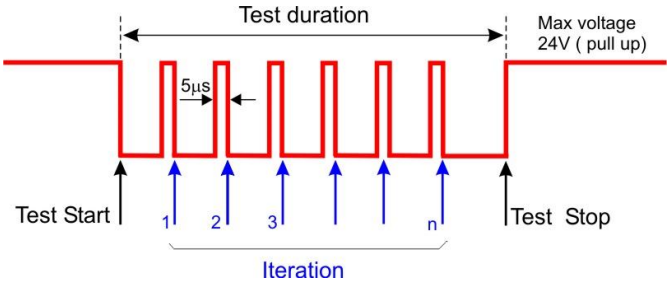
Trigger OUT at Event



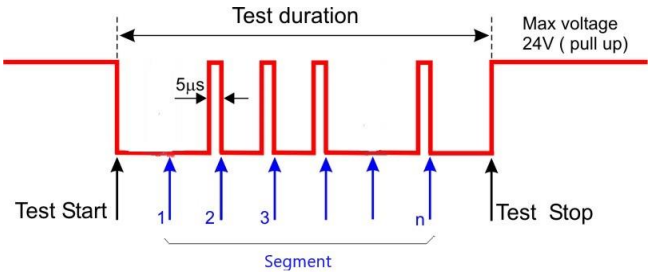
Trigger OUT at Break



Trigger OUT at each Iteration

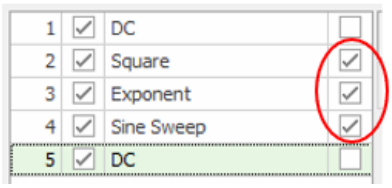


Trigger OUT at segment

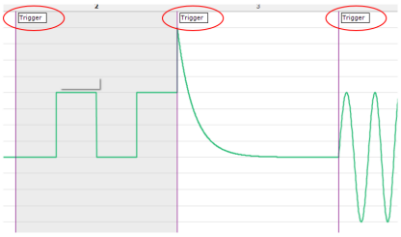


The segments can be individually selected in autowave.control software.

1)Trigger selection



2)Trigger spot in graphic



The Autowave can be prepared from the factory with a built-in pullup circuit with option OPT AW-TRIG PU.

12. DUT monitor

DUT monitor for any fail detection.

DUT Monitor 1:
DUT Monitor 2:

Function:
Input signal: Negative slope.

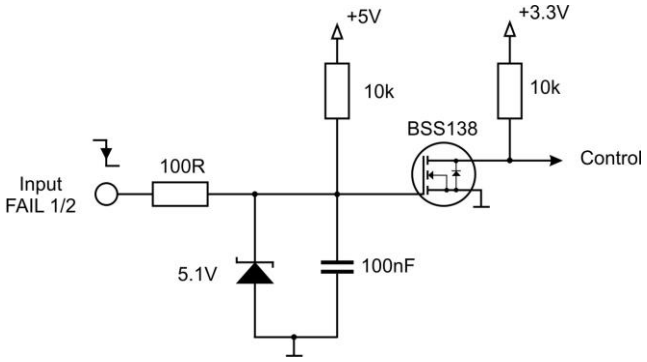
NOTE: The signal must be released to high before you start the next wave. The test will start and does not stop if the monitor signal is at low level during the wave start

Settings
The DUT monitor is settable in the AutoWave software and has the following function

Disabled	no function
Stop	stops immediately the wave
Notify	send a message to DUT Log file

NOTE: The output voltage after a stop event depends on the setting of the end voltage parameter:

YES	V= Set end voltage
NO	V keeps at the actual voltage



13. DC input

Plugs for dc power supply like a car battery. The output is protected against reverse battery polarization.

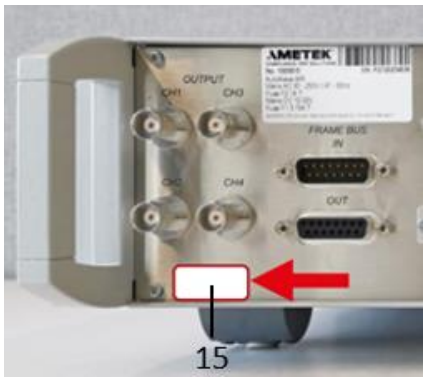
DC input voltage range: 12V – 32V dc

Not available on all models.
Only AutoWave until June 2021 and AutoWave-WR.

14. Power on switch

Power ON switch for AutoWave. The system needs approx. 35 seconds for booting.

15. OPT AW1-FAST



The label “OPT AW1-FAST indicates, the AutoWave includes a modification, to meet faster rise and fall time requirements of <3us at the VDS 200Qx.2 series.

Remark:
The faster rise and fall times can only be achieved when using a model of the VDS 200Qx.2 series. Other VDS models like 200Qx, R, N are not suitable to achieve this.

2.3. Put in service

2.3.1. Unpacking

Please check if the packing is not damaged. If there is an external damage, make inform your representative.

2.3.2. Installation in a System

The AutoWave is used to control one or more DC sources and / or for measuring and recording of the transient behavior of a voltage during a sequence.

2.3.2.1. Installation or mount in a 19” Rack

1. Unlock the two knobs on the front side and pull out the drawer

2. Mount the AutoWave into the four bolts. This fixation will allow the user to uncase the equipment in a short time for external use.

3. Connect the cables to the AutoWave

Output CH1 to CH4	BNC
Mains	115...230V
Interface IEEE / GPIB	
Ethernet	if available
Trigger IN / OUT	BNC (if available)
DUT Monitor	BNC (if available)

4. Final work
   - check the proper cabling
   - insert the drawer
   - fix the two knobs

2.3.3. Hardware wiring

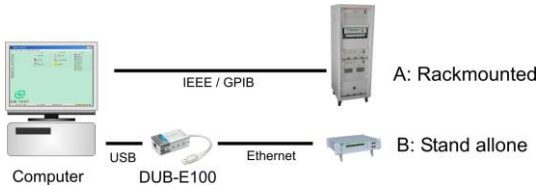
There are two solutions to connect the computer to the AutoWave.
- **IEEE** connection
- **Ethernet** connection

Both interface connections are applicable. Depends of the implementation AMETEK CTS propose the IEEE or Ethernet interface.
iso.control software uses the IEEE interface. Ethernet interface is not supported by iso.control.

Connection to

A: **Rack** with ISO equipment (IEEE)

B: **Stand alone** equipment (Ethernet)



iso.control software uses the IEEE interface. Ethernet is not supported by iso.control

When setting up the test national and international regulations regarding human safety have to be guaranteed.

It is recommended to connect the simulator to the ground reference plane of the test set-up.

The generators of the series 200, UCS, LD, PFS and VDS can be linked together to a fully automotive test set-up.

The set-up communicates via the IEEE/GPIB bus and is controlled by ISM ISO software.

For setting up the system see the following figures:

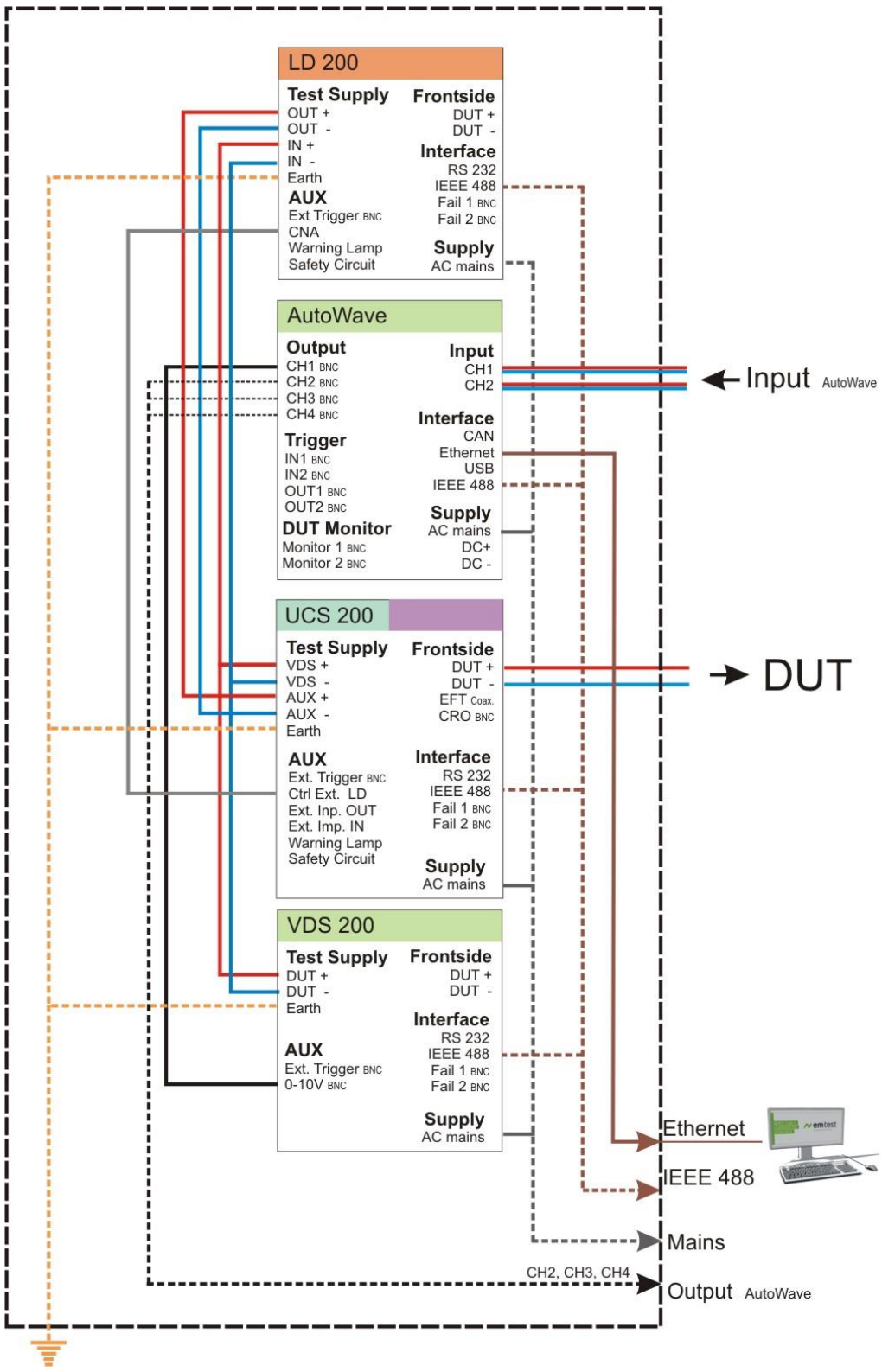
Each generator can be operated individually as a single equipment.

