

Manual

for Operation



VSS 500N6x

Voltage Impulse Simulator

VSS 500N6.4	1,2/50 μ s
VSS 500N6.3	1,2/50 μ s
Constant energy	0.5 J

VSS500N6 – voltage surge generator designed for testing components and safety devices.

The distinct operation features, convenient DUT connection facilities, a clearly arranged menu structure and display philosophy as well as the pre-programmed standard test routines make testing easy, reliable and safe.

Extendable by a variety of test accessories the VSS 500N6 is a universal equipment for a broad range of recommendations.

- IEC 60255-27
- IEC 60747-5
- IEC 62052-11



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1. General

1.1. Intended use

The pulse generator VSS 500Nx is a test device for the simulation of conducted electromagnetic disturbances as they can occur during the operation of a device. The necessary EMC knowledge is required for the operation of this device. Regarding safety, the relevant safety manual must be read in full and observed.

During operation, the device may emit electromagnetic interference which may affect other devices in the environment. For this reason, the operator must ensure that the necessary precautions are taken to avoid influencing the environment (e.g. operation in a shielded room).

1.2. Product return procedure

1. Request a Return Material Authorization (RMA) number from the local AMETEK CTS representative
2. When requesting an RMA, have the following information ready:
 - Model number
 - Serial number
 - Description of the problem

NOTE: Unauthorized returns will not be accepted and will be returned at the shipper's expense.

NOTE: A returned product found upon inspection by AMETEK CTS, to be in specification is subject to an evaluation fee and applicable freight charges.

1.3. Recycling and Disposal

1.3.1. RoHS directive 2011/65/EU (RoHS 2)

RoHS directive *2011/65/EU* (RoHS 2)

The AMETEK CTS equipment complies with the directive 2011/65/EU (RoHS - Restriction of certain Hazardous Substances).

From December 2005, all AMETEK CTS products either hand soldered or by machine are produced using lead-free solder.

1.3.2. WEEE directive 2012/19/EU

The AMETEK CTS equipments, is dedicated under category 9 in the directive 2012/19/EU (WEEE).

The product should be recycled through a professional organization with appropriate experience for the disposal and recycling of electronic products. AMETEK CTS is also available to help with questions relating to the recycling of this equipment.

1.3.3. Dismantling information

Always remove power cord first. There is no special danger involved in dismantling the VSS 500N6x. For safety reasons, only the capacitors must be discharged with a high-impedance resistor (10 k Ω , 15 W).

1.3.4. Parts which can be recycled

The equipment contains parts made from steel, aluminum, PVC, two-component sealing compound. The impulse capacitors are filled with non-poisonous mineral oil. The various parts can be separated and recycled.

1.3.5. Parts which cannot be recycled

All parts in the equipment can be recycled.

2. Safety information

Read the following operation manual carefully. Pay special attention to both safety and operation details !!! Observe all of these precautions to ensure your personal safety and to prevent damage to the test equipment. The generators correspond to Installation Category II (overvoltage category).



Attention

Before using this equipment, read the operating manual and the separate delivered **safety manual** carefully

2.1. Intended use of the equipment

The “VSS 500Nx” test system is designed primarily for produce voltage transients for testing as per standards IEC 60255-27, IEC 60747-5 and IEC 62052-11

2.2. Responsibility of the operator

These operating instructions form an essential part of the equipment and must be available to the operator always. The user must obey all safety instructions and warnings.



WARNING

The purpose of this instrument is the generation of defined interferences signals for EMI immunity testing. Depending on the arrangement of the test rig, the configuration, the cabling and the properties of the EUT itself, a significant amount of electromagnetic radiation may result that could also affect other equipment and systems.

The equipment is designed to operate in industrial environment. For operating in other or sensitive environment, such as light industry, airport area..., the user may use a shielded room for operate.

The user himself or herself is ultimately responsible for the correct and controlled operation of the rig. In case of doubt, the tests should be carried out in a Faraday cage.

2.3. General hazard

Before applying power to the system, verify that your product is configured properly for your application.



WARNING

The VSS 500N6X system and its accessories operate at high voltages.

Hazardous voltages may be present when covers are removed. Qualified personnel must use extreme caution when servicing this equipment.

Circuit boards, test points, and output voltages also may be floating above (below) chassis ground.

Only *qualified personnel* who deal with attendant hazards in impulse generators, can perform installation and servicing.

Ensure that the AC power line ground is connected properly to the Power Rack input connector or chassis. Similarly, other power ground lines including those to application and maintenance equipment *must* be grounded properly for both personnel and equipment safety.

Always ensure that facility AC input power is de-energized prior to connecting or disconnecting any cable.

The user must ensure that the output power lines are labeled properly as to the safety hazards and that any inadvertent contact with hazardous voltages is eliminated.

Guard against risks of electrical shock during open cover checks by not touching any portion of the electrical circuits. Even when power is off, capacitors may retain an electrical charge. Use safety glasses during open cover checks to avoid personal injury by any sudden component failure.

Neither AMETEK CTS, nor any of the subsidiary sales organizations can accept any responsibility for personnel, material or inconsequential injury, loss or damage that results from improper use of the equipment and accessories.



WARNING Personnel fitted with a heart pacemaker must neither operate the instrument nor approach the test setup while a test is being executed.

Only approved accessories, connectors, adapters, etc. are to be used to ensure safe operation.

2.4. Qualification of personnel

The VSS 500Nx voltage simulator must be operated only by authorized and trained specialists.

2.5. Safety label on the device

Please take note of the following explanations of the symbols used to achieve the optimum benefit from this manual and to ensure safety during operation of the equipment.



This symbol warns of a potential risk of shock hazard. The symbol on an instrument shows that it can source 1000 volt or more, including the combined effect of normal and common mode voltages. Use standard safety precautions to avoid personal contact with these voltages.



This symbol indicates where a caution is required. Refer to the operating instructions located in the manual to protect against personal injury or damage the equipment

CAUTION

The CAUTION symbol indicates a potential hazard. It calls attention to a procedure, practice or condition which, if not followed, could possibly cause damage to equipment. Such damage may invalidate the warranty. If a CAUTION is indicated, do not proceed until its conditions are fully understood and met.

WARNING

The WARNING symbol indicates a potential hazard. It calls attention to a procedure, practice or condition which, if not followed, could possibly cause bodily injured or death. If a WARNING is indicated, do not proceed until its conditions are fully understood and met.

2.6. Prohibition of unauthorized conversions and modifications

The user is not entitled to the device to perform its own modifications and adaptations. Modifying parts on the generator by unauthorized persons will void the warranty of the device and the correct functioning cannot be guaranteed.

2.7. Specific accessories required for safety reason

Only use accessories approved by AMETEK CTS for these generators and intended as accessories for these devices. Measuring instruments for the measurement of instrument parameters shall be designed for the maximum voltage and current from the generator. Otherwise safety cannot be guaranteed.

2.8. Procedure in case of hazard

If a hazard could exist due to an unintended condition of the generator, the following procedure is recommended: Disconnect the device- and EUT power supplies from the power supply and ensure that the generator is earthed via the supply lines or a different ground connection. Wait at least 15 minutes and ground all outputs via a 10 k Ω , 15 W resistor. Call a AMETEK service center.

3. Operating Functions

3.1. Front view



- | | | | |
|---|-----------------------|----|--------------------------------|
| 1 | Display | 7 | Escape |
| 2 | Function key "F1..F7" | 8 | CRO U for Peak Voltage |
| 3 | "TEST ON" | 9 | CRO Trigger |
| 4 | Knob (Inc/Dec) | 10 | High voltage charge indication |
| 5 | Cursor "←" and "→" | 11 | High voltage pulse output |
| 6 | Exit | | |

1 Display

All functions and parameters are displayed (8 lines with max. 40 characters).

2 Function keys "F1..F7"

Parameters and functions, displayed in the lowest line, can be selected with the related function key.

3 Test on

By pressing the key "TEST ON", the test procedure is initialized with the preselected parameters. The flash indicates the trigger of an event.