2.3.3.1. Wiring

Devices **Wiring**

Setup example with:

AutoWave
UCS 200
VDS 200N
LD200

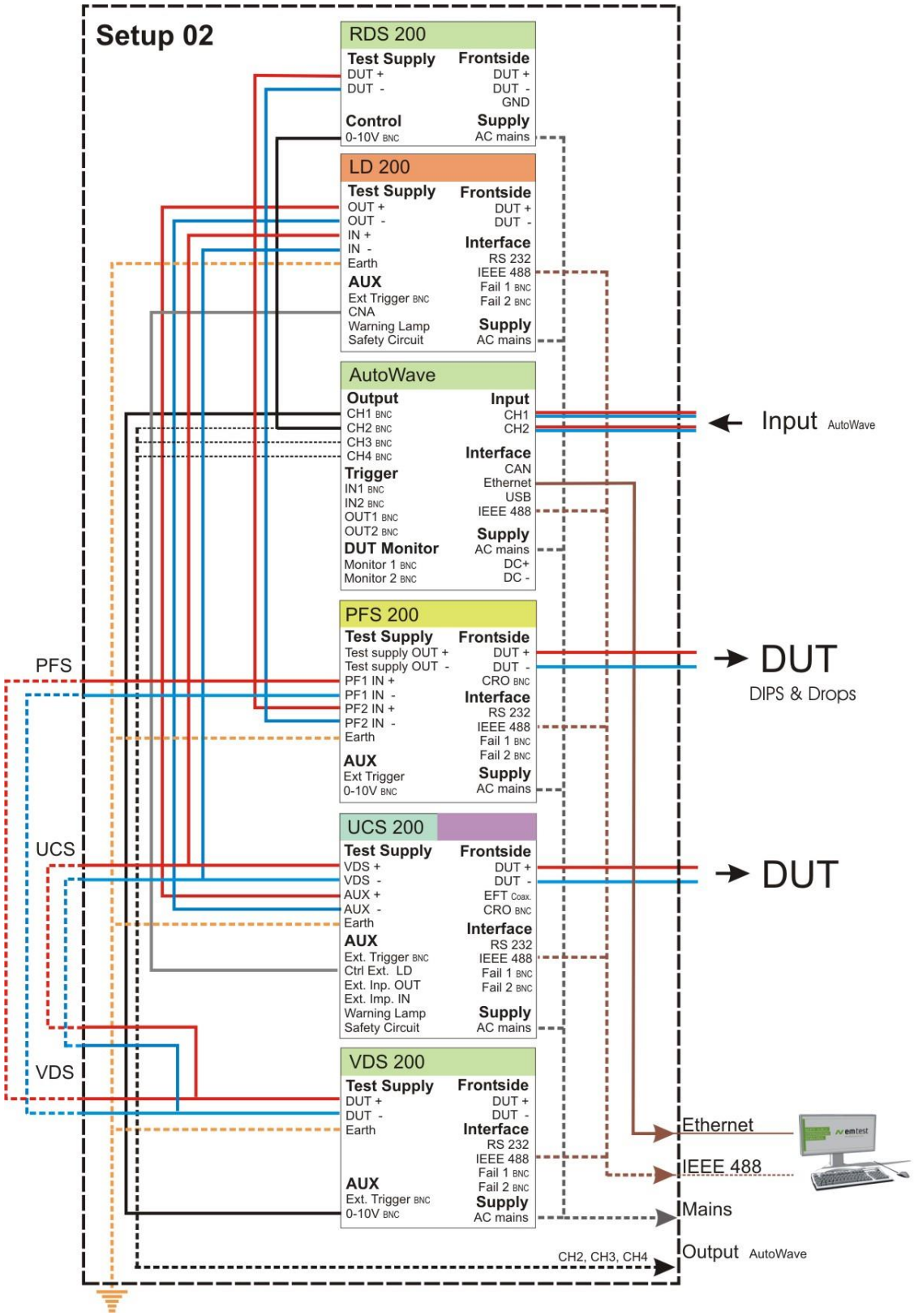


Devices

Setup example with:

AutoWave
UCS 200
VDS 200N
LD200
PFS 200
RDS 200

Wiring



Supply connections from VDS200 to UCS200 and PFS200 can be wired inside the rack.

Note: Do never connect The PFS200 output 0-10V in parallel with any AutoWave output. In this case the controlled DC source will deliver a wrong output signal. It is not allowed to connect two output sources in parallel.

Setup 3:
example with:

Rack 1
RDS 200
RDS 200
RDS 200

AutoWave

PFS 200N
VDS 200N

Rack 2
LD 200N
UCS 200N

This configuration is suitable for testing Ford AC CI-230 tests with four waves at the same time. The figure shows the output for:

- General tests at UCS output
- Dips and Drops at PFS 200
- Ford AC CI-230 at RDS and VDS outputs

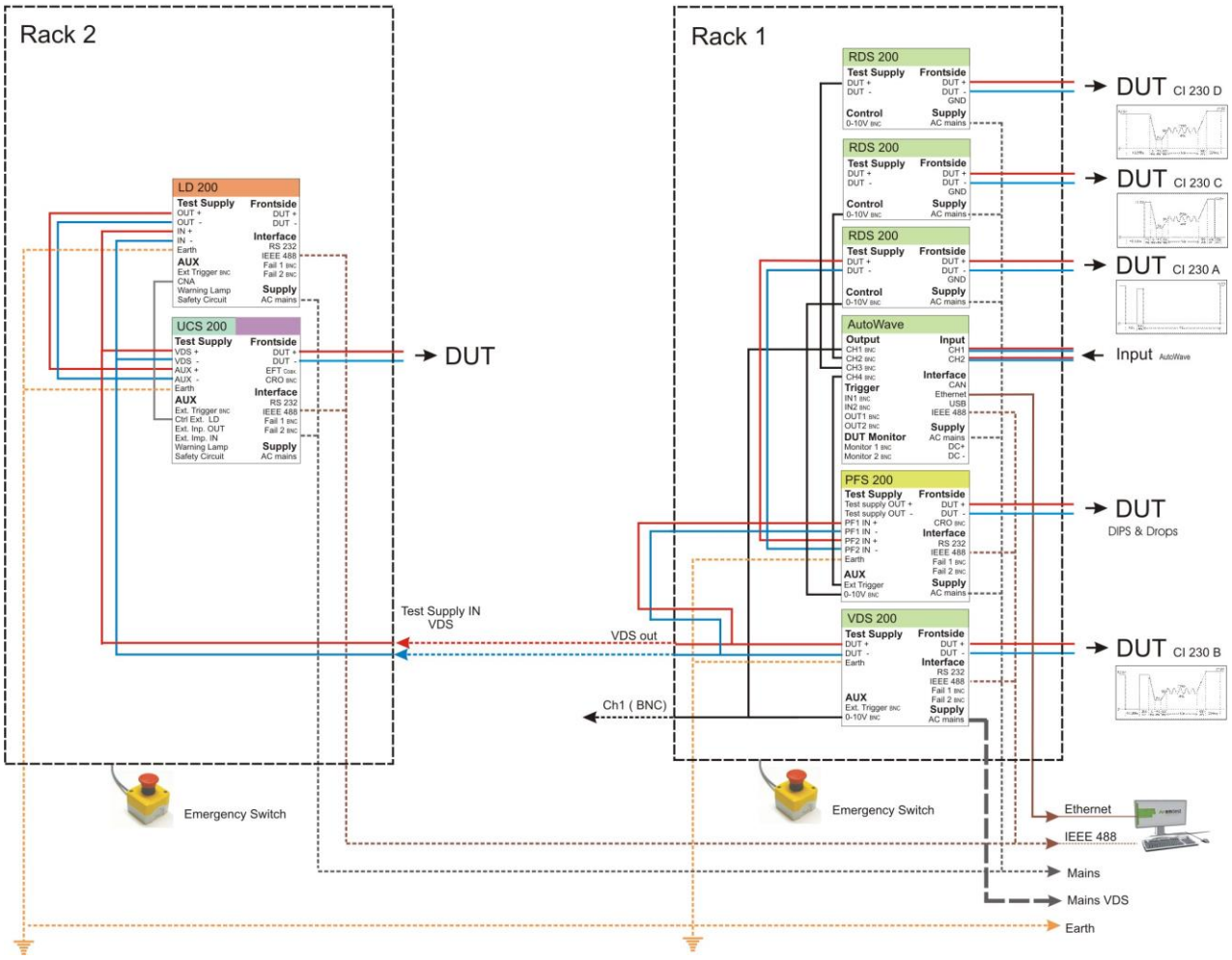
Note: The default connection between the two racks is ***Test Supply Out VDS – Test Supply IN PFS***.

Dips and Drops are available on UCS 200 output, when the connection ***Test Supply out PFS*** is used. The disadvantage is the additional voltage drop inside the UCS 200.

Supply connections from VDS200Nx to PFS200N can be wired inside the rack.

Automotive rack for with 4 DC output for Ford AC CI-230 test

Setup 03



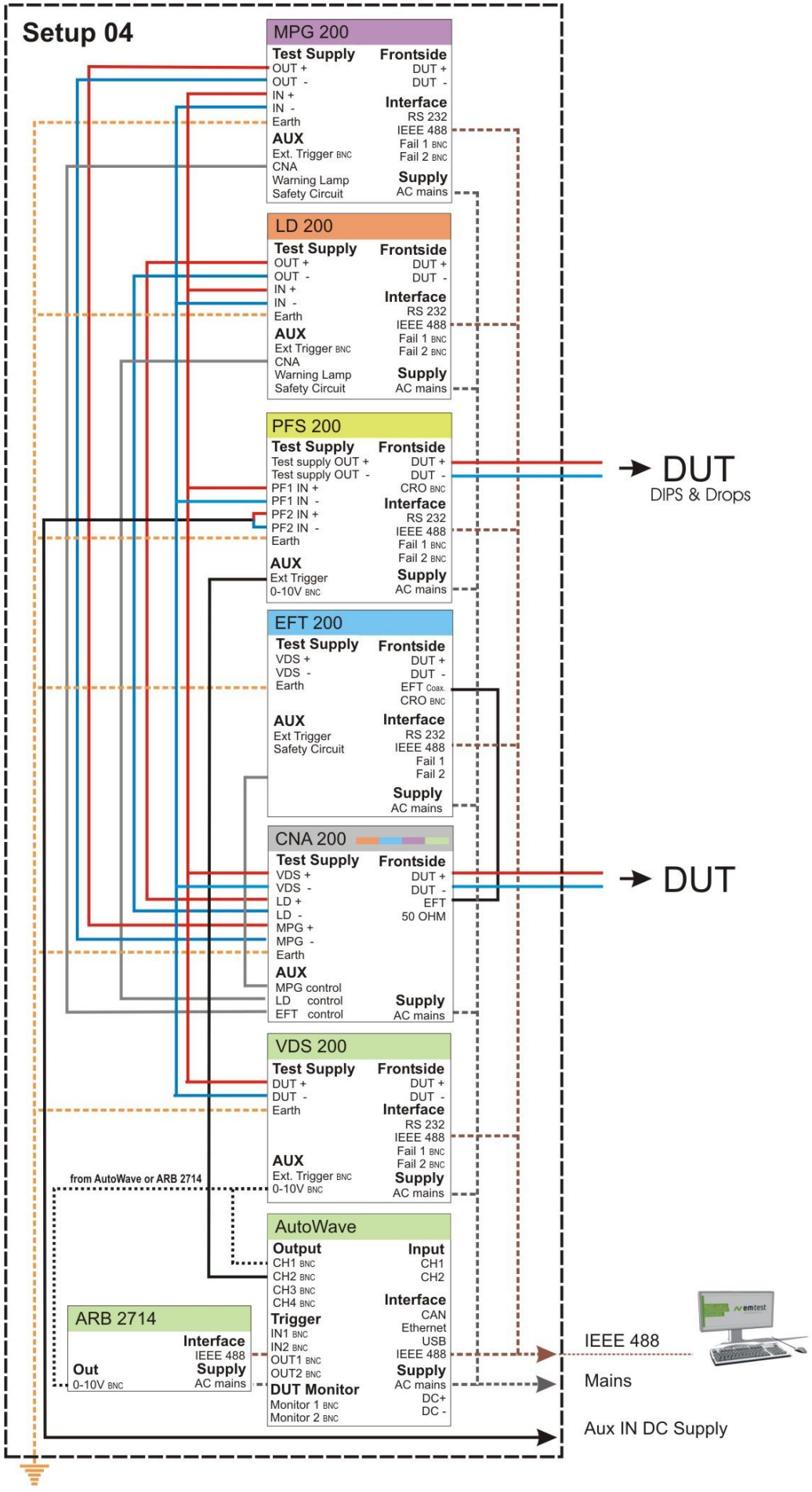
Setup 4:
example with:

Rack
MPG 200
LD 200

PFS200
VDS 200N
EFT 200

CNA 200

AutoWave for replace
ARB 2714



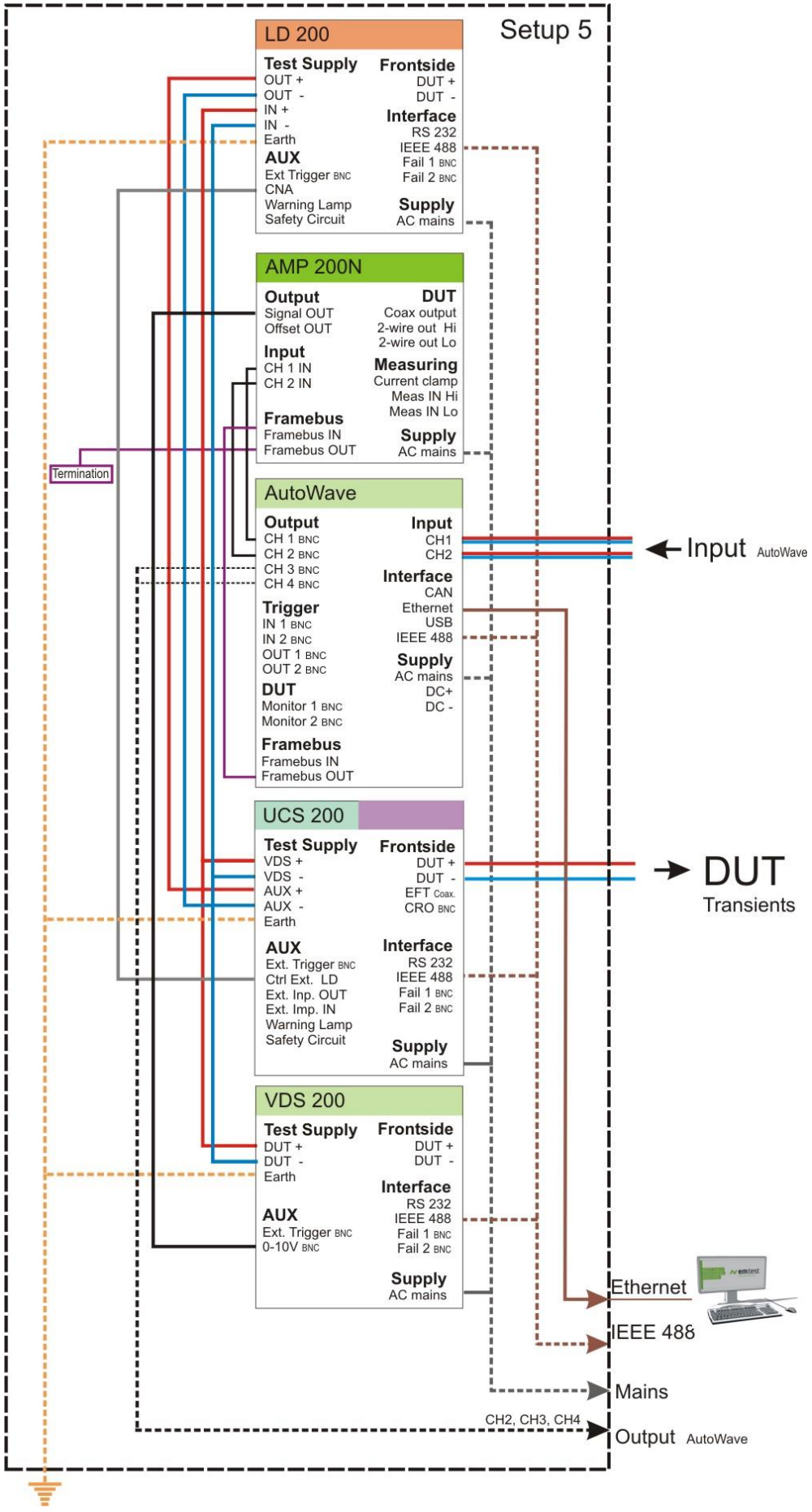
2.3.3.2. Wiring examples with AMP 200

Setup 5:
example with:

Rack
LD 200N

AMP 200N
AutoWave

UCS 200N
VDS 200N



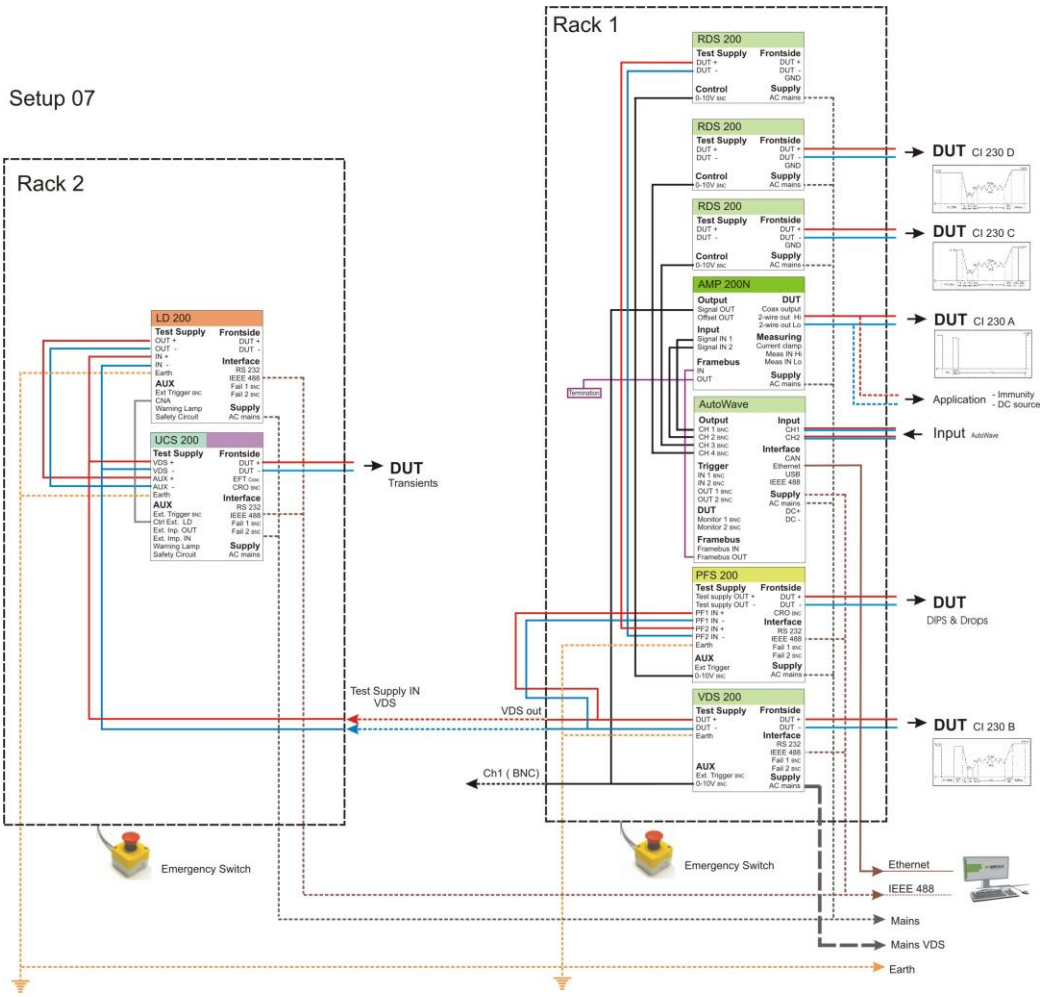
Setup 7:
example with:

Rack 1
RDS 200
RDS 200
RDS 200

AMP 200N
AutoWave

PFS 200N
VDS 200N

Rack 2
LD 200N
UCS 200N



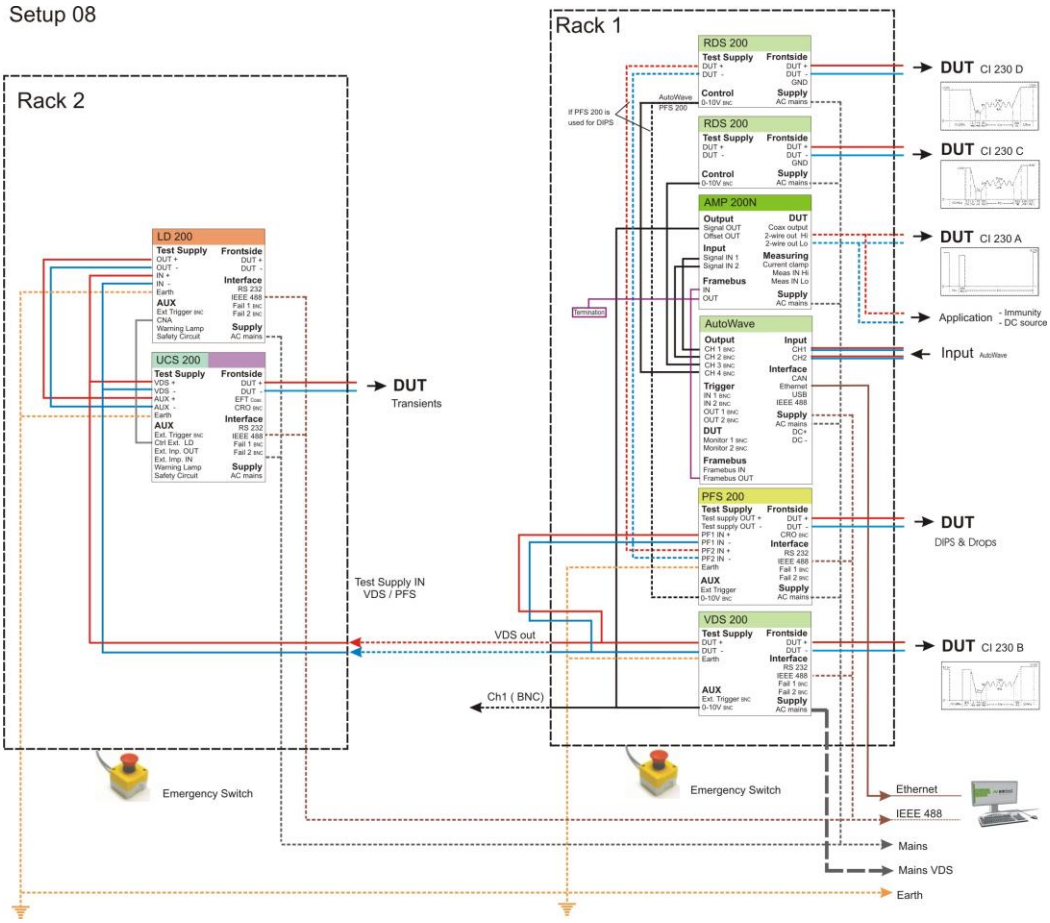
Setup 8:
example with:

Rack 1
RDS 200
RDS 200

AMP 200N
AutoWave

PFS 200N
VDS 200N

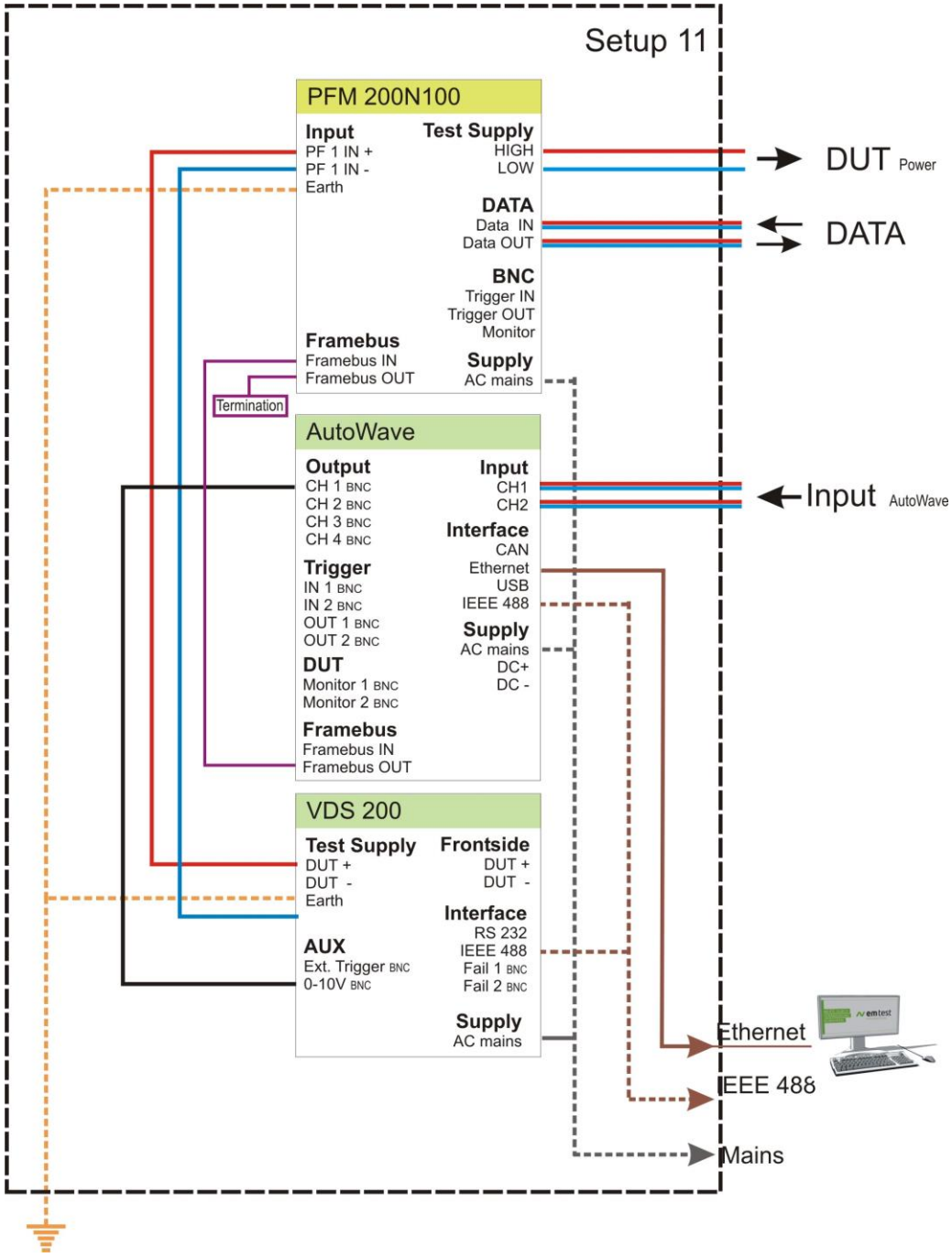
Rack 2
LD 200N
UCS 200N



2.3.3.3. Setup with PFM 200N100

Setup 11:
example with:

Rack
AutoWave
PFM 200N100
VDS 200N

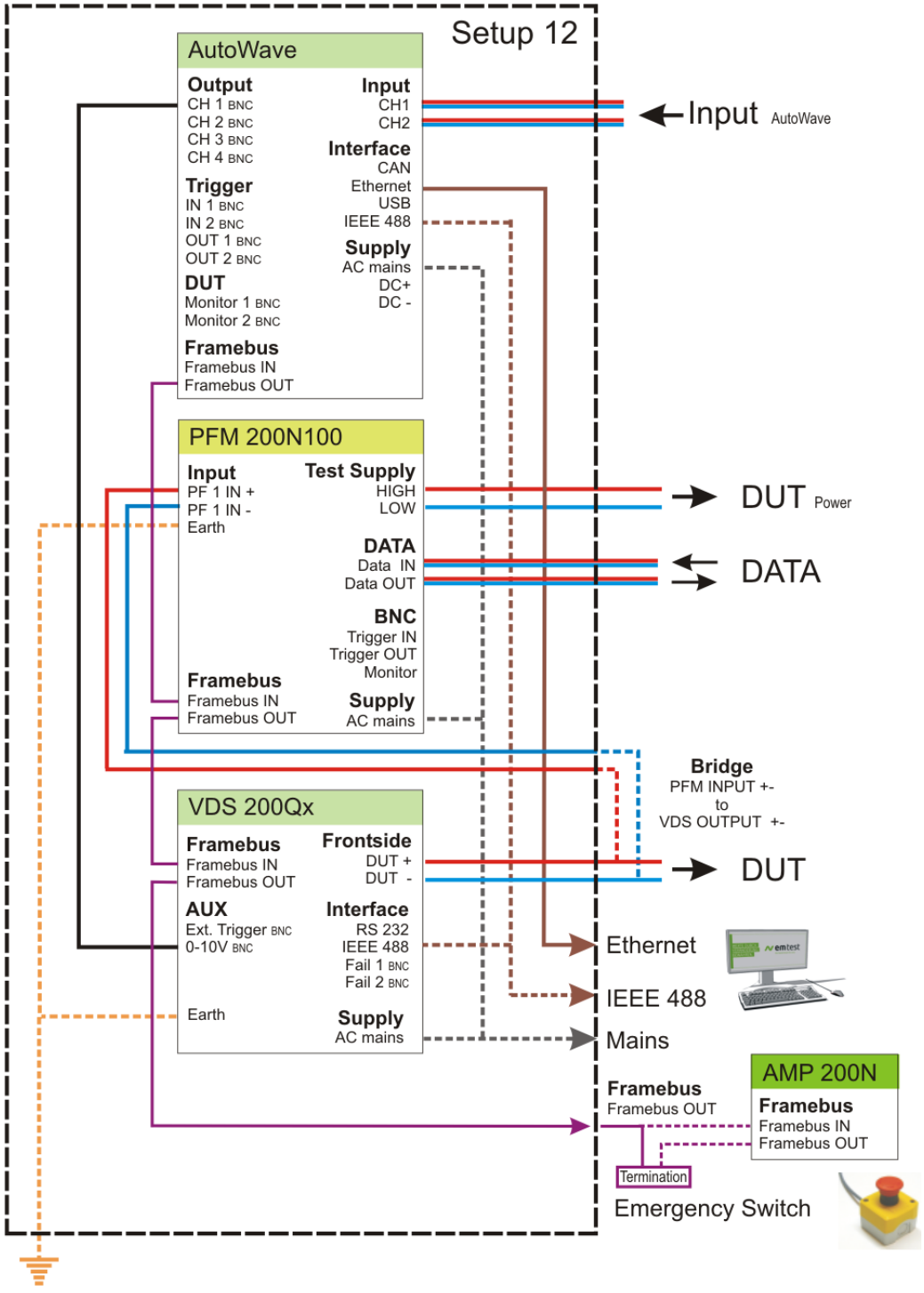


2.3.3.4. Setup with AutoWave and VDS 200Q and PFM 200N100

Setup 12:
example with:

Rack
AutoWave
PFM 200N100
VDS 200Q 25, Q 50

External: AMP 200

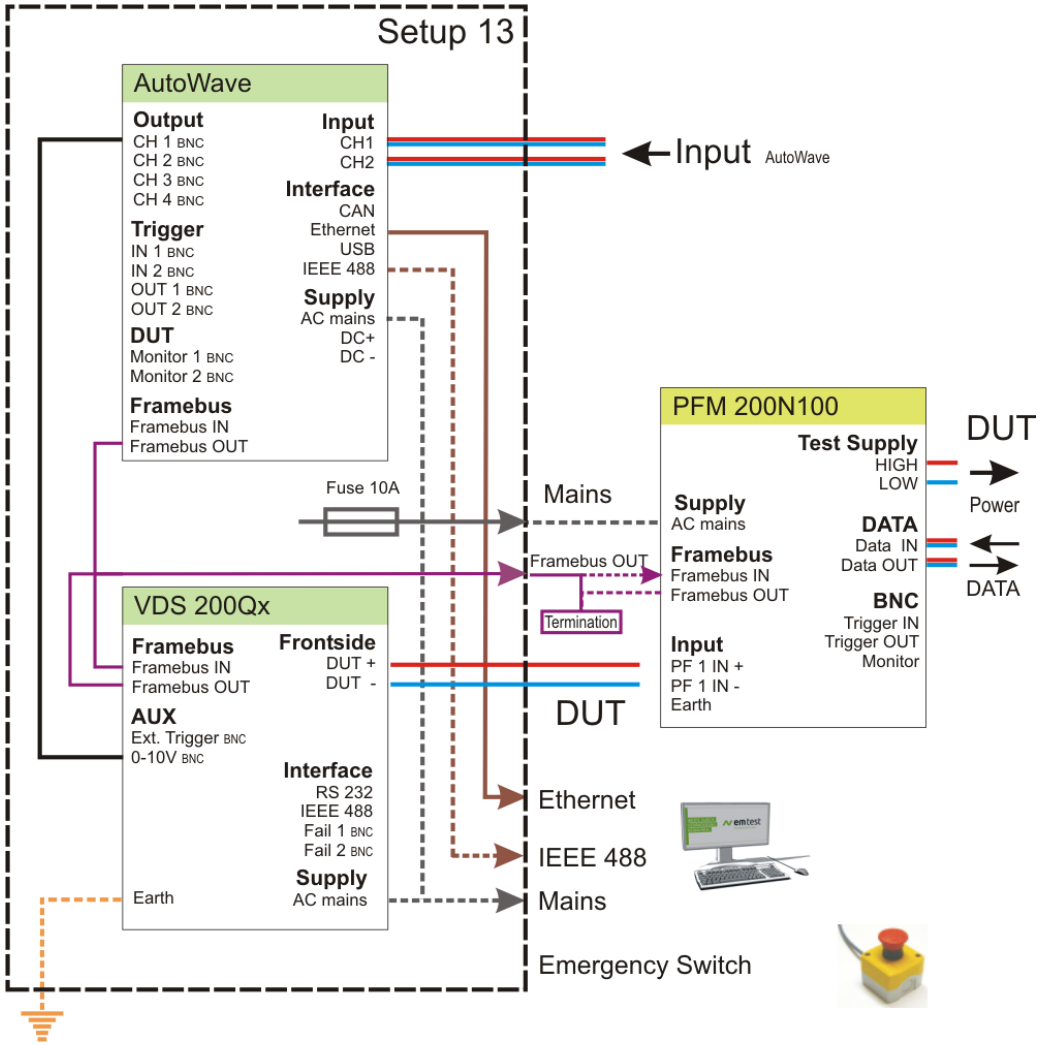


2.3.3.5. Setup with AutoWave and VDS 200Q and PFM 200N100

Setup 13:
example with:

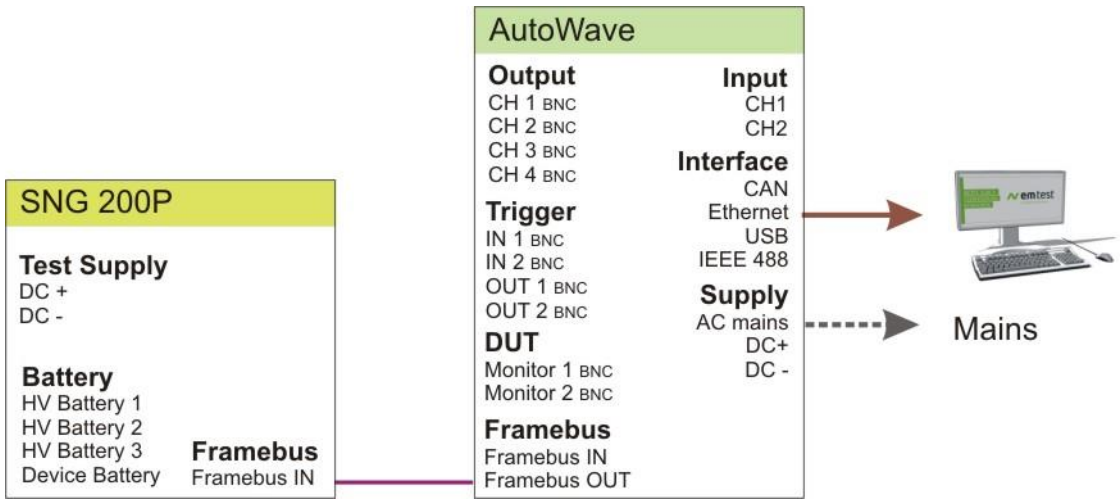
Rack
AutoWave
VDS 200Q100

External:
PFM 200N100



2.3.4. Hardware wiring AutoWave to SNG 200P

The setup below is for programming the SNG 200P via the Autowave



3. Operation

3.1. Power on

After switching on, AutoWave needs approx. 35s for booting. During this time the display is blank. AutoWave is ready when the display shows AutoWave and the current version.

The AutoWave is operated by an easy menu control system. Five function keys are available to select parameters and functions.

3.2. Menu structure

There are two buttons to navigate through the menus.

MODE button: Navigate through the menu WaveGenerator, WaveRecorder and Wave Manager.

SETUP button: Configuration of the device settings

STOP button: Return to welcome screen (Startup)

3.2.1. Mode Menu

Figure 4.1 shows the handling of the Mode menu which rotates cyclic by pressing the **Mode** button.

1st line: Menu or submenu title
2nd line: Actual Menu Function

WaveGenerator
Easy waveform generation of all automotive standards.
Generation of all kind of voltage profiles via software.
Replay of waveforms from imported data or plot files.
Check of the DUT under real world conditions.

WaveRecorder
Recording the voltage variation in the lab setup.
Replay of the measured data via an adequate dc source or amplifier.
Check of the DUT under real world conditions.

Wave Manager
File exchange to/ from a memory stick for data transfer to an external computer.
Deleteing of waveforms

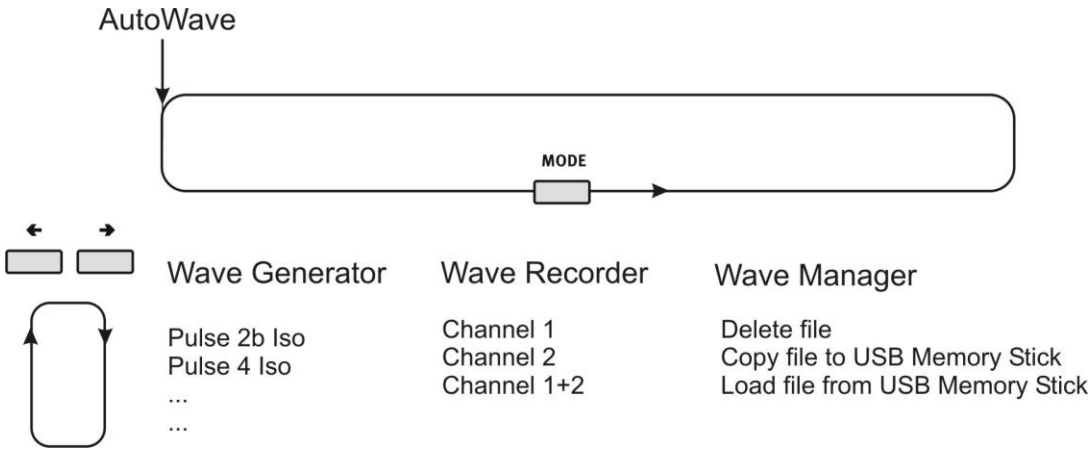


Figure 4.1 Mode Menu

3.2.1.1. Menu Wave Generator

Functions
- Selecting files
- Play files

The **output active LED** indicates the output channel(s) of the selected file.

Note: Files with multiple waves indicates all used output channels. The software AutoWave delivers the detailed information about the wave on each channel.

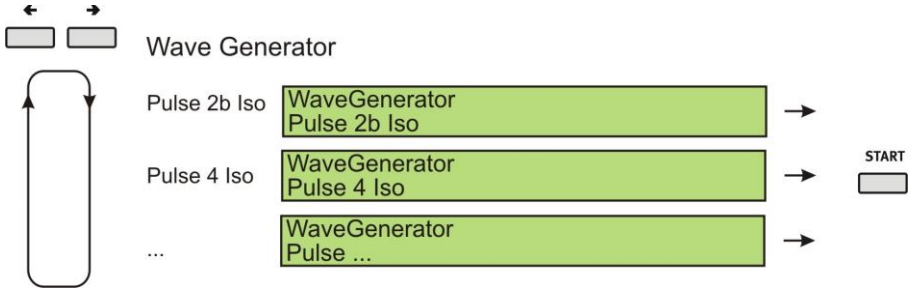
blinking: Running
off: Ready to start

A selected wave will be repeated according to the selected number of “Events”. The time counter begins after each restart at zero.

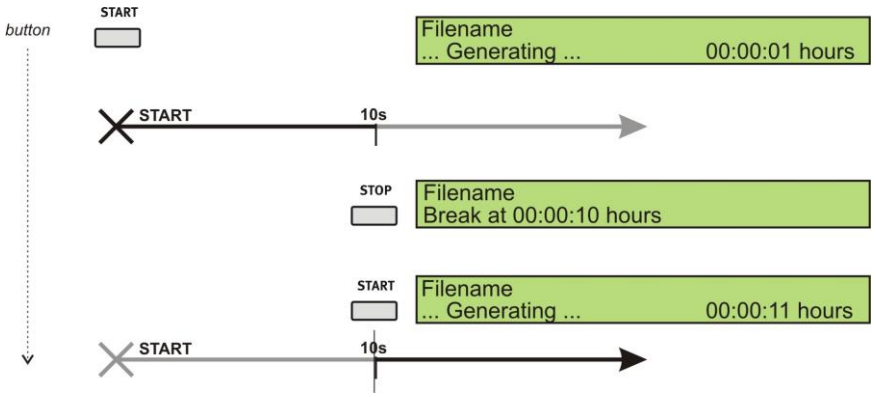
Key functions

Select a file

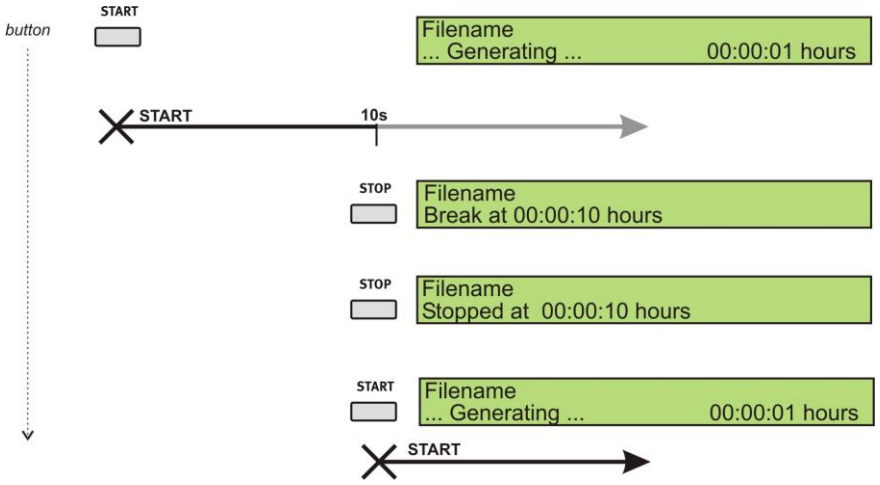
1. Select with the ◄ ► buttons the desired file.
2. Press START STOP buttons to play and stop the file.



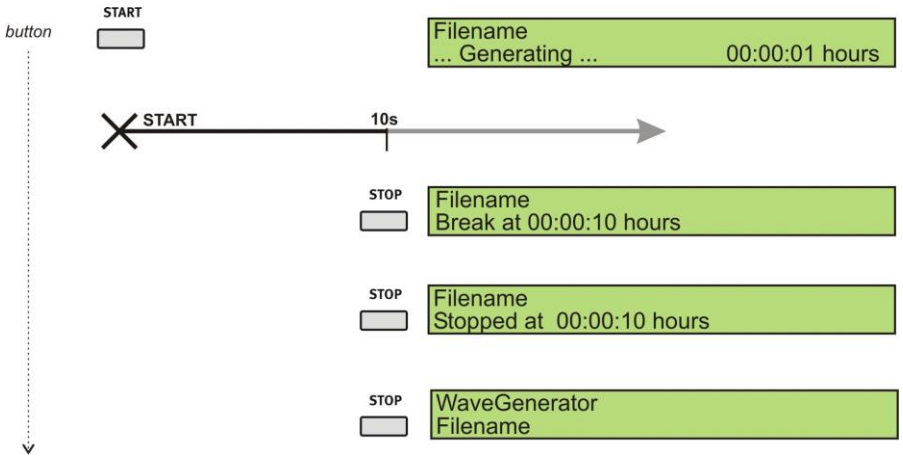
Start, Break and Continue



Start, Break and Restart same file



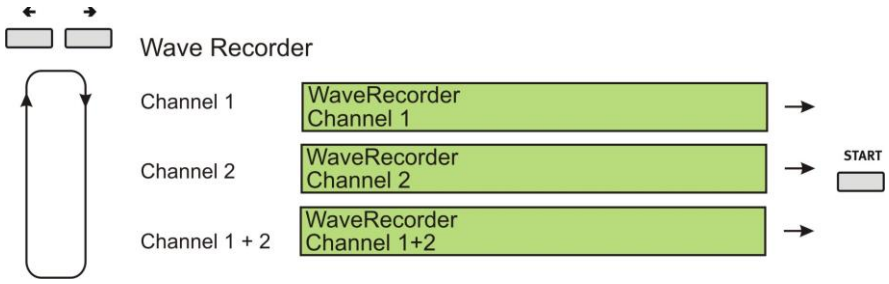
Start, Stop and return to WaveGenerator menu