4 Knob

The knob increments or decrements test parameters with a numeric value or selects from a list of parameters.

5 Cursor

Parameters and functions can be changed on-line. The selection of those parameters is realized with the cursor moving left or right.

6 EXIT

Pressing of the Exit function will cause a reset of the firmware. This is only possible if no test routine is running.

7 ESC

Pressing the ESC button the user moves back one page in the menu.

8 BNC CRO U

At the CRO output the voltage pulse of the generator can be measured. The level is 10V for a 6.6kV pulse.

9 BNC CRO trigger

At the BNC output a trigger signal is available, which is synchronized to the pulse generation.

10 High Voltage Indication

This LED bar graph gives a visual indication about the High Voltage charging process of the generator.

11 High Voltage pulse output

The generator high voltage output "High" and the "Low". The Low path is internal connected to the PE (chassis). PE is available at the generator rear side. **LOW = Earth**

3.2. Rear View



- | | |
|---|--|
| 1 High Voltage pulse output (only for rack mounted units) | 6 Safety circuit |
| 2 SYNC input | 7 External trigger |
| 3 Reference earth connection | 8 Mains selector 115 V / 230 V |
| 4 Ventilator | 9 Power on switch, fuses |
| 5 Connection warning lamp | 10 Fuse of the high voltage power supply |

1 High Voltage pulse output (only for rack mounted units)

The generator high voltage output “High” and the “Low”. The Low path is internal connected to the PE (chassis). PE is available at the generator rear side.

2 SYNC input

The release of single surge pulses can be synchronized to the signal at the Sync input. Normally this input may be connected directly to the phase of the power mains supply. If no signal is connected the generator automatically works in asynchronous mode.

3 Reference earth connection

The generator must be connected to the reference earth plane of the test set up.

4 Ventilation

After long term duration tests the generator should keep on running for some minutes to cool down the system.

5 Warning lamp

A voltage free contact (230 V 6 A) is available for external warning indications (warning lamp). The signal is generated after pressing TEST ON.

6 Safety circuit

The test can only be started if the security circuit is closed. If the circuit is opened during a running test the simulator will be switched off immediately.

7 External trigger

One single transient can be released. Trigger level 5-15V positive going.

8 Mains selector

Selection of 115 V / 230 V

9 Power on switch

The switch is part of the mains filter. Mains fuses are part of the filter. (230 V / 2x 2 A and 115 V / 2x 4 A)

10 Fuse of the high voltage power supply

The high voltage power supply is protected by this fuse „F3“. In case that no high voltage is generated but the control unit works properly this fuse shall be checked.



- | | | | |
|-----------|------------------------------------|-----------|-----------------------------|
| 11 | Serial interface RS 232 or USB | 13 | Remote control connector CN |
| 12 | Parallel interface GPIB / IEEE 488 | 14 | FAIL 1 / 2 Input |

11 Serial interface USB/RS232

For data transfer a USB interface is available. The internal RS 232 interface is converted to USB standard. Therefore, the user must set the same Baudrate in the device and control software.

Using the USB interface the user can have EMC problems during burst tests. Our experiences say, that usually the computer USB port is disturbed by interference's. Therefore, a high quality USB cable (USB 2.0 standard) must be used.

12 Parallel GPIB / IEEE 488

IEEE 488 interface with IEEE connector

13 Remote control connector CN

External coupling devices are controlled via this remote control connector.

14 Fail detection FAIL 1 EUT control (TEST STOP)

Grounding this input will cause a complete stop of the running test procedure. (+15V to ground) The test must be completely restarted.

Fail detection FAIL 2 EUT control (TEST PAUSE)

Grounding this input will cause a break for the running test procedure (+15V to ground). The test will be continued when the input is no more connected to ground.

4. Operation

4.1. Description of the menus

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



The selected parameter is blinking and can be changed by turning the knob (incr./decr.).

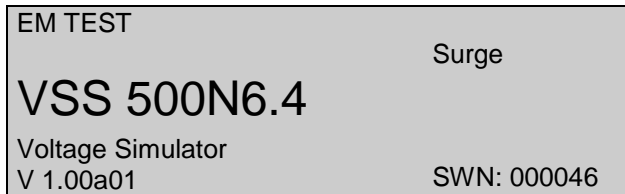
↔ : The digit to be changed can be selected with the cursor (↔).

- Setted values are direct indicated on the screen.

- Status on the bottom lines shows the desired status after pressing the function key.

ESC: ESC will take you back to the previous level in the menu and set the displayed values. The latest settings are stored automatically and will be recalled when the menu is selected again.

EXIT: The firmware will reset to the main screen.



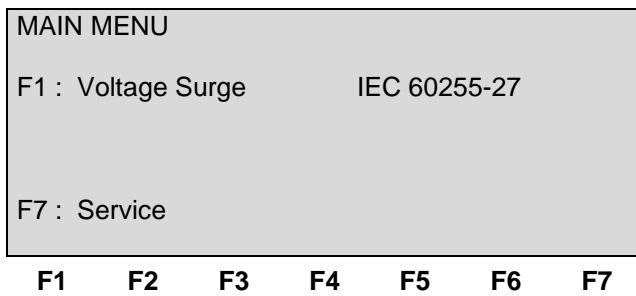
The serial number and the version number SWN are used for traceability reasons. These numbers are listed in the test reports and calibration certificates. These numbers also are listed within the test reports generated by the iec.control software.

4.2. Menu structure

Level 0...4

Level 0	Level 1	Level 2	Level 3	Level 4
Main menu F1 Voltage Surge F7 SERVICE	Voltage Surge F1 Quick Start F2 User Test Routines F3 Standard Test Routines F7 Setup Current Limiter	Quick Start F1 Start F2 Change F3 Continue	Start Start the test procedure Change Change parameters Cont Continue the test procedure	
		User Test Routines F1 User Routines F2 Change voltage V after n by ΔV F3 Change angle after n by ΔA F7 Change polarity after n	User Test Routines F1 : F7 Store F1... Store F7	User Test Routines F1..F7 F1 Start F2 Change F3 Continue
		Standard Test Routines F1 0.55 kV F2 1.0 kV F3 3.0 kV F4 5.0 kV F5 6.6 kV F6 Level X – Level Y	Start Start the test procedure Change Change parameters Cont Continue the test procedure	Standard Test Routines F1 Start F2 Change F3 Continue
		Current Limiter F1 Current I		
	Service F1 Address F2 Self test F3 Setup	Setup F1 Change language F2 LCD backlighting F3 Interface F4 Keyboard beeper F5 Timer	Change language German or English LCD backlighting On, Off, Auto Interface Select all parameters Keyboard beeper (On, Off) Timer Display of total operating time	

4.3. Main menu



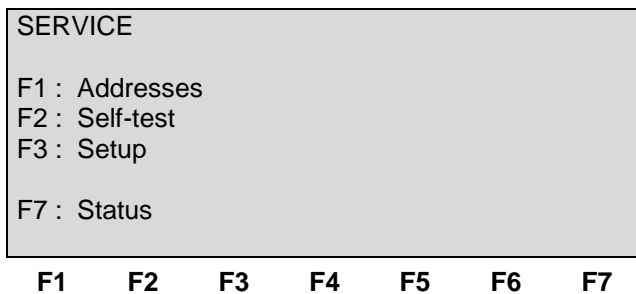
F1 Surge

With F1 the different test routines for surge testing can be selected.

F7 Service

Setup, self-test, addresses of AMETEK CTS can be selected and displayed.

4.4. Service

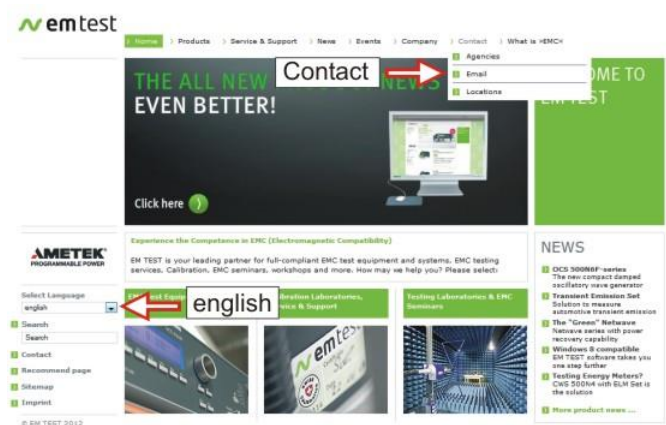


F1 Addresses

The addresses of the AMETEK CTS (Switzerland) GmbH and the AMETEK CTS Germany GmbH are shown.

The addresses of all AMETEK CTS sales agencies are listed on the web site of AMETEK CTS under:

www.emtest.com



F2 Self-test

Together with the user the software can test some parts of the equipment. The software will clearly explain the self-test procedure.

F3 Set-up

The software will clearly explain the set-up procedure.

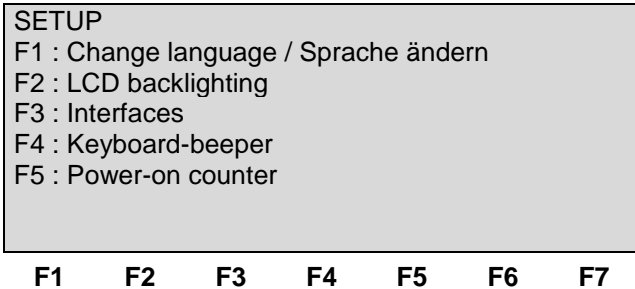
F7 Status

Status information

- Device name, firmware version and Software number
- Power-ON counter
- Settings
- Offset Level Adjustment

4.5. Setup

Within the Setup menu basic generator settings can be selected.



F1 Change language

Actually the user can select between two languages, German or English.

F2 LCD backlighting

With use of F2 the backlighting can be switched on or off. Additionally, the AUTO OFF function can be programmed to switch off the backlighting after a defined time, when the equipment is not in operation (1 - 30 min). Because of the limited lifetime of LCD displays, app. 10000 h this function should always be activated.

F3 Interfaces

This menu will help the user to define the status of the integrated serial and parallel interfaces, e.g. the baudrate of the RS 232 or the address of the IEEE interface.

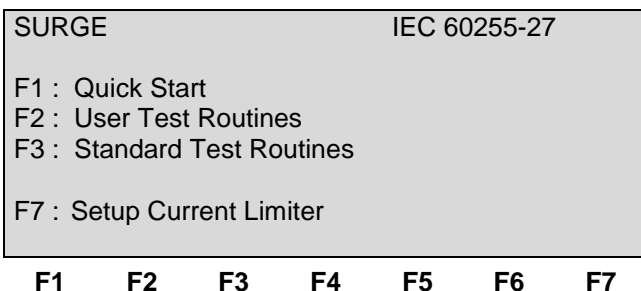
F4 Keyboard-beeper

F1 is the selector for the keyboard beeper ON/OFF mode. (Short beep at every keyboard hit)
 To indicate that a running test is finished the beeper sounds always 3 times (not changeable).

F5 Power-on counter

Pressing F3 will show the total operating time of the test equipment.

4.6. Surge Tests



F1 Quick Start

Easy to use and fast operation of the equipment without special functions (memory).

F2 User Test Routines

The user can save and recall his own specific test routines. He can select standard routines or special functions as automatic change of voltage or frequency during a test routine.

F3 Standard Test Routines

Five fixed test levels can be selected within this menu. At each test level the internally stored energy is 0.5J. The voltage levels are:

VSS 500N6: 0.55 – 0.9 – 3.0 – 5.0 – 6.6 kV
 VSS 500N6.3: 0.55 – 1.0 – 1.5 – 5.0 – 6.6 kV

F7 Setup Current Limiter

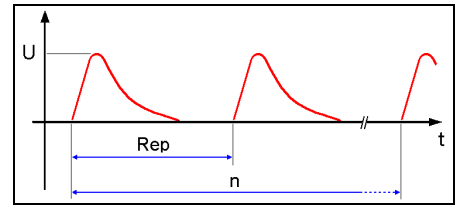
The discharge current into the EUT is measured by the generator. The user can specify a certain peak current to stop the test.

4.6.1. Quick Start

Easy and very fast operation of all standard functions of the equipment. The latest simulator settings are stored automatically and will be recalled with the next selection of Quick Start.

Page 3 (Show parameters)

SURGE		Quick Start	
U = 5000 V	A = 0	grd	
+/- = +	cpl = /		
rep = 10s	tri = Auto		
n = endless			
START CHANGE			



F1 F2 F3 F4 F5 F6 F7

Press **START** and the test routines begin to work.
 Press **CHANGE** and the actual parameters can be changed.
 All function keys with exception of F2 (manual Trigger) will stop the test.

Vs	Test level
A	Selectable phase angle to superimpose the pulse to the mains (only with external CDN)
+/-	Polarity of the generated pulse
Cpl	This mode is not active within the VSS 500N6 model; no parameter change is possible
rep (t1)	Repetition rate of the generated pulses
tri	Trigger mode; AUTO, MAN or EXT
n	Number of pulses to be generated

Page 4 (Start)

SURGE		Quick Start	
V = 5000 V	A = 0	grd	
+/- = +	cpl = /		
rep = 10 s	tri = Auto		
n = endless			
Vset = 5000V	U = + 5000V	Counter	
STOP	I = + 10A	0000043	

F1 F2 F3 F4 F5 F6 F7

After the Start button was pressed the test voltage indication is blinking. The user can change the blinking value by turning the digital knob. Any parameter to be changed can be selected by the operator by using the cursor buttons Up and Down.

Voltage setting: The test voltage can be adjusted continuously. As soon as the test voltage reaches one of the fixed test levels by +10% the generator switches over to the next smaller internal capacitor. Therefore, during the use of Quick Start the generator may work outside of the specified energy of 0.5 J ±10%. For exact energy values the specified voltage levels or the Standard Test Routines shall be selected.

All functions keys except F2 (MAN TRIGGER) can stop the test routine. The latest setting will be displayed. Pressing the ESC button will bring the user back to the previous level.

Page 4 (Change)

Surge		Quick Start				
Voltage	V	:	250V	-	6600V	
Angle	A	:	0 grd	-	360 grd	
Events	n	:	1	-	30000	
Repetition	rep	:	1s	-	100s	
V	A	+/-	coupl	rep	n	tri
500	0	+	/	4	00001	Auto
F1	F2	F3	F4	F5	F6	F7

The possible range is displayed for each parameter selected.

The value for change can be selected with the function key and then changed with the INC/DECR knob. By moving the cursor, the digit to be changed can be selected to speed up the procedure.

With **ESC** the operator can go back to the previous menu and start testing with the new parameters.

4.6.2. User Test Routines

The user can save his own specific test routines, recall and change them. All special functions and routines are stored in this part of the user menu.

Page 3 (Selection of the function)

SURGE		USER TEST ROUTINES				
F1	Usual routine					
F2	Voltage change after n by ΔV					
F3	Change angle after n by ΔA					
F4	Change polarity after n					
F1	F2	F3	F4	F5	F6	F7

Each special function can include 7 stored test routines.

Page 4 (Select store)

SURGE		USUAL ROUTINE				
F1	Store F1	F5	Store F5			
F2	Store F2	F6	Store F6			
F3	Store F3	F7	Store F7			
F4	Store F4					
F1	F2	F3	F4	F5	F6	F7

After the selection of a stored test file the test parameters will be indicated on the display.

Page 5 (Show parameters)

SURGE		USUAL ROUTINE		MEM F1		
V	=	3000V	A	=	0 dgr	
+/-	=	+	cpl	=	/	
Rep	=	15s	tri	=	Auto	
n	=	00001				
START CHANGE			SAVE			
F1	F2	F3	F4	F5	F6	F7

All functions are the same as under Quick Start. The function SAVE will store the new parameters of a test file.