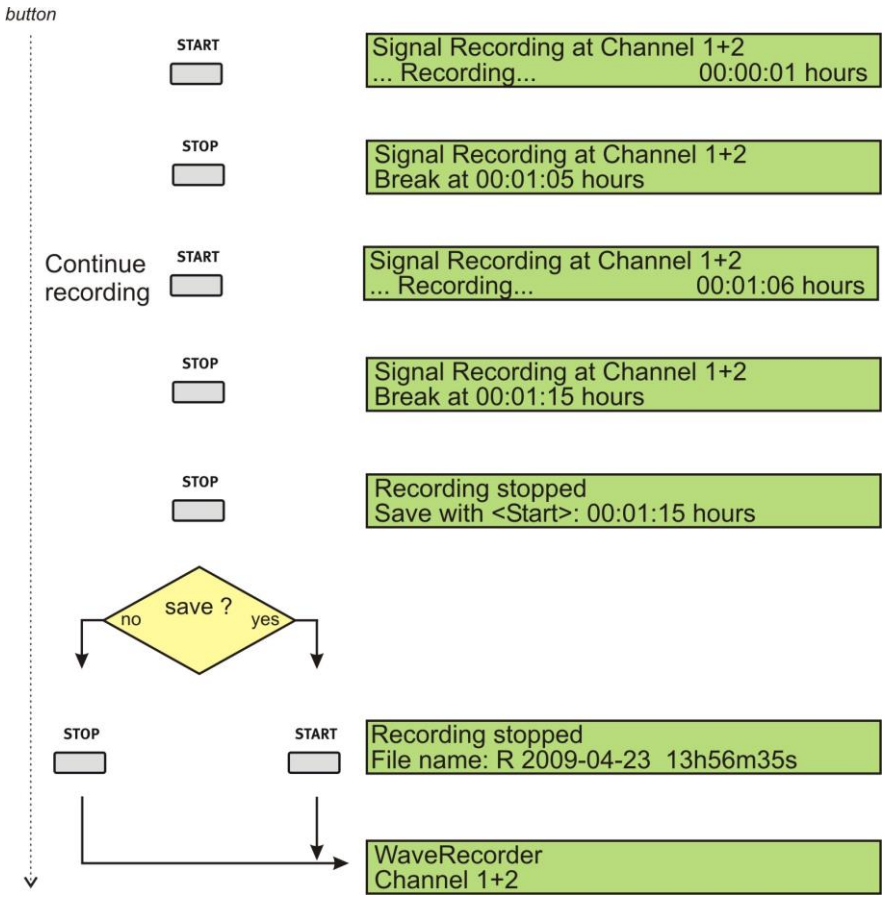
3.2.1.2. Menu Wave Recorder

Functions
Recording the voltage variation in the lab setup.
Replay of the measured data via an adequate dc source or amplifier.
Check of the DUT under real world conditions.

Channel selection



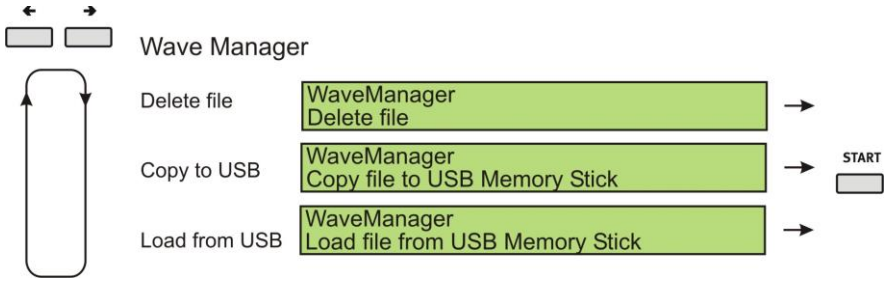
Recording



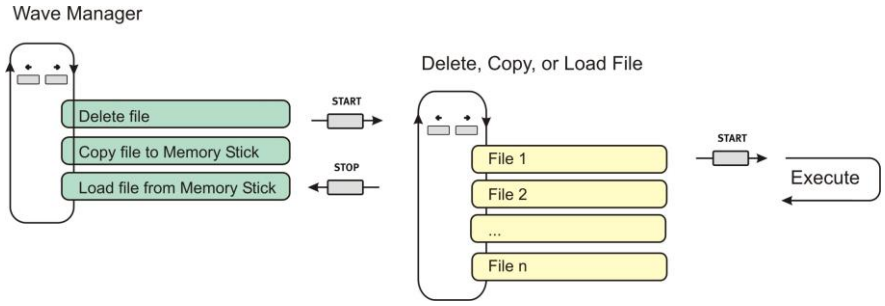
3.2.1.3. Menu Wave Manager

Functions
- Copy file to USB Memory stick
- Load file from USB Memory stick
- Delete file

Function selection



Select a file and
- Delete
- Copy
- Load



3.2.2. Setup Menu

In the setup menu all settings of the AutoWave can be done manually. The following figures show the configuration of the different parameters.

How to navigate in the Setup menu

Figure 4.2 shows the handling of the Setup menu. The small buttons inside the circle shows how to step through the menu or parameter list. The setup menu “Sample Frequency and Input Range“ occurs only when the option record is built in.

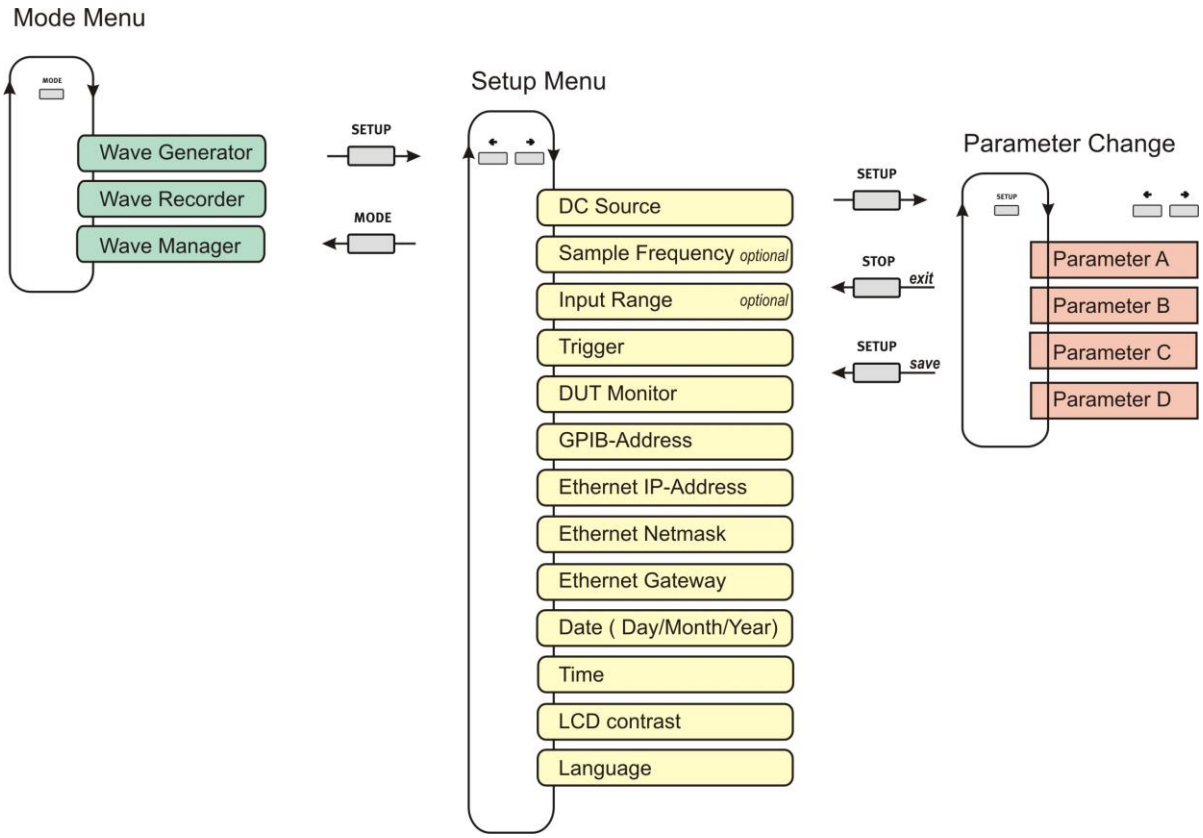
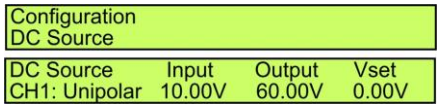


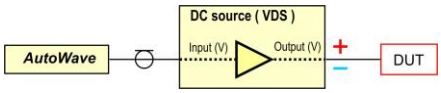
Figure 4.2 Setup Menu

3.2.3. DC Source

Parameter to control the connected voltage source. This setting must be done for each channel CH1...CH4 with a connected voltage source. AutoWave calculates automatically the correct output signal for controlling the source.



Channel	Selected output channel for setting the parameters
Source	Source design for polarity output
Input U	Max. input signal to control the power supply from AutoWave (individual each channel)
Output U	Max. output signal of the power source to the DUT
Vset	Manually setting DC output voltage of each channel. (Vset ≤ Output)



Channel	CH1, CH2, CH3, CH4	Examples for VDS
Source	Unipolar , Bipolar	Unipolar
Input U	Voltage range [0V ... 10.00V] step 0.01	10.00V
Output U	Voltage range [0V...999.99V] step 0.01	30.00V or 60.00V

Mode of value setting

The user has a choice of two modes to edit values for voltage and frequency parameters.

The "**normal**" mode is the usual one, and is done in two steps:
- first step to setup the integer part
- second step to setup the fractional part.

The "**all step editor**" mode selects each digit from left to right and the value is parsed sequentially.

Toggle between the two edit modes with the button **MODE** MODE

"Normal" Mode

30.00V→SETUP→30.00V→SETUP→next value to setup

Available keys:
STOP: Ends the editing, discarding any changes
LEFT: Decrease the value with acceleration
RIGHT: Increase the value with acceleration
SETUP: Move from integer part to fractional part and then validate the setting
MODE: Change editing mode to "**All Step Edition**"

Note: In this mode, when you are setting the integer part, the fractional is set to zero.

"All Step Editor" Mode

30.00V→SETUP→30.00V→SETUP→30.00V→SETUP→30.00V→SETUP→next value to setup

Available keys:
STOP: Ends the editing, discarding any changes
LEFT: Decrease the value with acceleration
RIGHT: Increase the value with acceleration
SETUP: Move the edited digit step by step from the left to right position / validate the setting
MODE: Change editing mode to "**Normal**"

Note: in this mode, any acceleration on LEFT or RIGHT key is disabled.

3.2.4. Sample frequency (only with the option record)

Sample frequency for data recording. The max. sampling frequency is limited by the number of used measuring channels.

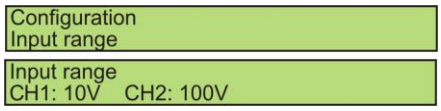
Sampling frequency

Default 5kS/s

Sampling Frequency [kHz] depends on the number of channels	
Single channel CH1 or CH2	**Dual channel CH1 and CH2**
500kHz	--
250kHz	--
100kHz	100kHz
50kHz	50kHz
25kHz	25kHz
10kHz	10kHz
5kHz	5kHz
2.5kHz	2.5kHz
1kHz	1kHz
500Hz	500Hz
250Hz	250Hz
100Hz	100Hz
50Hz	50Hz
25Hz	25Hz
10Hz	10Hz
5Hz	5Hz

3.2.5. Input Range (only with the option record)

Setting the measuring input range of the two input channels



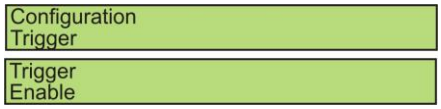
Input Range bipolar input. Each channel can be set individually.