Page 6 (Save)

SURGE		USUAL ROUTINE		MEM F1	
Save in store ?					
F1 : Store F1					
F7 : Store F7					
F1	F2	F3	F4	F5	F6 F7

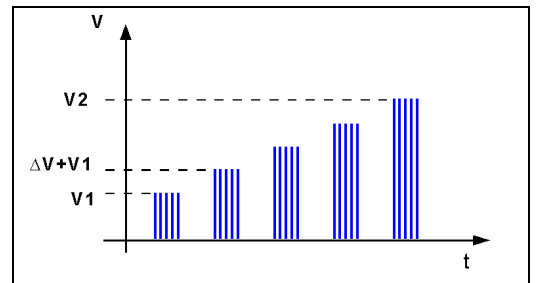
The user must define a store. If there exists a saved test file, the firmware will ask to overwrite the existing procedure or not.

Usual routine

The software controls standard test routines as per to the specification of the user. All limitations are the same as defined under Quick Start.

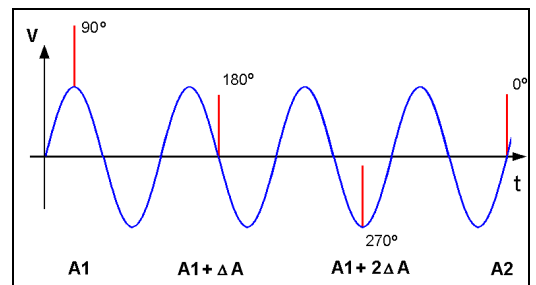
F2 Voltage change after n pulses by ΔV

The test voltage V is changed from $V1$ to $V2$. After the preselected number pulses the test level is changed by ΔV until $V2$ is reached. The same parameters as under Quick Start are selectable. For the limitation of the max. admissible repetition rate the higher value of $V1$ and $V2$ is valid.



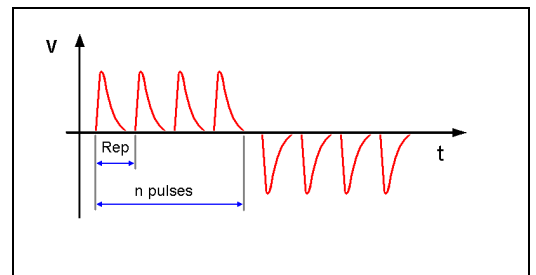
F3 Change the phase angle A after n pulses by ΔA

The phase angle related to which the surge pulse is released is changed from $A1$ to $A2$. After the preselected number of n pulses the actual phase angle is changed by ΔA until $A2$ is reached. The same parameters as under Quick Start can be selected.



F5 Change polarity after n pulses

After the release of the preselected number of pulses the polarity is changed. The procedure always starts with positive polarity and changes than to negative. The same parameters as under Quick Start can be selected.



4.6.3. Standard Test Routines

Within this menu 5 fixed preprogrammed test routines are available for the user.

VSS500N6.4: Page 3 (Selection of the function)

```

SURGE          Standard Test Routines
F1 : 0.55kV // 0.5J
F2 : 1.00kV // 0.5J
F3 : 3.00kV // 0.5J
F4 : 5.00kV // 0.5J
F5 : 6.60kV // 0.5J
F6 : Level X to Level Y
  
```

F1 F2 F3 F4 F5 F6 F7

After the selection of a stored test file the test parameters will be indicated on the display.

Within this menu 5 fixed preprogrammed test routines are available for the user.

VSS 500N6.3 Page 3 (Selection of the function)

```

SURGE          Standard Test Routines
F1 : 0.55kV // 0.5J
F2 : 1.00kV // 0.5J
F3 : 1.50kV // 0.5J
F4 : 5.00kV // 0.5J
F5 : 6.60kV // 0.5J
F6 : Level X to Level Y
  
```

F1 F2 F3 F4 F5 F6 F7

After the selection of a stored test file the test parameters will be indicated on the display.

Page 4 (Show parameters)

```

SURGE          Standard Test Routines F4
V      = 5000V      A      = 0 dgr
+/-    = +          cpl    = /
Rep    = 15s       tri    = Auto
n      = 00001
START CHANGE          SAVE      PRINT
  
```

F1 F2 F3 F4 F5 F6 F7

All functions can changed, except the test level.

4.6.4. Setup Current Limiter

The current limiter stops the test run when during a test the measured peak current of a surge pulse is higher than the preselected current value. This safety function protects the EUT for further surge pulses can occur any dangerous situation.

page 3 (show parameters)

```

SURGE          Setup Current Limiter

Current I : 0.0 A – 20 A

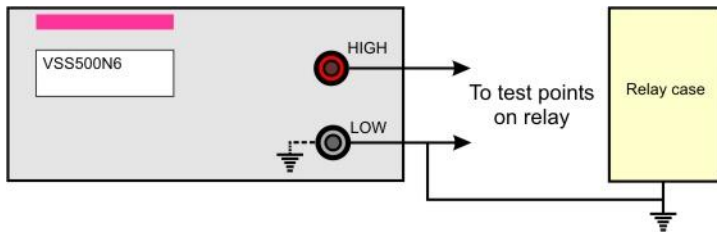
I
20.0
  
```

F1 F2 F3 F4 F5 F6 F7

4.7. Application

4.7.1. Setup

The figure below shows the setup for relay testing as per IEC 60255-27 Standard. Please note that the LOW output is internal connected to the frame of the VSS 500N6 generator.



4.7.2. Test voltage covered by VSS 500N6.x

The table below shows the test levels can be used with the VSS 500N6.x series for get an impulse with a energy of 0.5 J ±10% tolerance.

For other values please contact AMETEK CTS

Test level E = 0.5J	Test level @-10% E = 0.45J	Test level @+10% E = 0.55J	VSS 500N6.3	VSS 500N6.4
Udc	Udc	Udc		
550	509	563	yes	yes
1000	949	1049	yes	yes
1500	1430	1581	yes	--
3000	2739	3028	--	yes
5000	4743	5244	yes	yes
6600	6000	6633	yes	yes

5. Put in service

5.1. Safety aspects

Please read carefully the safety manual before put in operation.

5.2. Verification

The Surge generator VSS 500N6.x might be verified in two steps. The generator shall be verified directly at the high voltage output High and Low on the front panel of the generator.

1. Verify the peak voltage V

Select the Quick Start mode and the test level at which you want to verify the simulator. Start the test under no load condition. The measured peak values will be indicated in the display.

2. Calibration of the waveform.

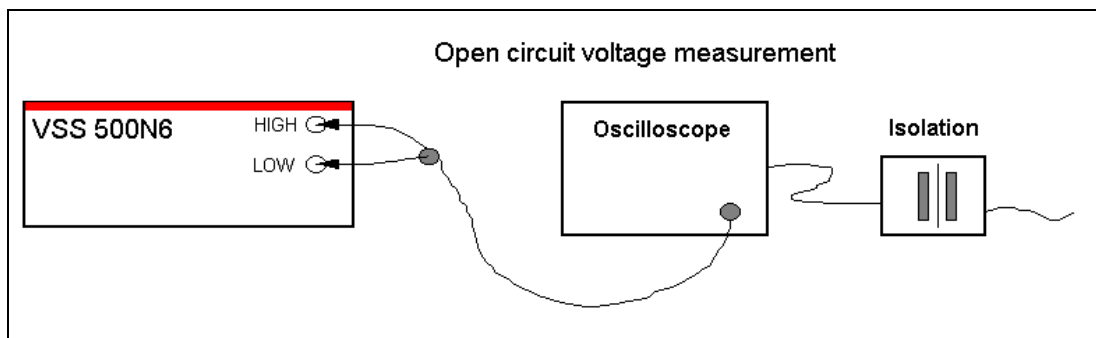
For a true calibration procedure, external measuring probes shall be used to verify the generator characteristics. The probes shall have a sufficient voltage capability.

For this measurement, the operator must use a storage oscilloscope with a minimum bandwidth of 20 MHz.

5.3. Verification setup

5.3.1. Verification of the Surge pulse open circuit voltage

- The surge shall be measured directly between the High - Low output of the generator
- Decouple the oscilloscope by an isolating transformer from the mains
- Divider ratio of the voltage probe shall be 1:100 or 1:1000
- Voltage capability of the voltage probe > 6000V



Setup for surge verification

Current surge measurements:

The internal current measuring device shall only be used for peak current detection. It is not designated to have this function for pulse shape verification.

In case of spark-over at the EUT side the peak current will increase significantly compared to the peak current under normal test conditions. The max peak current level under short circuit output condition can be roughly calculated by test voltage V_s divided by internal R_i (500Ω), e.g. $6600 \text{ V} : 500 \Omega = 13.2 \text{ A}$

If no load is connected the displayed peak current value is app. 30 % of the max short circuit current available at the selected test voltage, e.g. $3.8 \text{ A} @ 6600 \text{ V}$.

5.4. Specification of the wave shape

The specification is in accordance with IEC 469-1 and IEC 61000-4-5 (IEC 61180-1)

IEC 61000-4-5 allows two different procedures to evaluate the pulse wave shape:

1. **As per IEC 469-1, rise time 10 %-90 % and pulse duration 50 %-50 %. This is the basis for all new IEC standard to evaluate pulse shape parameters.**
2. **As per IEC 60-1, the old specification of the 1,2 / 50 μ s pulses in high voltage testing. This specification also allows the operator to use older test equipment for IEC 61000-4-5 testing.**

Both specification are valid in IEC 61000-4-5 (old IEC 1000-4-5)

Surge voltage pulse 1,2 / 50 μ s (no load condition)

Definition			Tolerance acc to the standard		Range	As per
Risetime	tr	(30% - 90%)	1.2 μ s	+/- 30%	0.86 μ s - 1.56 μ s	IEC 60060-1
Risetime	tr	(30% - 90%)	1.2 μ s	+/- 30%	0.86 μ s - 1.56 μ s	IEC 61180-1
Risetime	tr	(10% - 90%)	1 μ s	+/- 30%	0.7 μ s - 1.3 μ s	IEC 60469-1
Pulse width	td	(50% - 50%)	50 μ s	+/- 20%	40 μ s - 60 μ s	
Peak voltage			± 10 %			

For more details please see the attached calibration certificate which is part of the shipment for each generator.

Surge, Open circuit

according to IEC 60255-27

Pulse 1,2 / 50 μ s	Unit	Nominal Value	Tolerance
Pulse level	[V]	±550 ±1000 ±3000 ±5000 ±6600	± 10%
Output energy at pulse level	[J]	0.5	± 10%
Front time	[ms]	1.2 (T30%-90% x 1.67)	± 30%
Time to halve value	[ms]	50	± 20%

6. Test Equipment VSS 500N6.x

6.1. Design VSS 500N6.x

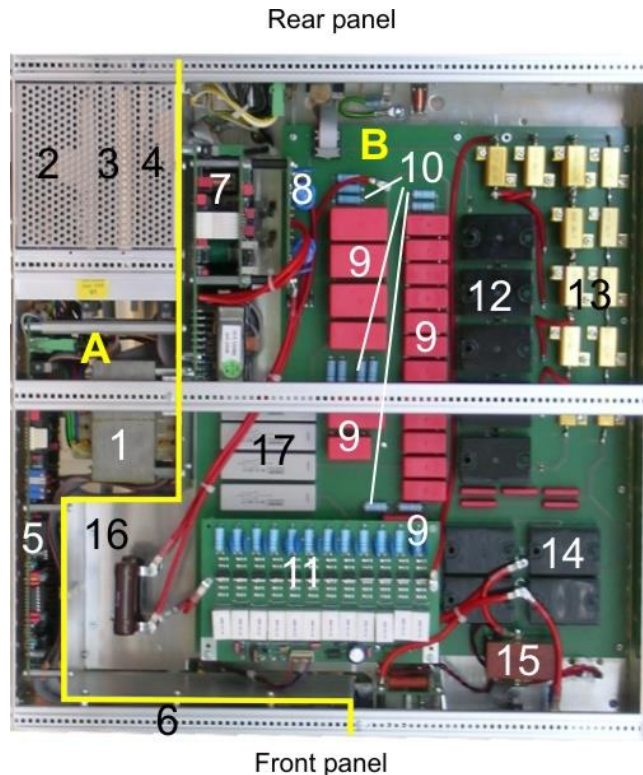
The surge generator type VSS 500N6 is divided into three main parts. The control unit is completely separated and decoupled from the high voltage part.

A Control unit

- 1 Transformer
- 2 Power supply
- 3 Interface board
- 4 Processor board
- 5 Filter- measurement board
- 6 Keyboard / LCD-display

B High voltage unit

- 7 High voltage power supply
- 8 High voltage cascade
- 9 Energy storage capacitor
- 10 Security discharge resistors
- 11 High voltage switch
- 12 Relays to discharge resistors
- 13 Discharge resistors
- 14 +/- relays
- 15 Peak Measuring
- 16 Decoupling resistor
- 17 Level switching relays

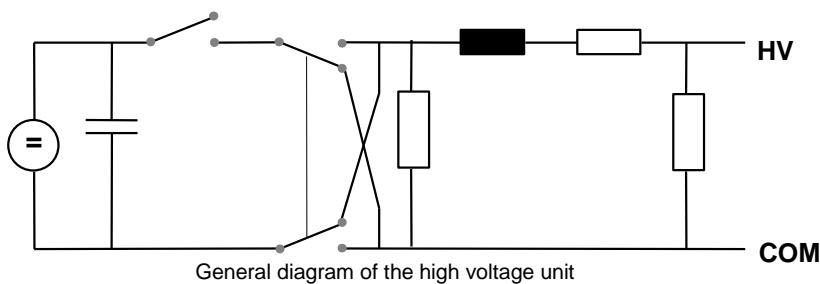


6.1.1. Control Unit

The control part includes the processing unit and the driver electronics for the high voltage part. All signals coming from and going to the processing part are decoupled.

6.1.2. High voltage unit

The high voltage part includes the high voltage power supply and the complete pulse forming part. The complete high voltage part is floating.



The pulse capacitor C1 is charged and will be discharged into the pulse forming network as soon as the specified voltage level is reached. For each specified test level an individual pulse forming network is used to realize the constant energy of 0.5 J.

The discharge switch is a highly reproducible semiconductor switch.

The **COM output is internal connected to protected earth PE** in VSS 500N5 generator.

7. Technical data

7.1. Pulse forming unit

Open circuit voltage	250 V – 6'600 V ± 10 %		
Rise time tr	1,2 µs ± 30 %		
Pulse duration	50 µs / ± 20 %		
Test Level		VSS 500N6.3	VSS 500N6.4
	0.55 kV / 3.47 µF	x	x
	1.00 kV / 1.00 µF	x	x
	1.50 kV / 0.44 µF	x	
	3.00 kV / 0.12 µF		x
	5.00 kV / 0.042 µF	x	x
	6.60 kV / 0.025 µF	x	x
Stored energy	0.5J at each fixed test level		

VSS 500N6.3	250 V - 650 V	C1: 3.47 µF
Voltage range of used capacity	700 V - 1150 V	C2: 1.00 µF
	1200 V - 2050 V	C3: 0.44 µF
	2100 V - 5500 V	C4: 0.042 µF
	5550 V - 6600 V	C5: 0.025 µF

VSS 500N6.4	250 V - 650 V	C1: 3.47 µF
Voltage range of used capacity	700 V - 1200 V	C2: 1.00 µF
	1250 V - 2050 V	C3: 0.12 µF
	2100 V - 5500 V	C4: 0.042 µF
	5550 V - 6600 V	C5: 0.025 µF

Output impedance	500Ω
Polarity	Pos, Neg, Alternating
Repetition rate	1s* - 999 s (10 s >6000 V)
Events	Preselection 1 - 30'000 or Endless
Counter	1 - 1'000'000

* The VSS is limiting the max repetition rate in relation to the max power of the HV power supply.