Channels: CH 1, CH2
Default: 100V

Ranges for both channels
- ± 5V
- ± 10V
- ± 20V
- ± 50V
- ± 100V

3.2.6. Trigger

Setting of the trigger status



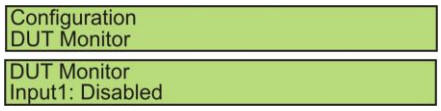
Enable: Function of Trigger IN is enabled.
- Trigger IN 1, IN 2

Default: Enabled

Disable: Function of Trigger IN is disabled.
- Trigger IN 1, IN 2

3.2.7. DUT Monitor

Open collector input for event control during a test or record.



The **DUT Monitor 1** and **DUT Monitor 2** control the behavior during a test or record. The following settings are offered for the two DUT monitor inputs
Default: Disabled

Settings DUT Monitor (open collector input)

- **Disable**: Input has no function
- **Notify**: Message will be written on a file
- **Stop**: Wave stops and continue according the user decision

3.2.8. GPIB Address

GPIB Address for using the AutoWave with the software iso.control

Standard: IEEE 488
Address: 1...30
Default: 18 Default address for iso.control software

3.2.9. Ethernet IP- Address

Set Ethernet IP Address of the target AutoWave

Selectable range: 0.0.0.0 to 255.255.255.255

Default Address: 10.0.0.2

3.2.10. Ethernet Netmask

Set Ethernet Netmask of the target AutoWave

Selectable range: 0.0.0.0 to 255.255.255.255

Default Netmask: 255.0.0.0

3.2.11. Ethernet Gateway

Set Ethernet Gateway of the target AutoWave

Selectable range: 0.0.0.0 to 255.255.255.255

Default Gateway: 10.0.0.1

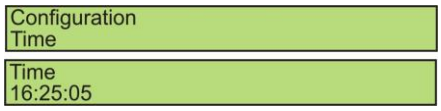
3.2.12. Date

Day: 1...31
Month: 1...12
Year: 2000...2200

Note: When pressing Setup to exit the Date setup, the display returns after few seconds delay to the Configuration display

3.2.13. Time

The time is used for mark the stored files.

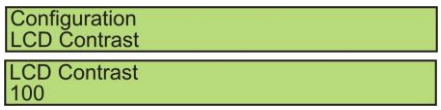


Format: HH.MM:SS (H: Hour M: Minute S:Second)
Mode: 24 hours / day

Note: When pressing Setup to exit the Time setup, the display returns after few seconds delay to the Configuration display

3.2.14. LCD Contrast

The LCD Contrast is selectable between the value 70 to 100.

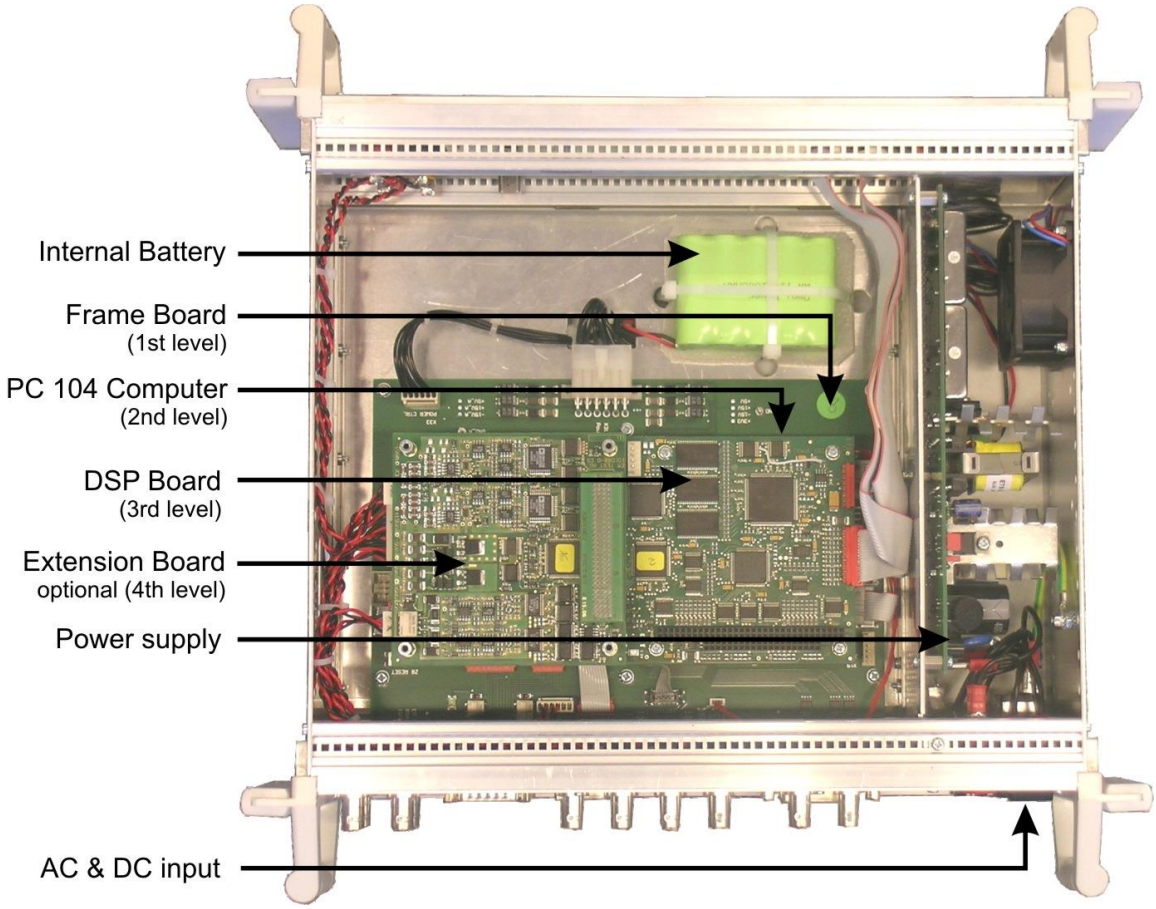


3.2.15. Language

Selection of the desired language.

English: Default setting
German: Change to German language

4. Test Equipment



PC 104 Computer
The computer is a PC 104 board with AMD SC520 processor and 32 MB SDRAM

DSP Board
The DSP board is based on the DSP 56303 100 MHz from Motorola which includes two output channels with a resolution of 16 bits / 500kHz

Extension Board
The extension board is a mezzanine card that includes:
- 2 input channels 16 bits / 500kHz
- 2 output channels 16 bits / 500kHz

Power supply
The AutoWave can be operated on two different power supply system.
- AC mains power
- DC supply from car battery

AC input
The AC mains power input is a wide range AC input that allows to operate the AutoWave in every country of the world. With the voltage input range from 90V ... 250V and 47Hz ... 63Hz it is not necessary to use an adapter transformer.

DC Input
The DC input is used for mobile operation in a car. The input is designed for 12V and 24V systems

Internal Battery (optional)
An internal battery pack is used for buffer voltage dips. In case of dropouts below approx. 3V, the device will switch off and reboot when the DC voltage is higher than 10V. The Autowave does not operate with the internal buffer battery.

5. Technical data

AutoWave	
Number of output channels	2 channels; Depending on model, 2 additional channels can be built-in as an option
Output voltage	10V, unipolar or bipolar
Resolution	16 Bit
Frequency range	DC ... 50kHz (10samples per sinus period at 500kSample/sec)
Output Range	±10V
Output Type	Single Ended
Resolution	16 bit
Differential linearity error	±8 LSB (DAC)
Integral linearity error	±4 LSB (DAC)
Accuracy	±(0.5% + 5mV)
Maximum Sampling Rate	500kS/s (Accuracy: ± 50ppm) for one channel
Transition Time	< 5µs Tested with 1kHz Square wave (20Vpp / without Offset).
Output Impedance	50Ω
Max Output Current	10mA Output short circuit protected.

Wave Forms	
Segment types	DC voltage
	Sine
	Sine sweep (log, linear)
	Damp Sine
	Sine Ramp
	Square wave
	Profile
	Triangular
	Sawtooth
	Ramp up / Ramp down
	Step
	Exponential
	Calculated based on mathematical formula
Segment duration	Unlimited
Segments per wave form	20-30 depends on the complexity of the segment

WaveRecorder	
Number of input channels	2 channels (only AutoWave-WR)
Input voltage ranges	5V, 10V, 20V, 50V and 100V; unipolar or bipolar
Resolution	16 Bit
Accuracy	better than 0.2%
Frequency range	DC ... 50kHz
Sampling rate (selectable)	5S/s...500kS/s (one channel) 5S/s...100kS/s (two or four channels)
Storage	File size max. 1 GByte

Display and Controls	
Display	Text LCD 2 lines, 40 characters
LED indicators	Power On
	Active channel 6 (2 inputs, 4 outputs)
	Trigger
	Running status
Operation	6 function keys
Trigger and DUT Monitoring	
Trigger	2 inputs, 2 outputs
DUT monitoring	2 inputs, configurable
Control	
Computer	PC 104 computer AMD Microprocessor 100MHz 32MB RAM
Operating system	Linux, with Real time extension
DSP Signal processor	Motorola DSP 56303
Data storage	Hard disk 40GB (standard)
Interfaces	
	GPIB Address 1...30
	Ethernet
	USB (for memory stick and ext. hard disc) I max. 500mA
	CAN (inactive)
	Frame bus (internal system bus)
Storage battery	
Lithium battery	Type: CR2032 3V, 235mAh 20.0 x 3.2 mm
Buffer battery (option)	Rechargeable battery 12V, 2000mAh NiMH
Environmental Hard disk	
Temperature	
operating	5...40°C
storage	-20...60°C
gradient	20°C / hour
Humidity	10%...90% non-condensing
Vibration	
Operating	1.0G
Non Operating	5.0G
Shock	
Operating	225G (2ms)
Non Operating	900G (1ms)

General Data	
Safety design	per IEC 1010, EN 61010
Power supply	AC: 90V ... 250V , 47Hz...63Hz DC: 12V ... 32V, filtered and buffered (only AutoWave-WR model)
Fuses	F1: 3.15 A slow blow (DC) F2: 1.00 A slow blow (AC)
Power requirement	40W max.
Dimension (W x H x D)	380 x100 x 390 mm
Weight	6kg

= => not relevant data for the standards can be changed by the manufacturer <= =

6. Maintenance

6.1. General

The AutoWave is absolutely maintenance-free.

Replacement of storage battery
Lithium battery: after approx. 10 years (indicates by memory lost of setting)
Internal battery pack (option): NiMH type (Replace after .3..6 years necessary)

6.2. Calibration and Verification

6.2.1. Factory calibration

Every AMETEK CTS generator is entirely checked and calibrated as per international standard regulations before delivery. A calibration certificate is issued and delivered along with a list of the equipment used for the calibration proving the traceability of the measuring equipment. All auxiliary equipment and accessories are checked to our internal manufacturer guidelines.

The calibration certificate and the certificate of compliance (if available) show the date of calibration.

The AMETEK CTS equipment are calibrated in the factory and marked with a calibration mark. The used measuring instruments are traceable to the Swiss Federal Office of Metrology.
The calibration date is marked. The validity of the calibration is to the responsibility of the user's quality system. Neither the certificate of calibration nor the corresponding label mark any due date for re-calibration.

Example: Calibration mark

6.2.2. Guideline to determine the calibration period of AMETEK CTS instrumentation

Our International Service Departments and our QA Manager are frequently asked about the calibration interval of AMETEK CTS equipment.