7.2. Trigger

Automatic	Automatic repetition of surges
Manual	Manual trigger of one single surge
Extern	External trigger of one single surge via external trigger input
Synchronization	0° - 360° (16 – 500 Hz) resolution: 1°

7.3. Output

Direct	HV and COM output at the front panel
CRO Trigger	5 V Trigger signal
CRO Ū	10 V at 6.6 kV
CRO Î	Not mounted
Peak volt meter	6600 V ±10%
Peak current meter	11.7 A @ 6600 V

7.4. Test Routines

Quick Start

Immediate start, all parameters can be changed ON LINE

User Test Routines

1. Usual test routines
2. Voltage change after n by ΔV
3. Change phase angle after n by ΔA
4. Change polarity after n pulses

Standard Test Routines

	VSS 500N6.3	VSS 500N6.4
Level 1	550 V // 0.5 J	550 V // 0.5 J
Level 2	1000 V // 0.5 J	1000 V // 0.5 J
Level 3	1500 V // 0.5 J	3000 V // 0.5 J
Level 4	5000 V // 0.5 J	5000 V // 0.5 J
Level 5	6600 V // 0.5 J	6600 V // 0.5 J

Service

Setup

7.5. Safety

Safety circuit

Control input must be short circuited

Warning lamp

Voltage free contact max. 250 V / 6 A

7.6. General

Dimensions

19" / 3 HE

450 x 500 x 155mm

Weight

16.1 kg

Power supply

115 V / 230 V + 10 / - 15 %

Fuses F1, F3

230V: 2 AT slow blow
 115V: 4 AT slow blow

=> All parameters which are not relevant for the standard can be changed by manufacturer <=

8. Maintenance

8.1. General

The generator is absolutely maintenance-free by using a solid-state semiconductor switch to generate transients

8.1.1. Test set- up



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

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

The generators of the series 500, UCS, VCS, CSS, TSS and CNI, can be linked together to a fully automotive test set-up.

The set-up communicates via the IEEE / GPIB bus and is controlled by ISMIEC software. For setting up the system see the following figures:

Each generator can be operated individual as a single equipment.

8.2. Coupling network

Due to the many national safety instructions, the coupling network has no ON/OFF key as well as no internal fuse protection.

The EUT must be fused by the user.

Special supply adapters with switch and fuse protection are available but must be specified by the user.

8.3. Testing

Test setup

Around the test setup national and international regulations regarding human safety must be guaranteed.

The test setup must satisfy the adequate international instructions as per IEC 61000-4-5.

8.4. Calibration and Verification

8.4.1. 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 is 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.



Examples: Calibration mark

8.4.2. 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 is performed during the life cycle of 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 must be defined based on two criteria:

- The first one is the customer's Quality Assurance Policy. Any existent internal regulation must be applied at highest priority. In the absence of such internal regulation the utilization rate of the test equipment must be taken into consideration.
- Based on the experience and observation collected over the years **AMETEK CTS recommends 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.

8.4.3. 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.

8.4.4. 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 for refer to the waveshape and values of the original calibration certificate.

9. Delivery group

9.1. Basic equipment

- Surge generator VSS 500N6.X
- SCC Short circuit connector (Safety Circuit)
- Power Mains cable Country coded
- Test cable – open end 1 Meter HV cable 2.5 mm² HV-Banana red to open
1 Meter HV cable 2.5 mm² HV-Banana black to open
- USB cable USB interface cable
- on **USB memorystick**
 - Manual
 - iec.control software
 - Software license if ordered

Identical accessory parts are delivered only once if several devices are ordered. The delivered packing list is in each case valid for the delivery.



Equipment with standard accessories

9.2. Accessories and options

- **User software "iec.control"**
 - Test, analysis and documentation with windows
 - License version for testing according the most industrial standards
 - Report generator with export function to word-processing software
- **Test Cable – Tips # 107278**
 - Test tip 2 piece
 - HV cable 1 x black, 1 x red
- **Test cable – Alligator**
 - Alligator Clip 1 x black, 1 x red
 - 2 meter cable 2.5mm² 1 x black, 1 x red



USB Interface

- **K-USB USB interface cable**
High quality USB 2.0 interface cable for datatransfer to the computer.
Length: 3m connector type USB A – USB B
- **FER-USB**
Ferrite for suppress burst pulses on the USB cable.
Application: 8 turns for the best result. max. 10cm above ground.



10. Remote Control

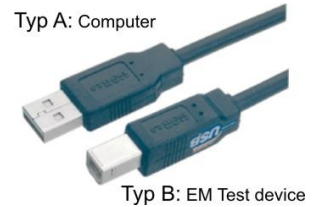
10.1. Interfaces

All following interfaces are standard features of the VSS 500 N6.

USB Interface

Device	Interface
Computer - VSS 500 N6x	USB A / B

Communication via COM Port
 Baudrate 1200 – 19200 Baud (8-databit, 1 start/stop bit)



Parallel IEEE 488 interface, addresses 1 - 30 selectable

- Command: (SH1, AH1, T4, L2, SR1, RL2, PP1, DC0, DT0, C0, E1)
- Connector and pin layout as per to IEEE - 488 - 1975
- 24-pin Amphenol connector
- 8 ground pins

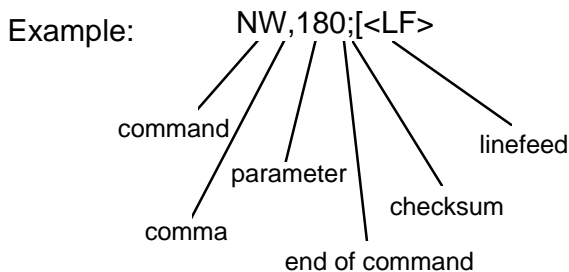
Equipment interface

The parallel equipment interface controls the external coupling networks.

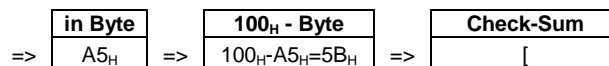
10.2. General information

The commands must be closed by an <LF>. Just before the <LF> the check sum of the complete string must be transmitted.

Calculating : check sum = 100_H - (sum of all ASCII codes in one byte)



	ASCII Hex
N	4E _H
W	57 _H
,	2C _H
1	31 _H
8	38 _H
0	30 _H
;	3B _H
SUMME	1A5 _H



Remark: sum of all ASCII codes in one byte: Only the last 2 Digits of the sum of all ASCII codes in HEX will be considered.

The messages coming back from the VSS are sent without check sum.
 At the end of the message there is also an <LF>.

10.3. Commands

Parameters

Name	Description	Min-Max	Step	Unit	Value
Voltage VSS N6	U, U1, U2	250 – 6600	50	V	250 – 6600
	ΔU	50 – 6350	50	V	50 – 6350
Angle	W, W1, W2, ΔW	0 – 360	1	°	0 – 360
Polarity	pol	+, -, ALT			0, 1, 2
Trigger	tri	AUTO, MAN			0, 1
Repetition	tr	1 - 999	1	s	3 – 999
Events	n	1 - 30'000 endless	1		1 - 30'000 30'001
Coupling	Cop	Nc			0

Notes

The minimum value of the repetition rate is dependant on the voltage value (test level).

	U <= 850V:	tr _{Min} = 1 s
850V <	U <= 1500:	tr _{Min} = 2 s
:	:	:
:	:	:
5950V <	U <= 6600V:	tr _{Min} =10 s

If the repetition rate is defined as a minimum value it will be increased automatically by the simulator. A message is sent to the interface.

10.4. V – Commands, *IDN?

Comm.	Syntax	Description
VC	VC;	VC and *IDN? are checking the remote connection of the interface and are setting the generator in remote mode. Additionally, it will be checked if an external coupling network is connected and some other generator details will be sent back. Remark The *IDN? command is used the same way as the EC-Command. If using this command itself the checksum will be disabled and all following commands may be sent without checksum (until to next local mode). Example: VC; (or *IDN?) → Type, Version, SWN, CN, ACode, MCode, VMax, PCode; Type: VSS500N6 Name of the generator Version: V1.00a01 Firmware version CDN: 0 Bit coded type of coupling network: no internal CDN ACode: 0 Additional bit coded information MCode: 256 Bit coded module types: Vsurge-Modul Bit0 → Burst module Bit1 → Surge module Bit2 → PowerFail module Bit3 → RingWave module Bit4 → Tsurge module Bit5 → Csurge0 module Bit6 → Csurge1 module Bit7 → Csurge2 module Bit8 → Vsurge N x (VMax,PCode) 6600,4; For each detected module the maximum voltage and the matching pulse code will be transmitted 6600,4; Max Burst Voltage 5500V Bit2 → 1.2/50 Voltage Surge acc. IEC60255-27
*IDN?	*IDN?	
VN	VN,U,W,pol,cop,tr,n,tri;	The VN command handles the parameter for the Quickstart mode.
VU	VU,U1,U2, ΔU , W,pol,cop,tr,n,tri;	The VU command handles the parameter for the voltage change mode. The voltage U1 is increased after n pulses by ΔU until U2 is reached
VW	VW,U,W1,W2, ΔW ,pol, cop,tr,n,tri;	The VW command handles the parameter for the change phase angle mode. The phase angle W1 is increased after n pulses by ΔW until W2 is reached.

10.5. N – Commands

Comm.	Syntax	Description
NU	NU,U;	The NU command sends a new voltage level. This handling can be realized ON LINE during a running test.
NW	NW,W;	The NW command sends a new value for phase angle. This handling can be realized ON LINE during a running test.
NP	NP,pol;	The NP command sends a new value for polarity. This handling can be realized ON LINE during a running test
NC	NC,cop;	The NC command sends a new value for coupling. This handling can be realized ON LINE during a running test.

10.6. A- Commands, *GTL

Comm.	Syntax	Description
AA	AA;	The AA command starts the test routine. At first all parameters and the routine must be handled by an E command.
AT	AT;	The AT command triggers on single pulse, if before MAN mode was selected.
AS	AS;	The AS command stops a running test.
AW	AW;	The AW command continues a stopped test routine (break).
AR *GTL	AR; *GTL	The AR and *GTL command stops a running test and sets the device in local mode.

10.7. Feedback messages

Message	Meaning
RR 00 <LF>	The test routine is finished correctly.
RR 01 <LF>	One single pulse was triggered.
RR 02 <LF>	Ready, the simulator is ready to be discharged. MAN trigger mode.
RR 05 <LF>	Fail 1
RR 06 <LF>	Fail 2
RR 07 <LF>	Continue after Fail 2
RR 10 <LF>	There was an error in data transmission, this means too few or too many characters.
RR 11 <LF>	Test start is not possible because TEST ON is not switched ON.
RR 12 <LF>	Synchrony error. For synchronized test routines, there must be a ac signal available at the input of the coupling network.
RR 13 <LF>	No, or wrong Cnx, the required coupling mode can not be selected.
RR 14 <LF>	One or several values are limited by the simulator.
RR 15 <LF>	Check sum error.
RR 20 <LF>	Not correctable limitation error.
RM, U, I; <LF>	Voltage and current value will be send after every pulse

11. Annex

11.1. Declaration of conformity

Manufacturer: **AMETEK CTS GmbH**
Address: Sternenhofstr. 15
CH 4153 Reinach BL1
Switzerland

declare, that under is sole responsibility, the product 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 name: Surge generator
Model Number(s) VSS 500N6.4

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 Class A
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.

Manufacturer
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Fax: +41 61 204 41 00



By A. Burger
Design and Research
Place Reinach BL, Switzerland
Date 1. July 2017

11.2. Declaration of conformity

Manufacturer: **AMETEK CTS GmbH**
Address: Sternenhofstr. 15
CH 4153 Reinach BL1
Switzerland

declare, that under is sole responsibility, the product 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 name: Surge generator
Model Number(s) VSS 500N6.3

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:

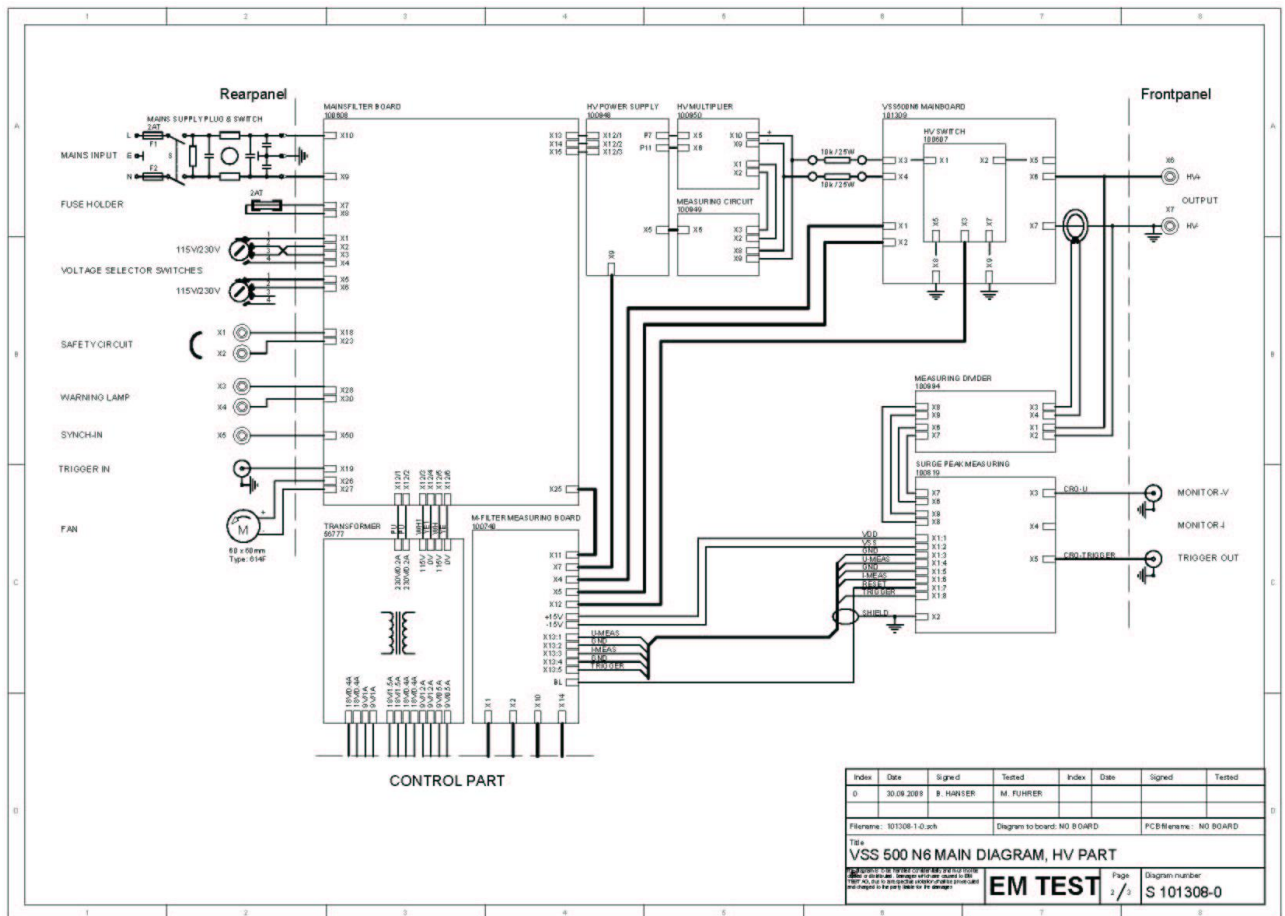
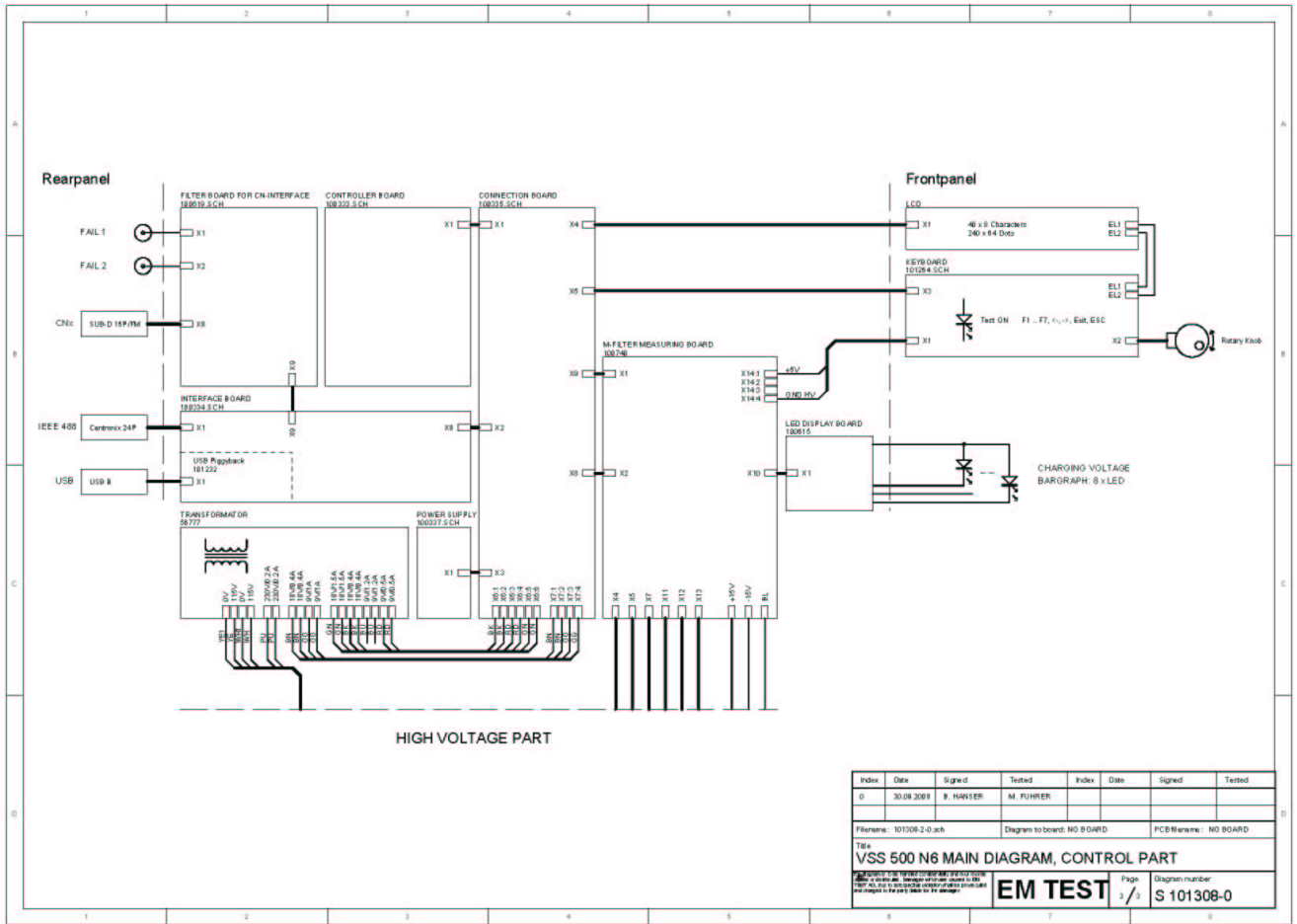
EN 61326-1: 2013 Electrical equipment for measurement, control and laboratory use Class A
EN 61000-3-2: 2014 Limits for harmonic current emissions
EN 61000-3-3: 2013 Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