AMETEK CTS doesn't know each customer's Quality Assurance Policy nor do we know how often the equipment is used and what kind of tests are performed during the life cycle of a test equipment. Only the customer knows all the details and therefore the customer needs to specify the calibration interval for his test equipment.

In reply to all these questions we like to approach this issue as follows:
AMETEK CTS make use of a solid state semiconductor switch technique to generate high voltage transients. A precious advantage of this technique is the absolute lack of periodical maintenance effort. In consequence thereof a useful calibration period has to be defined based on two criteria:

- The first one is the customer's Quality Assurance Policy. Any existent internal regulation has to be applied at highest priority. In the absence of such internal regulation the utilization rate of the test equipment has to be taken into consideration.

- Based on the experience and observation collected over the years **AMETEK CTS recommend a calibration interval of 1 year** for frequently used equipment. A 2-years calibration interval is considered sufficient for rarely used test generators in order to assure proper performance and compliance to the standard specifications.

6.2.3. Calibration of Accessories made by passive components only:

Passive components do not change their technical specification during storage. Consequently the measured values and the plots stay valid throughout the storage time. The date of shipment shall be considered as the date of calibration.

6.2.4. Periodically In-house verification

Please refer to the corresponding standard before carrying out a calibration or verification. The standard describes the procedure, the tolerances and the necessary auxiliary means. Suitable calibration adapters are needed. To compare the verification results, AMETEK CTS suggests to refer to the waveshape and values of the original calibration certificate.

6.3. Calibration

For periodical calibration the AutoWave has to return back to the manufacturer

6.4. Verification

A verification can be done with the following procedure:

Output channel

Setting a defined voltage to the output channel and verification with a DMM (5½ digit)

Measuring: 0.00V
5.00V
10.00V

7. Delivery Groups

7.1. Basic equipment

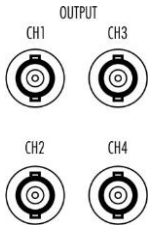
- Arbitrary generator type AutoWave
- Mains cable
- Calibration certificate
- Manual on USB memory stick
- Safety manual

7.2. Accessories and options

7.2.1. Extension Board (some models only)

Extension Board

- 2 output channels 16 Bit CH3 , CH 4 ± 10V



7.3. Useful Accessories

The Accessories in this paragraph are **not part of the AMETEK CTS delivery list**. AMETEK CTS suggest to buy this devices from a local dealer.

7.3.1. Hi-Speed USB 2.0 Fast Ethernet Adapter installation

For user where **no Ethernet connector is available**, AMETEK CTS suggest to buy an USB - Ethernet adapter on the IT-market. This USB – Ethernet adapter is not part of the AMETEK CTS delivery.

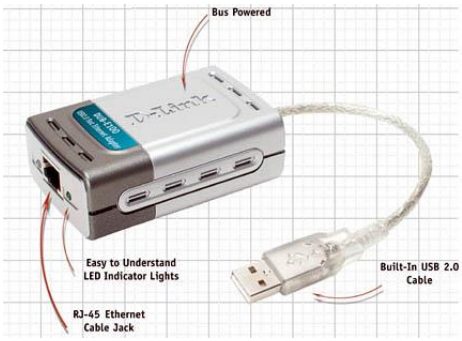
AMETEK CTS proposes and tested the following device:

D-Link : DUB-E100

For communication with the *AutoWave* via Ethernet a Hi-Speed USB 2.0 Fast Ethernet Adapter type DUB-E100 is available. This connection is used if the *AutoWave* is not installed in a rack with other AMETEK CTS equipment.

Product Features:

- True 10/100Mbps Network Connectivity
- Auto 10/100Mbps Speed Detection
- Backwards Compatible with USB 1.1



Product Description:

The D-Link DUB-E100 is a Hi-Speed USB 2.0 10/100Mbps Fast Ethernet Adapter specifically designed to plug into an available Universal Serial Bus (USB) port on a desktop or laptop PC under Microsoft Windows XP, Me, 2000 or 98SE. Based on USB 2.0, the DUB-E100 extends the transfer speed of earlier USB Fast Ethernet adapters to true 10/100Mbps connectivity.

As a USB device, the D-Link DUB-E100 eliminates the need to use an ISA, PCI, or PC Card slot to add LAN connectivity to a PC desktop or laptop computer. Installation and use are further simplified by living the USB's out-of-the-box installation approach to connecting computer peripherals. You will not need to open the case of your computer, nor will you be required to set IRQ's. The D-Link DUB-E100 represents the simplest way to connect your computer to an Ethernet based network.

The D-Link DUB-E100 provides a standard RJ-45 connector for a quick and simple method of connecting to an Ethernet 10Mbps or Fast Ethernet 100Mbps based LAN via a network hub or switch. The built-in USB 2.0 cable connects directly to your computer or laptop.

Power for the DUB-E100 is provided directly by the USB bus, eliminating the need for an external power adapter. It also supports USB's energy saving suspension and resumes functions to minimize power consumption, which is specifically useful for laptop/notebook users.

8. Annex

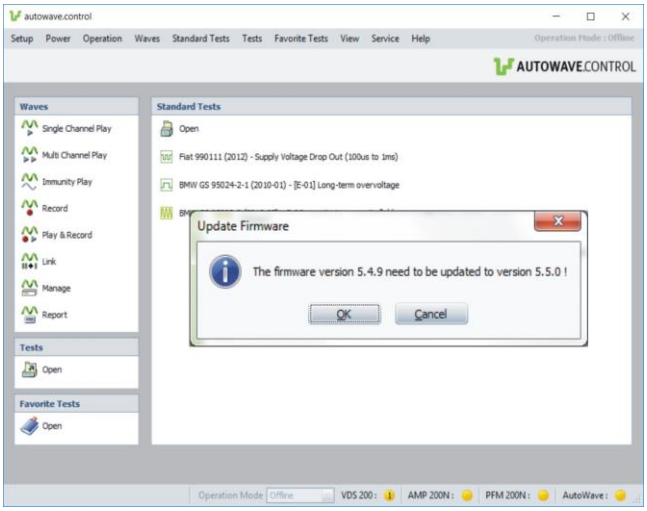
8.1. Update a new Firmware

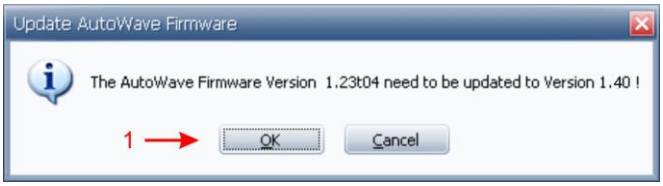
To update the Firmware start the program AutoWaveControl. A firmware update is recommended:

A: **After the installation** or **update** of the *AutoWaveControl* software.

A message box may automatically appear if *AutoWaveControl* software detects an older firmware on the *AutoWave*.

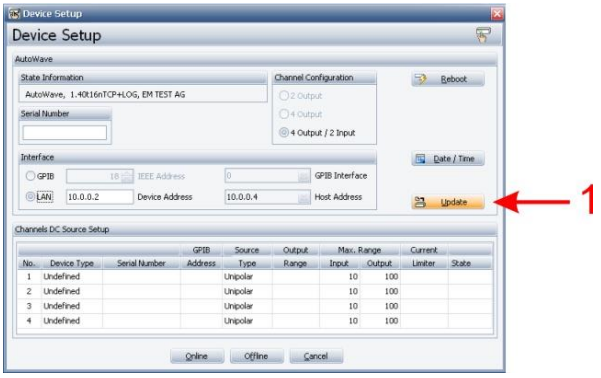
1. Press the **OK** button to enter the Device update window.





B: When the **user has different firmware** versions to operate with the *AutoWave*.

1. Press the **Update** button in the device setup for enter the Device update window.



Actual Firmware Version field:
Firmware version being installed in the *AutoWave*.

Select the Firmware field:
Firmware versions in the computer for download into the *AutoWave*.

2. Press the **Download** button to download the new firmware into the *AutoWave*.

After “download the AutoWave display shows

AutoWave REMOTE
AuitoWave.tgz stored

The message “**File Stored**” confirms the successful download of the new firmware to *AutoWave*.

3. Press the **Reboot** button for Booting the *AutoWave*.
During the booting process the *AutoWave* will install the new firmware version

Reboot : please wait!

A bar graph shows the booting progress.

After a successful update the actual firmware of the *AutoWave* is displayed in the field “Actual Firmware Version”.

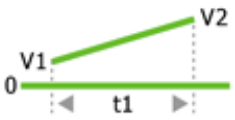
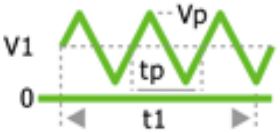
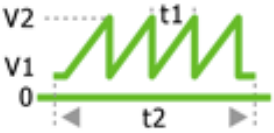
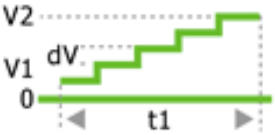
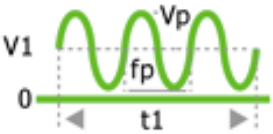
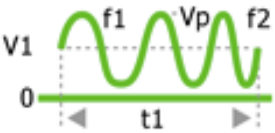
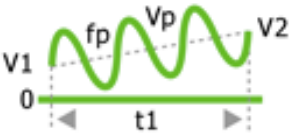
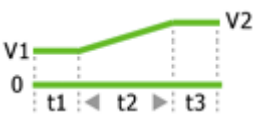
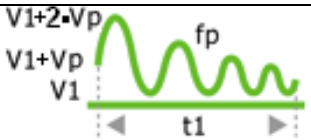
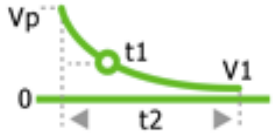
4. Press the **OK** button to return to the Device Setup Window.

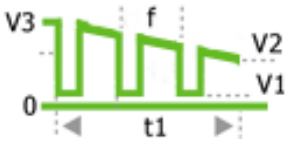
AutoWave REMOTE
Version 1.30 Out: 4 In: 2

8.2. Basic Waves

The AutoWave generates the waves like an arbitrary generator as **PointWaves**, where all samples are stored in a file. As an advantage the AutoWave firmware generates the waves as **segmented waves** from a parameter list. This has the advantage to save a lot of memory and to create waves who can not be realized by PointWaves.

The following waves are programmed inside the AutoWave:

Segment name	Picture	Description
DC		Constant DC voltage at V1 level during the selected duration t1.
Ramp		Voltage ramp where the time t1 goes from 0% to 100% or 10% to 90%
Square		Square function with defined voltage parameters V1 and V2 offset and the square duration of V1 and V2.
Triangle		
sawtooth		
Step		
Sine		
Sine Sweep		Sine wave with frequency sweep over the duration t1. The sine starts with the frequency f1 and ends with the frequency f2. The frequency can sweep up or down with the frequency.
Sine ramp		
Switching		
Damped sine		**Description**: Damped sine with asymptote end voltage on Vp2 offset level = V1-Vp1
Exponent		**Description**: This function simulates a fall or rise of an exponential impulse waveshape. It simulates a typical fall or rise of a capacitive impulse waveshape.

Profile		
Square Ramp		

8.3. Declaration of CE-Conformity

Manufacturer:	**AMETEK CTS GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product's name:	AutoWave AutoWave-WR

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1: 2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

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By	A. Burger Business Manager Conducted EMC
Place	Reinach BL, Switzerland
Date	25. February 2016

8.4. AutoWave - General Diagram