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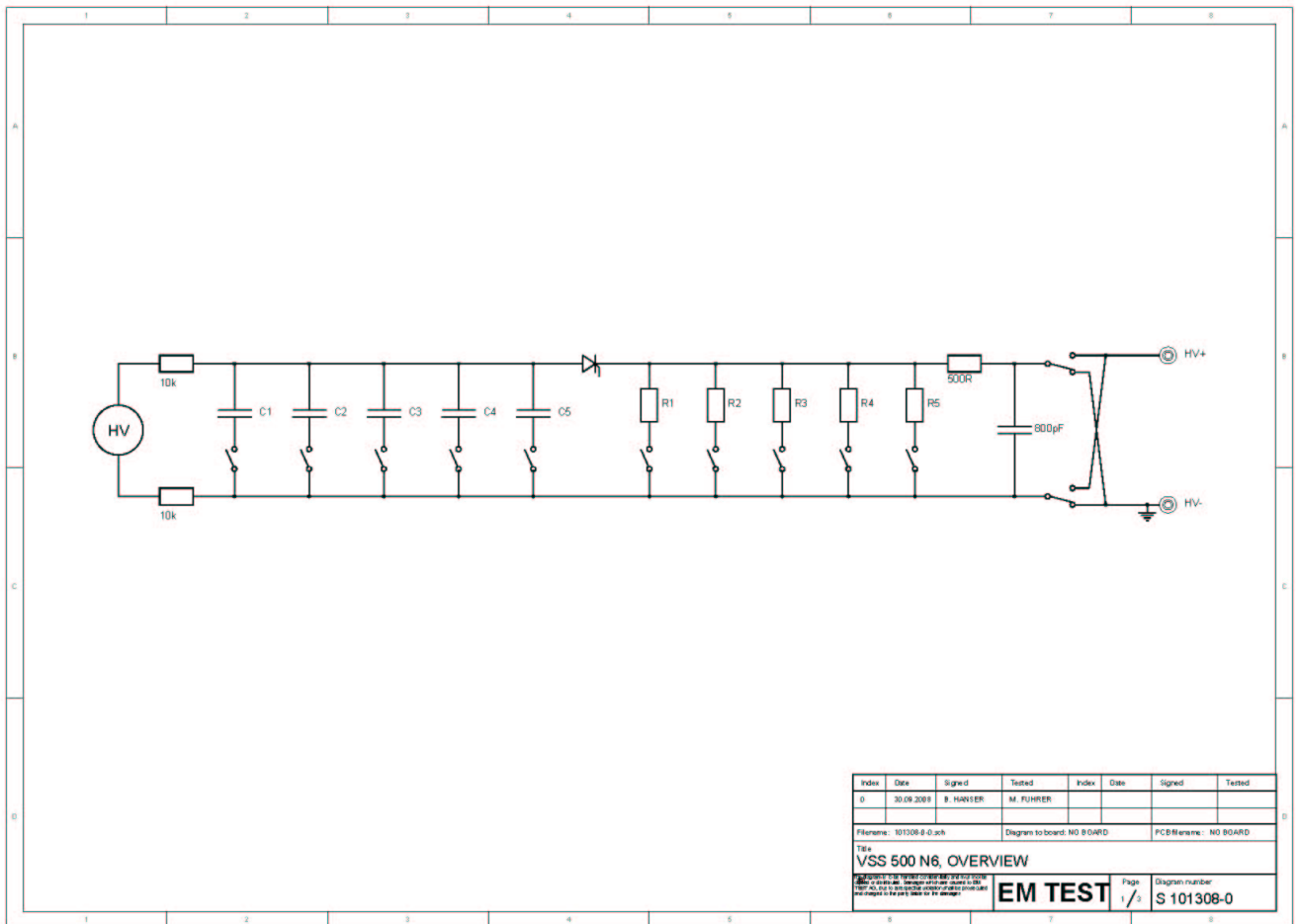


By A. Burger
Design and Research
Place Reinach BL, Switzerland
Date 1. July 2017

11.3. VSS 500N6 - General schematic



11.4. Scematic High voltage connections



Index	Date	Signed	Tested	Index	Date	Signed	Tested
0	30.08.2008	B. HANSEER	M. FUHRER				
Filename: 101308-0-0.sch			Diagram to board: NO BOARD			PCB Name: NO BOARD	
Title: VSS 500 N6, OVERVIEW							
<small>EM TEST</small> <small>EM TEST</small>						Page: 1/3	Diagram number: S 101308-0